

Technical Commission 3AF - SIGMA2



Progress report on UAP 2021



SUMMARY

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« Because it is more difficult to break down a prejudice than an atom »

Albert Einstein

Theoretical physicist, inventor of the theory of Relativity (20th century)

« And the Astronomers, who, by measuring the size of the stars, find them much larger than the Earth, also confirm it: for if, from the indefinite extent of the world, we infer that there must be inhabitants elsewhere than 'in the Earth, it can also be inferred from the extent that all the Astronomers attribute to it; because there is no one who does not judge that the Earth is smaller in the eyes of all Heaven, than n 'is a grain of sand in the face of a mountain. » (Letter to Chanut of June 6, 1647)

René Descartes

French mathematician, physicist and philosopher (17th century)

« Science has the good fortune and the modesty to know that it is in the provisional, to move the frontiers of the unknown and to move forward »

Marc Augé

French ethnologist and anthropologist (20th-21st century)



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Summary Work progress Report SIGMA 2

Introduction

Dr Paul Kuentzmann summarized in two quotes made at the beginning (Albert Einstein and Marc Augé) the principles of exploration of new, unknown subjects, such as UAP by combining audacity and prudence, perseverance and modesty in the face of the difficulties encountered in terms of Scientific procedure. Indeed, prejudices or incredulity, skepticism oppose curiosity in the face of the unknown, and the absence of sufficient data is also one of the difficulties in moving from simple observation to knowledge, transforming **Facts**, in **Hypotheses**, then in **Laws** and finally in **Theories**.

As a preamble to our work, Dr Paul Kuentzmann recalled its definition, which is a good introduction to the subject. We will leave it to each reader to assess the state of the art of the subject UAP as seen from SIGMA2 on the knowledge scale. We will express our vision for today in the conclusion.

FACT: Observation repeatedly confirmed and considered "true"; however, scientific truth is never "final".

HYPOTHESIS: Assertion test leading to deductions that can be tested; the more the deductions are verified, the more "correct" the hypothesis becomes.

LAW: Descriptive generalization of how a certain aspect of the natural world behaves under given circumstances.

THEORY: Sustained explanation regarding a certain aspect of the natural world, which may incorporate facts, laws and tested hypotheses.

Mandate

The role of the SIGMA2 commission is to modestly follow this logic by bringing together factual elements, by comparing hypotheses to try to characterize these phenomena, by confronting them with the laws of physics and the theories of standard science, while questioning themselves on new theories, a subject barely sketched out.

SIGMA 2 Commission has been mandated in 2013 to conduct technical and scientific investigation on UAP cases and adopted the following approach

1. Undertake desk research and the creation of a database for investigation of data and documents whose authenticity has been established and quality assessed.
2. Build a scientific and technical network with first, building links with

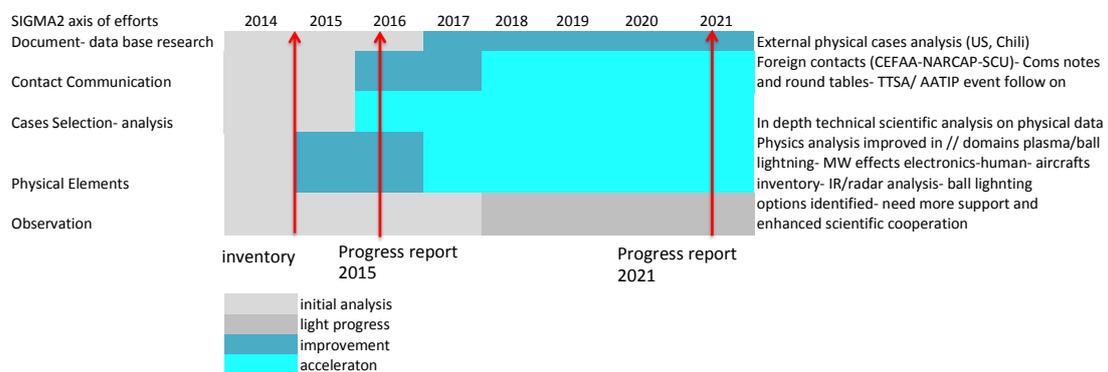


- recognized institutions in the field of UAP, starting with CNES-GEIPAN¹.
3. Establish a selection of case studies from available databases to conduct technical investigations.
 4. Initiate a reflection on the physical manifestations of these phenomena and their links with the physical sciences.
 5. Establish an inventory of the means and techniques of observation and, starting from a physical analysis, make recommendations on the improvement of observation techniques.

SIGMA2 worked on these five axes on the UAP in France and outside France following an initial two-year schedule (2014-2015) which resulted in a first progress report issued in early 2016. It had the first exchanges of analyzes technical, in particular with the Chilean CEFAA, but also with the NARCAP US and the SCU US².

Work continued over the 2016-2021 period with the drafting of specific reports, one in 2017 on the Cougar Chilean case, the other in early 2018 in the form of a note concerning the disclosure of the American AATIP (Advanced Air Threat Investigation Program) and infrared videos taken by US Navy F18s. These two documents have been made freely available on the 3AF CT SIGMA2 site.

This progress report builds on the 2015 report with a particular focus on contact development, data and report research, in-depth case study (especially data from Chile, or the USA , as well as the cross-checking of old cases with electromagnetic effects), and the study of physical phenomena.



Methodology for a documentation and database

An inventory of the databases, French and foreign, has been established as well as a

- 1 The Group for Study and Information on Unidentified Aerospace Phenomena of the *Centre National d'Etudes Spatiales* (National Centre for Spatial Studies)
- 2 Scientific Coalition for UFO



document assessment methodology relating to cases of UAP but also to research in this area, particularly in the USA, Great Britain and in Eastern Europe countries.

Researches has also been carried out on official documents tracing contacts on the UAP subject at the UN in the late 60's, and then in 1978 with the decision 33/426 for international cooperation and data sharing, that have never been materialized. This decision was actually neutralized and turned into an incentive to nations to conduct their own research and to inform the General Secretary of the collected data.

The publication of archives previously classified by many countries in the course of the 2000s might answer this incentive.

A methodology has been established to provide a systematic classification with an assessment of the reference documents used in our work. A computerized documentary basis for its transfer to 3AF was drafted. It is being enriched not only from the GEIPAN archives but also from some official document databases available. In particular, the research on old cases is very useful, especially exploring the Blue Book US report, but also the UK MoD (Ministry Of Defense) report on UAP, such as the Russian case and research account.

Regarding French data, SIGMA2 identified the origin of the surveys on UAP in France. They date back to 1951 with the opening of the MOC (Mysterious Celestial Objects) file by the Air Force Scientific Research Office, followed in 1954 by Ministerial Directive 267 / EMFA / A / BS / DR on MOCs. The study of the archives of the Historical Service of Defense (Gendarmerie archive fund on the NAPs) also presents a means of researching information on past cases.

On the American side, the UAP subject has been evolving since 2017, even since 2016 if we take into account the dissemination of CIA archives. These also demonstrate a follow-up of the UAP subject long after the closure of the US Air Force's Blue Book files in 1969, as we had already recalled in the 2015 progress report.

This is a hot topic that may portend a much wider impact on research after the Pentagon's UAP report is delivered to Congress, due in June 2021. The full SIGMA2 2021 progress report is scheduled for the same period.

The revelations made at the end of 2017 by former Pentagon officials on the AATIP (Advanced Air Threat Investigation Program) research program carried out by the DIA (Defense Intelligence Agency) and the USDI (Under Secretariat for Defense and Intelligence)³, have been confirmed by the Pentagon. In 2019, this recognizes the existence of AATIP research by the DIA on exotic technologies (meta-materials, invisibility, magneto-hydrodynamics, warp-drive, EM effects of UAP on humans, etc.). It also attests to the authenticity of the UAP IR videos broadcast in 2017 and 2018⁴ but also to recent testimonies from US Navy pilots who have made repeated observations

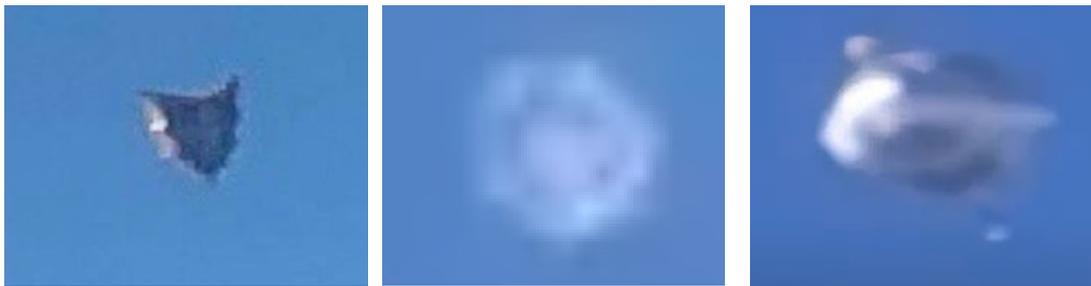
³ Organizations attached to the Secretary of US Department of Defense

⁴ <https://www.defense.gov/Newsroom/Releases/Release/Article/2165713/statement-by-the-department-of-defense-on-the-release-of-historical-navy-videos/>

since 2014, with supporting photos (see Figures 1 to 4 below).

A Task Force on UAP (UAPTF) was created by the Pentagon at the request of the Congress Intelligence Committee in August 2020. Its objective is to gather all the available elements on the UAP, then to submit a report to Congress in June 2021.

The communication policy of the USA on the UAP therefore knows a strong inflection⁵ and could lead to revelations on the nature of the UAP or UFO which escape current scientific knowledge, according to the statements even of former directors of the American intelligence, like R. James Woolsey⁶ ex director of the CIA. We hope that new databases will eventually be made available, the possibility of scientific cooperation having been mentioned. For the moment photos are leaking on the internet, and the Pentagon confirms their authenticity⁷ without comment.



« acorn »

« sphere »

« metal blimp »

Figures 1-2-3

Photos taken by F/A-18 Hornet (US Navy) pilots off shore Oceana (04/03/2019)



Figure 4 « pyramid »

These photos show various shapes which confirm the diversity of shapes observed and even the change in shape of UAP (called polymorphism), reported by American observations as well as British, Russian or French research (see Figures 5, 6 and 7).

⁵ <https://www.newyorker.com/magazine/2021/05/10/how-the-pentagon-started-taking-ufos-seriously>

⁶ https://nypost.com/2021/04/06/former-cia-director-says-he-believes-ufos-could-exist-report/amp/?twitter_impression=true

⁷ <https://www.theblackvault.com/documentarchive/pentagon-confirms-recent-uap-ufo-leaks-as-genuine/>



However, at the end of 2017⁸, SIGMA2 questioned itself on the 3AF / SIGMA2 site about this shift in American communication policy and its purpose. Was it the work of private groups? What was the position of the US administration? It arises in a complex international strategic environment, where we observe a rivalry evoked in the United States with Russia and China, for example in the field of hypersonic missiles and other technologies.

The subject posed is that of incursions into American skies, an asserted security subject which has been a sensitive subject since 9/11, with regard to what? Are these completely unknown phenomena, are they foreign incursions? Is the aim pursued to bring to light the data and realities on the UAP? Is it a question of reinforcing defense credits on certain themes? Is it to consider information sharing (database) and wider cooperation on UAP, which would be new in the current climate.

On June 3, 2021, the NY Times published an article⁹ after reading the UAPTF report to Congress, titled: "U.S. Finds No Evidence of Alien Technology in Flying Objects, but Can't Rule It Out, Either." In other words: cases of UAP or unidentified objects are cited, 120 cases over the last two years.

No evidence is given of technologies of "extra-terrestrial" origin, ie confirming the Extra-Terrestrial Hypothesis (ETH); but we cannot rule out this "ETH" hypothesis because of the abnormal behavior of these objects. No further mention is made at this stage, acknowledging that classified, therefore undisclosed, data exists in appendices to the report.

The questions about incursions by Chinese or Russian devices are still being asked. But at the same time, the observation is drawn up of a kinematic behavior (brutal speeds and accelerations) inexplicable by known technologies, as well as the change of air-sea environment without interaction with the environment (absence of aerodynamic and acoustic effects, ...).

We can therefore conclude, after three years of questioning US communication, to a new fact. The report doubly contradicts the conclusions of the Condon report of 1969. The security of airspace is questioned by unexplained incursions and beyond the technologies mastered by the United States. The origin of phenomena does not refer to natural phenomena.

8 <https://www.3af.fr/news/3af-sigma2-comments-on-aatip-vf2-eng-1577>

9 <https://www.nytimes.com/2021/06/03/us/politics/ufos-sighting-alien-spacecraft-pentagon>

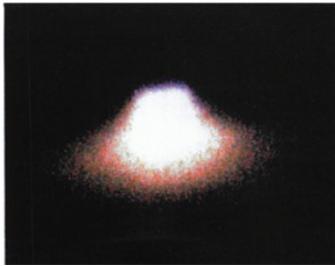


Figure 5 - Photo of a disk shape from MOD UK Report on UAP



Figure 6- 1975- North of France -Revigny

Two red-orange objects are photographed, first static for 20 to 30 seconds then in motion, following an S-shaped trajectory before disappearing.



Figure 7 – Observation and drawing of an UAP by an Air France crew (Flight AF3532 Nice-London) in 1994

Our work also focused on the UK MoD report on UAP's presence in UK airspace. This remarkable report, summarizing 20 years of research on UAP, confirms their existence without any doubt, their polymorphism and their astonishing kinematics: hovering, instantaneous accelerations, apparent absence of inertia. The work concludes that there are no proven risks, particularly for air traffic and defense, by emphasizing the possible origin of these phenomena in connection with atmospheric plasmas of natural origin. Artificial origin linked either to confidential devices or to a "HET" origin is considered unlikely. Physiological effects associated with close encounters with UAP are also described. Some interesting cases are discussed in the report and are described, including the observation of a craft surrounded by blue radiation, from RAF Tornados planes flying over the Channel, as numerous and diverse observations were recorded over French territory on November 5, 1990.

Russian studies over the period 1950-1990 show a peak in research in the period 1970-1986 with a civilian program (SETKA-AN) for the study of phenomena called "anomalies" and a military program (SETKA-MO) for defense work concerning the sensitivity of defense systems to these phenomena or the use of research for the purpose of military technological fallout. Among the military works, the role of the Soviet navy seems to have been important in view of the very numerous observations of flying or aquatic objects (nicknamed Quakers) brought together by their reinforced observation network between 1977 and 1980. Cases of material collection with particular properties are also mentioned on certain sites such as Dalnegorsk. This work seems to have stopped or to have been greatly slowed down after 1990. What about today?

We have not investigated Chinese work so far, but we have noted in the archives published by the American CIA, meetings between Russian and Chinese experts in the



early 1990s and the holding of symposia with the research environment around 1994. In addition, the Chinese research sector publishes numerous publications on related subjects such as ball lightning, meta-materials, etc. China is also developing technologies for space vehicles, missiles and efficient drones.

As a response to American questions, the People's Republic of China (PRC) responds to the Pentagon's report on UAP, with a statement¹⁰ relating a similar observation of regular incursions into Chinese airspace, acknowledging that this poses a security problem. The same observation is made of extraordinary kinematics for these “abnormal” atmospheric phenomena. The work carried out by a similar UAP Task Force, bringing together the academic research community with the armed forces of the PRC, refers to studies of UAP event recovery from analyzes of "weak signals" type Bigdata assisted by Artificial intelligence. It is also an important factor of change. The observation is therefore shared.

10 <https://thedebrief.org/china-confirms-it-has-its-own-ufo-task-force/>



Contacts and Communication

Many contacts have been established to, firstly, collect data on UAP's cases and, secondly, to build a scientific and technical network.

These contacts have been primarily made with CNES / GEIPAN, with which a cooperation started since late 2013 to deepen unexplained French cases (cases D category), and to investigate new cases. The complementarity of roles between CNES / GEIPAN – French official in charge of the UAP– and SIGMA2 – technical commission of 3AF – has been clarified.

Furthermore, SIGMA2 took further contacts in France, particularly with the French Air and Space Force (CDAOA¹¹), which led to a visit at the CNOA Air Operation and Cosmos Centers¹² in Lyon Mont Verdun French Air Force base in July 2015. It allowed to a better understanding of the missions and resources of CNOA and moreover to discuss the principles of cooperation with GEIPAN. These steps will be refined in the future as UAP's cases arise. Furthermore preliminary contacts were made with the Service Historique de la Défense (SHD), as part of a joint approach with the GEIPAN concerning research on defense archives before GEIPAN foundation.

In terms of means of observations, SIGMA2 recently contacted the IMCCE (Institute of Celestial Mechanics and Ephemeris Calculation of the Paris Observatory). The IMCCE is in charge of the deployment of FRIPON¹³ network (over hundred dedicated cameras networked with HF receivers) and interesting SIGMA2 and GEIPAN as an additional means for observing UAP to complement the conventional Air Traffic Control (ATC) and Air Defence capabilities. Initiatives will be taken for data gathering from scientific networks. Initiatives have been taken with the IMCCE to study a project (Trillian) aiming to improve the use of data from scientific networks of the Fripon type, by establishing detection classes distinguishing, for example, meteorites from TLE (Transient Luminous Event) phenomena.), ball lightning or UAP. Efforts should be made to develop such treatments with the help of researchers.

Concerning abroad contacts, a technical cooperation agreement has been concluded with the Chilean CEFAA¹⁴ in 2013, followed by a meeting in Paris at the end of 2014, then a study of the Cougar case (between 2015 and 2017 - see Figures 8 to 11). Another agreement was prepared with the American NARCAP in 2015. These two organizations, one official, the other associative, bring together technical capacities and carry out scientific case studies. SIGMA2 was also contacted by another American scientific group, the SCU (Scientific Coalition for UFO), for a case study (Aguadilla case - see Figures 12 to 15). SIGMA2 met during a meeting at CNES in 2017, the CEFAE (Center for the Study of Aerospace Phenomena), an institutional body dependent on the Argentine

11 Air Defence and Air Operations Command

12 Center dedicated to Space Operations for the CDAOA (Command for Air Defence and Air Operations)

13 Fireball Recovery and InterPlanetary Observation Network

14 Studies of Anomalous Aerial Phenomena Committee (*Comité de Estudios de Fenómenos Aéreos Anómalos*)



Air Force. The CEFAE became in 2019 the CIAE (Aerospace Identification Center), attached to a higher level within the General Staff of the Argentine Air Force. The CIAE is equipped with the IPACO image analysis software, provided by the IPACO team of Dr F. Louange.

Communications were published in the 3AF Letter¹⁵ as well as position papers on the 3AF / SIGMA2 website. This includes a situation update on the disclosure of the AATIP program and IR videos by TTSA (early 2018)¹⁶, the analysis of the Cougar case (2017) for which 3AF / SIGMA2 contributed to the identification of the Airbus A340 of Iberia in 2017¹⁷, not to be confused with a UFO. The techniques for radar and IR analysis of UAP were explained in the 3AF Letter article titled IR and Radar Cross-views on UAP¹⁸.

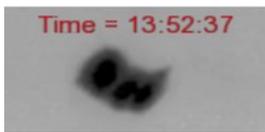


Figure 8: Cougar case- IR ¾ rear view of the plane in turn – 3 hot spots



Figure 9: Cougar case- IR full rear sector view- 2 hot spots seen



Figure 10: Cougar case- Rear sector IR view- exhaust condensation trail (altitude 9000 m)



Figure 11: Cougar case- Regional ATC radar picture



Figure 12: Aguadilla case: IR FLIR tracking of UAP from Boarder surveillance aircraft



Figure 13: Aguadilla case: radar plots- yellow area is the swept from the IR camera Line Of Sight (LOS) in time

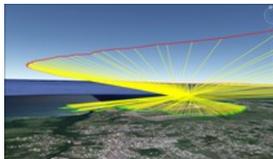


Figure 14: Aguadilla case- rebuilt possible UAP trajectories cross checked with the LOS

15 <http://www.3af.fr/article/en-direct-de-3af/sigma-2>

<http://www.3af.fr/article/en-direct-de-3af/sigma2-un-mandat-une-structure-un-plan-de-travail-et-d-action>

<http://www.3af.fr/article/opinion/le-controle-local-de-la-gravitation-mythe-ou-perspective>

<http://www.3af.fr/article/en-direct/rencontre-sur-les-fenomenos-aereos-anomalos-paris>

16 <https://www.3af.fr/news/commentaires-3af-sigma2-sur-le-programme-aatip-vf2-1576>

17 <https://www.3af.fr/news/analyse-du-cas-pan-video-ir-gougar-cefaa-mars-2017-travail-collectif-1485>

18 https://www.3af.fr/global/gene/link.php?doc_id=4234&fg

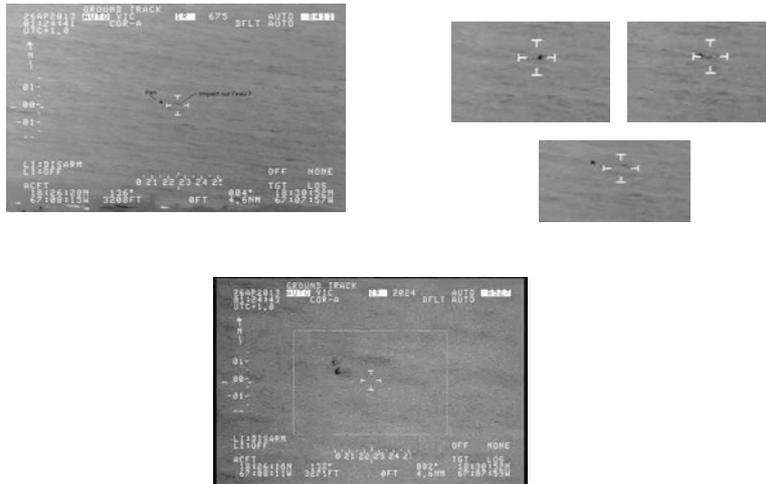


Figure 15: Aguadillacase: IR images- flight on sea background- possible ripple of object on the sea waves- apparent immersion and unwinding of objects

Direct interventions took place: at the symposium on aeronautical mysteries organized by 3AF and Alumni ONERA on the theme “IR-radar cross-views on UAP” (November 2020¹⁹), during a presentation at INHEST on UAP (November 2019) and during participation in films or televised debates related to the subject UFO / UAP (CNEWS “vent positif” in 2018, UFO: state case, in April 2020²⁰, followed by a debate on MaybePlanet; UFO in the « éclairage » show of AGORANEWS Sécurité March 2021²¹).

A round table with GEIPAN (R. Baldacchino) -SIGMA2 (L. Dini) was organized in May 2021 at the initiative of Pascal Fechner on Maybeplanet to explain the complementarity between the GEIPAN (survey, information on the cases of French PAN) and 3AF / SIGMA2, association for the study of PAN, French and foreign.

SIGMA2 has contacted some protagonists of the US AATIP program and is awaiting the release of the UAP Task Force report while remaining cautious about the meaning of the videos on which we lack information. We are nevertheless impatient and very interested to know the technical details of the preliminary conclusions and the possibility of a US initiative on data sharing and scientific cooperation.

The NY Times press release dated June 3, 2021 reveals the main conclusions of the report and therefore establishes the presence of unknown devices, with behavior beyond known technologies. This observation is supported by data which is not communicated. China has also acknowledged similar findings.

19 <https://www.youtube.com/watch?v=LoDhtK6UCPA&t=6115s>

20 <https://www.youtube.com/watch?v=-8dLYR0XQqg>

<https://www.amazon.com/Flying-Objects-Senator-Harry-Reid/dp/B08TQM2T4K>

21 <https://www.agoranews-securite.fr/eclairages-les-ovni-phenomenes-aerospatiaux-non-identifies/>



Case Selection

The SIGMA2 approach established the criteria for finding cases based on the existence of physical data associated with reliable and unexplained UAP observations. Cases were selected from the GEIPAN database but also from the British Ministry of Defense files published since 2008, as from other American archives. Likewise, contacts were made directly with organizations that witnessed UAP phenomena, such as Jersey air traffic control, whose testimonies and radar data were collected for analysis. SIGMA2 was also contacted in 2015 by the SCU to study data from a case of PAN that occurred near the Puerto Rico airport in 2013. Although the cases with physical records available are not very numerous, SIGMA2 tries to concentrate its resources on a few cases with such data. One of the challenges faced by SIGMA2, in addition to accessing physical data, is the ability to render and use computer data for in-depth analysis.

The latter (SCU) provided us with information on the Aguadilla case (Puerto Rico) as well as on a case of EM interference on equipment (smartphone, camera) that occurred in the State of Ontario near the US-Canada border during a close encounter with a UAP. It is analyzed in the SIGMA2 progress report among cases that have occurred with EME effects.

The work of SIGMA2 also details the analyzes of IR and radar cases such as that of the Chilean Cougar, the Aguadilla case of Puerto Rico, and the US Nimitz case. SIGMA2 is, to our knowledge, the only organization to have submitted to the Chilean CEFAA a complete report of radar and IR crossed analyzes in 2017²² identifying an Airbus A340, thanks to the data made available by the CEFAA ... This does not mean that unidentified UAP do not exist, as the objective of SIGMA2 is not to demystify cases of UAP. On the contrary, we believe that the available data attest to the existence of phenomena that are totally unexplained by their kinematics and their EM radiation. However, we also have objective and rigorous analysis methods with experts that allow the identification of known aircraft.

Regarding the US Nimitz case, we were unable to conduct a study due to lack of data, as an IR video was insufficient without context data or distance measurement. We have made an inventory of technologies studied by the US Navy known to explain, according to some, the IR and radar video recordings of objects moving at high speed. These are, for example, filament plasma lasers or UAV carrying jammers. According to the available data and our analyzes, these advanced technologies cannot explain the abnormal nature of the kinematics and radiation observed at great distances.

Physical elements

The work carried out on physical elements first aimed to establish an inventory of physical observations, ie the physical manifestations of phenomena including

²² <https://www.youtube.com/watch?v=LoDhtK6UCPA&t=6115s>



observations by radar, electromagnetic (interference), optical, acoustic, magnetic, gravitational ... but also on living organisms.

With enhanced skills (naval aeronautics, plasmas, fusion, quantum physics, missiles, drones, biochemistry, acoustic propagation, astrophysics, lightning, directed energy weapons, etc.), in addition to those already present (air defense, optical signatures, IR, space, medicine, etc.), this report takes stock of physics studies and case analysis abroad (USA, UK, Russia).

In particular, an analysis was carried out to try to establish a profile of "observables" to characterize the UAP and to seek, when possible, a correlation between different observations. This approach is currently being applied to the cases identified, in particular the cases with electromagnetic effects (EME) which are discussed below.

Likewise, a summary was drawn up by a doctor part the SIGMA2 commission in order to establish a parallel between certain cases of UAP identified and knowledge on the effects of ionizing radiation or not on living beings. The inventory includes, for example, the effects of microwaves on tissue, heart rate, memory, etc. depending on the types and levels of radiation.

We have also started an inventory of natural phenomena that may explain certain UAP such as plasma phenomena (link with Hessdalen type observations, ball lightning or related phenomena (see Figures 17 to 20), the studies listed in the reports of British Ministry of Defense studies on UAP) but also with reentry phenomena (meteors, reentry of artificial objects) or meteorological phenomena such as lenticular clouds.



Figure 17: TSLP (Transient Stormy Light Phenomenon happening in the troposphere-ball lightning family)



Figure 18: TSLP (Transient Stormy Light Phenomenon happening in the troposphere-ball lightning family)



Figure 19: TSLP (Transient Stormy Light Phenomenon happening in the troposphere-ball lightning family)



Figure 20: TSLP (Transient Stormy Light Phenomenon happening in the troposphere-ball lightning family)

The studies also focused on an inventory of cases of UAP (on the ground, aerial) characterized by electromagnetic effects in the USA, Russia and Iran between 1959 and the 1980s. The preliminary results show invariants such as disturbance effects. control electronics, radio communications, or else the emission of bluish-white radiation comparable to plasmas which could also be identified in the inventory of aeronautical cases drawn up by NARCAP US.



These radiating plasmas could be linked to microwave ionization frequencies around 3 GHz, themselves recorded by US ELINT²³ planes on irrefutable UAP cases. These frequencies also are similar to those of microwave weapons and overlap with observed effects on humans. The work also focused not only on the radiation emitted by plasmas but also on their kinematics as well as on technologies such as Magneto Hydro Dynamics (MHD). An inventory has been drawn up to identify IR and acoustic signatures and flying objects that can be confused with UAP, because their advanced technologies equipment: this can be the case with certain micro-drones equipped with micro-turbines or hypersonic missiles. Finally, the report issued by the British MoD on UAP was analyzed and its conclusions compared with those of SIGMA2, in particular on buoying plasmas. We also conclude to the possibility of buoying plasmas that exist in the atmosphere, similar to certain types of ball lightning or Earthlights related to seismic activity. However, according to our analyzes, the displacement of these plasmas cannot explain the cases of UAP endowed with high speeds and accelerations, because they cannot a priori exceed the speed of sound, nor follow changes of trajectories at 90 ° or cusps. Only the plasmas accompanying a hypersonic and hyper-maneuvering physical vehicle could explain the supersonic and erratic luminous phenomena, as well as the limited interaction effects with the environment (aerodynamic, hydro-dynamic) if however the machine was capable of it. However, there is no known one capable of going from zero speed to Mach 10 almost instantly.

At the same time, an inventory of the theories of standard physics was carried out as well as an inventory of the exotic propulsion theories which are sometimes mentioned to explain the kinematic and electromagnetic behaviors of UAP likely to be of artificial origin. These theories include in particular MHD, electro-gravitation...

A particular study was carried out on the possible link between the theory of electromagnetism and the general theory of relativity, a link which could lead to imagine a local control of gravity. Indeed, such a theory, if it were demonstrated, could explain certain cases of observation where the gravitational field seems to have been modified and explain an unusual kinematics observed which seems to defy the laws of known physics (inertia, aerodynamics). To date no conclusion can be drawn, except that some observations of UAP are difficult to explain by known natural phenomena. They could be linked to artificial devices whose behavior does not relate to known technologies, even in the case of confidential military devices program, except assuming that these relate to a very advanced physics, unknown, which would be very surprising. These artificial UAP could use unknown propulsion technologies, possibly using a nuclear power source, capable of developing great powers and very high electromagnetic fields. But this is only a hypothesis to explain physical behaviors that do not respect the laws of known physics, nor conventional propulsion technologies.

The first studies by SIGMA2 on the documents identifying the analysis of supposedly recovered materials raise several questions: what are the ejecta of metals in the liquid state? What would their function be? Would they play a role in a propulsion system using nuclear energy? What is the origin and function of complex metallic materials: Mention is made of multilayer materials with amazing properties concerning the

23 ELINT : EElectronic INTelligence



reflection of electromagnetic waves, unusual gravitational behavior, high mechanical resistance combined with lightness. These reputed materials discovered decades ago would resemble the meta-materials studied today. These are known to have properties of useful electromagnetic waveguides at very high frequencies or even sensitivity to gravitational waves.



Observation

We conducted an inventory of aeronautical observation means, civilian and military, that monitor air traffic but also space. Conventional monitoring means offer excellent performance but have limitations inheriting to observation missions of vehicles evolving from very low altitude to high altitude (i.e approximately 100,000ft), except specialized means such as tracking radars or space surveillance; but these are designed for satellites observation that follow Keplerian orbits.

At low altitudes, the increase in air traffic, the emergence of objects such as mini-drones also complicate the task of observing UAP among many objects flying at low altitude and at low speed. In addition, civilian radar resources are increasingly means operating on the principle of secondary radars to follow cooperative objects equipped with a radar transponder. The proliferation of infrared data collection with FLIR-type cameras on PAN cases has in some cases revealed their usefulness, by identifying planes or drones, but also other phenomena. But to be useful, these IR data must be crossed with radar data, unless 3D measurements are instantly available with laser rangefinders, which have proved to be unreliable at a long distance. Observation of UAP is not a taboo for the French Air and Space Force, which has procedures to identify cases and provide the data to GEIPAN, when saved. But the data retention time is limited in time, which requires responsiveness on the part of investigators and possibly an optimization of the feedback loop. The Air and Space Force is open to provide data but many missions to complete and case UAP observed are almost non-existent, so non-priority with respect to numerous air operations daily.

However, additional technologies such as passive radars, but also the observation of meteors networks, as the already mentioned FRIPON network – which implements optical cameras and HF passive receivers networks – suggests that new cases could be identified and recorded, this time with exploitable physical data.

It will be interesting to hear the American experience feedback on observations made by radar and IR cameras since 2004.



Conclusion and way ahead

The work of the SIGMA2 Commission has progressed on several axes such as the inventory and the case study, the follow-up of international activities, the work on physics, the inventory of advanced machine technologies... Many contacts have been made. Interesting documents have been identified, including work carried out abroad, but cases with indisputable physical data recorded are rare. The use of old cases, in particular EME from data of international but also French origin, allowed interesting comparisons.

However, as explained above, new technologies and means of observation are gradually being deployed and giving rise to hope for new data collection. If unexplained cases with physical data are already identified, no comprehensive explanation has yet been provided by SIGMA2, apart from the identification of certain physical theories, which have yet to be demonstrated.

Nevertheless, SIGMA2 tried to make a preliminary cross-checking between the electromagnetic observables of different phenomena. We compared the radiation emitted by plasmas (bluish radiation from atmospheric nitrogen plasmas) with recordings of electromagnetic signals at 3 GHz (US records). We were also able to observe electromagnetic disturbances on electronic equipment (on the ground or in flight) or even observed the effects induced by microwaves on the natural environment (soil, vegetation) or on humans. These overlaps raise many questions about their origin. Regarding the kinematic behavior of UAP, brutal accelerations, passage from a stationary position to very high speeds, we conclude that they cannot be explained by plasmas of natural origin, whose speed and accelerations are a priori limited in particular to the speed of sound. The speed of hypersonic movement and its accelerations can be explained if they accompany either a hypersonic mobile, performing brutal accelerations (according to an unknown technology), or by the projection of energy at a distance (like plasma lasers), but whose technological advances do not allow, a priori, the formation of plasmas at distances of several tens or hundreds of km. These findings are only partial and preliminary but constitute a common thread that could intersect with other research, for example on materials and their interactions with high frequency EM radiation.

Far from demonstrating the inconsistency of the cases identified or giving peremptory explanations, this militates in favor of further studies, of intensifying the collection of in situ data, on condition of having an organization capable of storing and to analyze such computer data without which it is illusory to claim to carry out serious analyzes of cases.

The implementation of a documentary database and computer skills tool has been carried out: this is one of the key points for building the documentary base but also for the use of the technical data collected on the cases. Both documentary research and archiving will then have to be intensified.



Likewise, it is necessary to involve physicists in order to compare the analyzed data and the physical hypotheses. The skills of CT SIGMA2 are evolving with the contribution of researchers (plasma, quantum physics, biochemistry, etc.) who have joined it.

Data sharing is an important topic. We can consider two factors of progress:

- on the one hand, the progressive contribution of scientists interested in the study of UAP and associated physics, starting with their interaction with the local environment. This requires data collection. These studies could cross-reference quantum physics, the link with gravitation...
- on the other hand, the evolution of American communication could have a leverage effect on the awareness of the phenomena and the sharing of data unlike the previous situation, local and national research without sharing of information. This remains to be proven.

Assuming increased scientific interest and a willingness to share data, holding an international scientific workshop on type D PAN cases would be desirable. It would allow an exchange of views between scientists, in a limited number, on serious cases identified and studied with physical data, as well as on their interpretation or on observation techniques. This could allow the construction of a real scientific network likely to arouse the interest of a few physicists in the published data and those to come.

3AF and SIGMA2 could contribute to such a workshop in the spirit of the Pocantico UFO evidence seminar organized by Peter Sturrock in 1998.

SIGMA2 reached conclusions in the 2015 report similar to those in the US UAPTF report regarding the unusual kinematics of the objects observed, such as those of the Army of the People's Republic of China. This observation on kinematics has since been reinforced by other characteristics such as electromagnetic emissions at certain frequencies, of artificial origin, which we are discussing. They have been noted in the past by the Americans as well as by the Russians, in their respective reports. But we have not yet noted any recall of these effects, nor knowledge of any intention to share the data. But the shared observation remains a first step.

What would be the information communicated by the USA on the UAP? Which databases? Would there also be a communication of the same nature from Russia on these phenomena, but also from China? From Israel? Other countries? Would there be a ripple effect? The reaction to the US UAPTF report have started.

To conclude by returning to the questions at the beginning: where are we on knowledge?

We may be past the stage of prejudice or disbelief.
Are we talking about Facts, Hypotheses, Laws or Theories?



Skepticism could give way to scientific curiosity in the face of the unknown supported from now on established Facts and inventoried Hypotheses.

Do known Laws explain everything? It seems that some cases are beyond known science and may prompt research into extensions of known laws or lead to other discoveries, confirming alternative theories, now qualified as speculative.

To the question do the UAP exist? We leave it to the reader to judge, but the answer is yes, in multiple and even changing forms during observations.

Progress will come from the collection and sharing of data as well as the interest of scientists in confronting the Laws and Theories under study.



1 Introduction

UAP Phenomena (Unidentified Aerial Phenomena) are not new: aeronautical cases (in flight) and cases on the ground (traces and observation) have been observed since World War II or even well before (cases reported in the Ministry report. of the British Defense since 1918 for the United Kingdom and in 1607 in Central Europe).

In France, a first wave of observations has been recorded since the beginning of the 1950s, which first motivated ministerial directives (Ministère des Armées) in 1951 and then in 1954 (see § 1.2). The objective was to gather information on these phenomena called "Mysterious Celestial Objects", from the various defense organizations (Air Force, research and prospective office, Gendarmerie Nationale, etc.).

The creation of GEPAN at CNES took place twenty years later, in 1977. A report¹ on the UAP was published in February 1978 in the journal of the Union of Auditors' Association of the Institute of High National Defense Studies (IHEDN) . This report will inspire the Cometa report published in 1999 under the leadership of the Cometa Committee made up of former IHEDN auditors and senior officials.

These phenomena present various observable characteristics according to the cases (kinematics, electromagnetics, optics, radiations, mechanical effects on the ground, etc...) sometimes unexplained by known physics.

Their reality is indisputable even if hoaxes exist and are demonstrated. Their natural or artificial origin is an open question depending on the case, due to poorly understood atmospheric or ionospheric light and electromagnetic phenomena (see Figures 1.1.1 to 1.1.16) but also to unpredictable electromagnetic and especially kinematic behavior. These strange behaviors defy the laws of physics, especially mechanics, which poses a problem for the means of observation to make systematic recordings. The illustrations and photos are now supplemented with more recent photos published by US Navy pilots, in the environment of recent UAP (Unidentified Aerial Phenomena) observations, as part of the newly created UAP Task Force by the Pentagon in August 2020.

Due to the exceptional nature of these aerospace phenomena and their scientific complexity which concerns many aerospace disciplines, the Technical Commission of 3AF, initially called PAN, then SIGMA, was created in 2008 (see Figure 1.2.1).

In April 2013, the mandate of the SIGMA Commission was refocused on the scientific and technical analysis of unexplained "D" cases (according to GEIPAN terminology): SIGMA2 succeeds SIGMA.

Its work is parallel and coordinated with that of GEIPAN in France (see Figure 1.2.2.1) and of institutional bodies or not, abroad (eg Chilean CEFAA). The technical analysis of

¹ Report entitled the Unidentified Air Phenomena appeared in the N°11 edition of the review of the IHEDN Alumni in February 1978. This report was drawn up by a committee chaired by General Richard (18th session of the IHEDN).



unexplained cases follows on from field surveys carried out by institutional services within a perimeter limited to the near terrestrial environment, atmospheric to the ionosphere (see §1.2.3).

SIGMA2 brings together a wide range of expertise (engineers from industry or the state sector, Air Defense specialists, radar, electromagnetism, retired specialists from the DGA, CNES, astronaut, retired officers, pilot, analyst,... astrophysicist, doctor...).

A work plan (see Figure 1.3.1.1) is built around 5 axes: environment and documentary base, contacts, selection of cases, physical elements, observation (means). A progress report was released in 2016.

The 2021 report is a more comprehensive report, particularly on international monitoring, case analysis and physical analyzes.

1.1 UAP: what are they?



Aerospace phenomena observed for decades, diverse, floating and unexplained. Observing deep space (see Figure 1.1.1) makes it possible to discover new stars and exoplanets every day, in search of life in the universe, or signals of extraterrestrial origin that would come from the deep space (SETI work, Breakthrough Initiative project, etc.).

Figure 1.1.1 - Deep Space

But above our heads, in our close environment, atmospheric or ionospheric, Unidentified Aerial Phenomena have been observed and reported by authorities for decades and remain unexplained ...

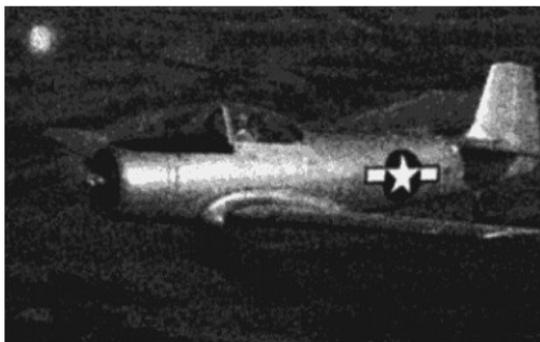


Figure 1.1.2 - An image of foo- fighter (luminous phenomenon observed by many pilots during The Second World War)

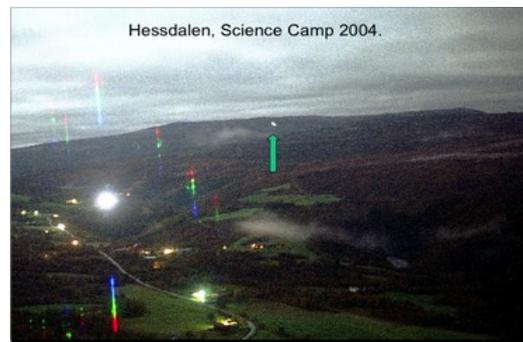


Figure 1.1.3 – Hessdalen Valley (Norway): 30 years of observation of static or moving light balls without explanation on their origin



Figure 1.1.4 - Stormy phenomenon observed from the ISS station.



Figure 1.1.5 - Transcient luminous phenomenon named "Sprite"²

² Sprite: sort of storm of short time occurring in the ionosphere between 40 and 100 km of altitude, source of interrogation on the physics of the upper atmosphere very close to our planet.

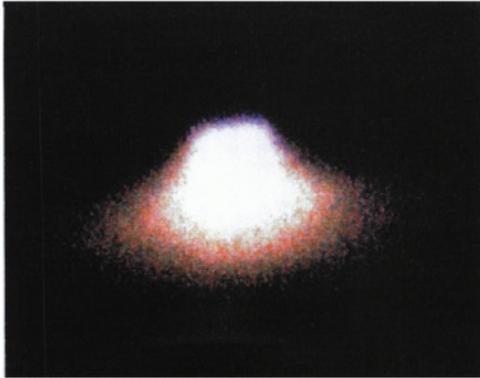


Figure 1.1.6 - Photo of a disc shape, taken from the MOD UK report

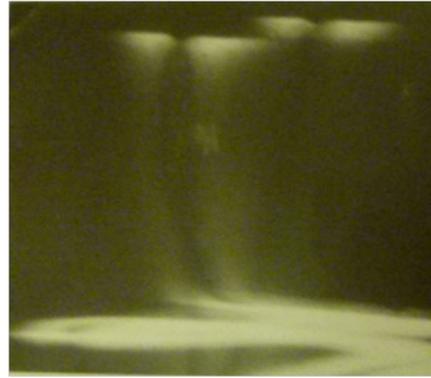


Figure 1.1.7 - 1975, North of France. Two red-orange objects are photographed, first static for 20 to 30 seconds and then in motion, following a trajectory in S before disappearing.

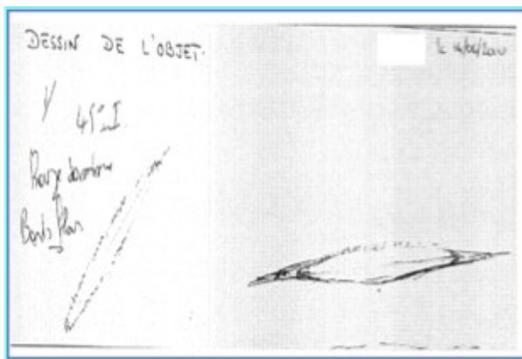


Figure 1.1.8 - Observation made by the crew of flight AF3532 Nice-London in 1994

Restoration of a dark red disc, changing shape, reproducing the observation made by the crew, with a radar track recorded simultaneously by the French Air Force: without explanation (CNES / GEIPAN data).



Figure 1.1.9 - Belgium (1989)

A photo of a reputed triangular object observed during the Belgian wave of 1989: **this is an hoax**, although radar observations by NATO and interception missions by the Belgian F16 were an undisputed reality.

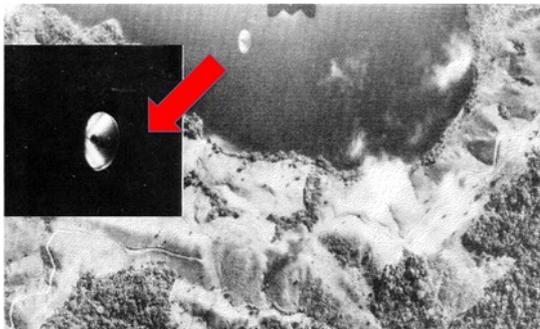


Figure 1.1.10 - Costa Rica case (1971)



Figure 1.1.11 - Yungay case, Chile (1967)

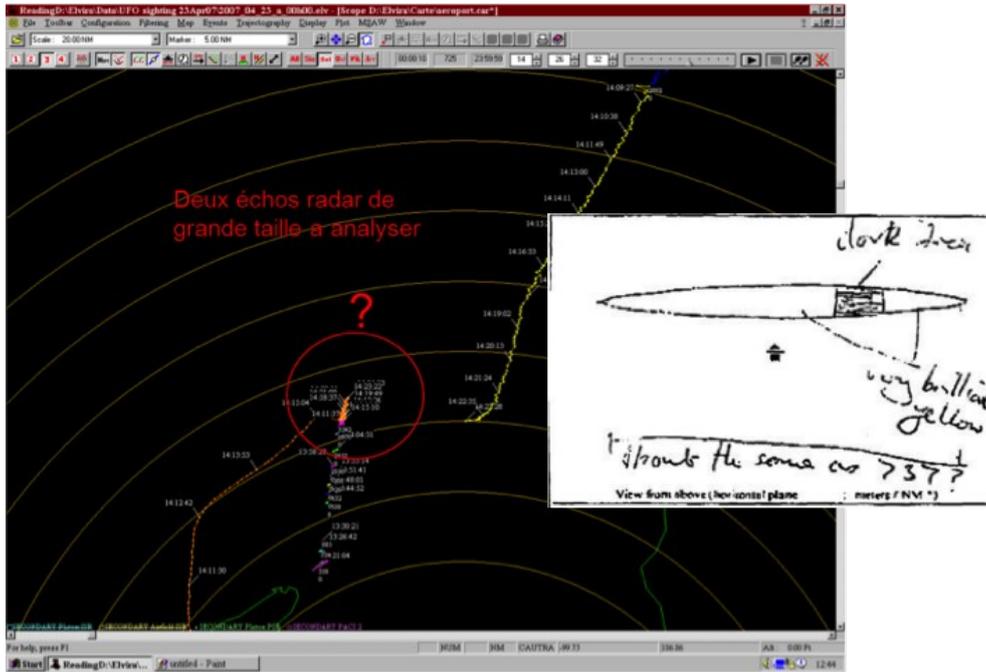
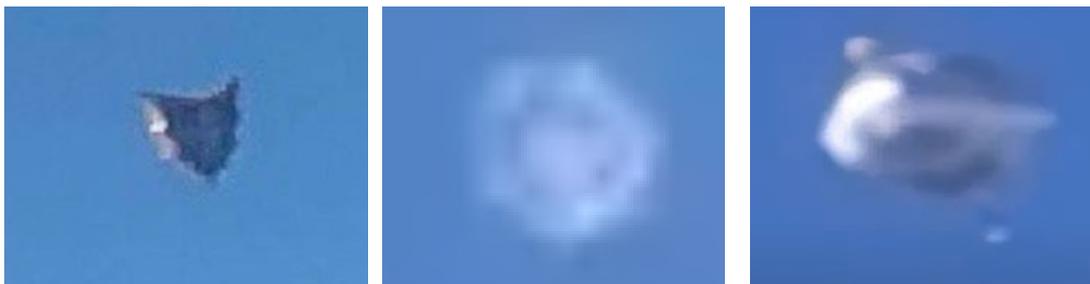


Figure 1.1.12 - Jersey (2007)

Two cigar-shaped objects were observed by the pilots of two planes between Guernsey and Jersey in 2007. The primary radar tracks were recorded by the ATC radar in Jersey for more than 10 minutes (slow returns of large dimensions not explained).



Figure 1.1.13
US observation of a UAP - IR shot and followed by a radar station - Nellis Range (Nevada, 1994)



«acorn»

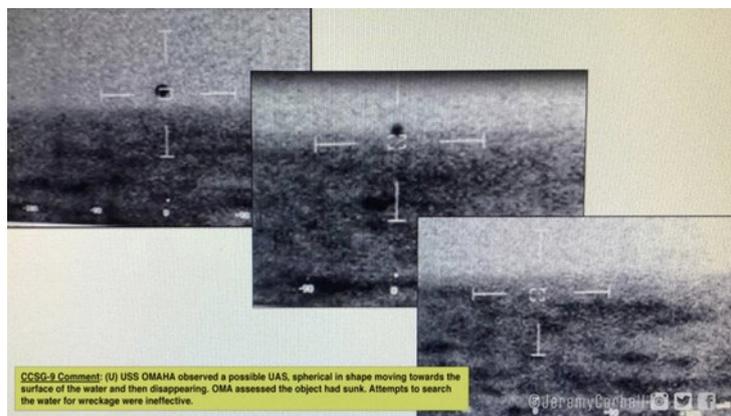
«sphere»

«metal blimp»

Figure 1.1.14
Photos taken by F18 pilots (US NAVy) off Oceana (03/04/2019)



**Figure 1.1.15 « pyramid»
USS Russel- recording with night vision device
(near San Diego- July 2019)**



**Figure 1.1.16 objet «trans medium sphere »
USS Omaha - observation of a sphere passing from the air environment into the sea (2019)**

1.2 SIGMA 2 and the research of UAP in France



Figure 1.2.1 – Some publications

1.2.1 History in France

- **1951:** Opening of the MOC (Mysterious Celestial Objects) file by the French Air Force Scientific Research Office (see text Figure 1.2.1.1)
- **1954: Ministerial Directive on MOC, 267 / EMFA / A / BS / DR**
- (see text Figure 1.2.1.2)
- **1974:** French Defense Minister Robert Galley makes a televised statement on the existence of observed and unexplained UAP phenomena since the 1950s.
- **1977:** Creation of a specialized CNES service, GEPAN.
- **1978:** Report of an IHEDN Alumni Union Committee on Unidentified Aerial Phenomena.
- **1999:** The COMETA group, made up of senior defense and security officials, former members of IHEDN, draws up the “COMETA” report which challenges the public authorities on the need to conduct research on UAP. This report is addressed to the President of the Republic Jacques Chirac and to the Prime Minister Lionel Jospin.
- **From 1977 until today:** GEPAN / SEPRA / GEIPAN investigates UAP with the



help of the Gendarmerie and the Air Force and publishes cases from 2007.

- **2013:** 3AF creates SIGMA2 focused on technical and scientific case studies.

Bureau Scientifique de l'Armée de l'Air, créé par le Ministère des Armées et qui, dès 1951, ouvre un dossier de suivi des "Mystérieux Objets Célestes" (MOC)¹, dont il archive la plupart des témoignages recueillis par la Gendarmerie Nationale et l'Armée de l'Air², sous la direction du colonel Poncet³ – Secrétariat d'Etat à l'Air: "Instruction concernant l'établissement et la transmission des comptes-rendus relatifs aux Mystérieux Objets Célestes (M. O. C. F., n° 267/EM FA/ABS/DR, 1954-10-22

Le jeudi 7 octobre 1954, des parlementaires demandent par écrit au Secrétariat des Forces de l'Armée de l'Air si l'armée française a ouvert une enquête sur les "soucoupes volantes", comme l'ont fait les USA et l'URSS : 13687. - M. de Léotard expose à M. le secrétaire d'Etat aux forces armées (air) que les récents témoignages relatifs à des "soucoupes volantes" et "cigares volants" n'ont pas manqué d'intriguer l'opinion publique, sinon de l'inquiéter ; il demande : 1° si des instructions ont été données pour que ces phénomènes soient systématiquement et scientifiquement observés ; 2° si ces "soucoupes" ou "cigares" ne pourraient pas être pris en chasse pour être mieux observés, afin que le public sache exactement s'il s'agit d'autosuggestion collective à dissiper, ou s'il y a lieu de tenir compte de ces phénomènes au point de vue de la sérénité et de la défense nationale⁴.

Une instruction est publiée, fixant les relations du BSAA avec les régions aériennes en matière d'ovnis.

Le mardi 11 janvier 1955, le Journal Officiel répond à la question du député Jean Nocher : 1° Des instructions ont effectivement été données aux formations de l'armée de l'air pour qu'une attention plus grande soit portée aux "objets aériens non identifiés" et pour qu'il soit rendu compte systématiquement des phénomènes observés. L'exploitation de ces comptes rendus et des renseignements contrôlables de toutes origines est assurée par l'état-major des forces armées "air" (bureau scientifique) où du personnel a été désigné à cet effet ; 2° l'observation à faible distance de ces phénomènes avec les qualités extraordinaires de vitesse, de plafond et de maniabilité qu'elle exige, n'a jamais donné de résultat lorsqu'elle a été tentée. Elle est cependant autorisée quand elle n'entraîne aucun risque pour le matériel et le personnel. Mais on s'efforcera plutôt de photographier et surtout de cinématographier les phénomènes, ce qui, jusqu'à ce jour, n'a pu être fait avec la netteté et l'authenticité désirables⁵.

Figure 1.2.1.1 - MOC Directive 1951



Instruction concernant l'établissement et la transmission des comptes-rendus relatifs aux Mystérieux Objets Célestes (M. O. C.)

Secrétariat d'Etat à l'Air, n° 267/EMFA/A/BS/DR

Paris, le 22 octobre 1954

A de nombreuses reprises la presse a signalé que des objets mystérieux - habituellement baptisés "Soucoupes Volantes" - étaient apparus au-dessus de la France, avaient survolé des agglomérations, des installations militaires ou des bases aériennes, et parfois atterri en campagne. Quelques-uns de ces apparitions ont même donné lieu à des rapports officiels.

En général, la description très vague des faits observés et le manque de détails essentiels sur les circonstances de l'observation ne permettent pas de se prononcer après coup sur la réalité des objets vus ni sur leur origine.

La plupart des phénomènes signalés par les témoins de bonne foi paraissent dus soit à des objets connus, mais vus dans des conditions anormales, soit à des effets d'optique ou d'électricité atmosphérique. Telle sont, d'ailleurs, les conclusions d'une enquête de l'US Air Force sur les cas observés aux Etats-Unis et l'opinion de nombreux savants français ou étrangers.

Un certain nombre de faits sont cependant restés inexplicables, faute de renseignements suffisants, et cette situation peut se reproduire. Il importe donc, tout en évitant de créer ou d'entretenir une émotion injustifiée, de rassembler le maximum d'informations sincères et précises sur les apparitions éventuelles. L'Armée de l'Air peut et doit apporter sa contribution à une appréciation objective des faits.

A cette fin, les Grands Commandements demanderont aux Commandants des bases et formations de l'Armée de l'Air placées sous leurs ordres de bien vouloir, lorsqu'un mystérieux objet céleste leur sera signalé :

Mystérieux Objets Célestes (MOC) en France:
faire établir par les témoins, militaires ou civils, un compte-rendu objectif et détaillé,
transmettre ce compte-rendu, revêtu de leur avis,
directement à l'Etat-Major (Bureau Scientifique)
sous le présent timbre.

Le Général de Corps Aérien GELEE
Major Général de l'Armée de l'Air
/GELEE/

Pour ampliation
directive ministérielle 267

Figure 1.2.1.2 - MOC Directive 1951

1.2.2 The complementarity of SIGMA2 with GEIPAN

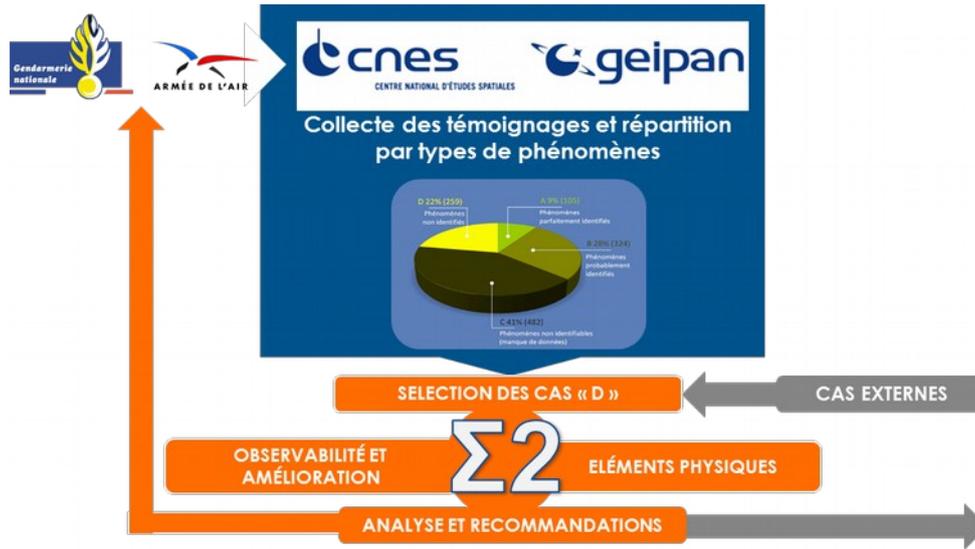


Figure 1.2.2.1 - SIGMA2 mission

The mission of SIGMA2 is therefore not to conduct parallel field investigations nor to replace witnesses, but at best to advise them to make known an interesting case, by testifying to the GEIPAN or the gendarmerie, who alone have the skills and resources to conduct investigations. SIGMA2 is therefore located downstream of the aforementioned process, to focus on the most “strange” unsolved cases classified as “type D” according to the name of GEIPAN.

1.2.3 SIGMA 2 scope

Space

UAP are observable phenomena, of natural or artificial origin, interacting with the terrestrial environment:

- Atmospheric: altitude <300 km
- Gravitational (captured by the terrestrial field or interacting): altitude <36,000 km or more?
- Magnetic.

Geographical

All countries and international organizations dealing with UAP, related physical phenomena, or having observation facilities likely to observe UAP or objects that may be mistaken for UAP in the sky or near space.

Temporal

The main waves of UAP are listed from the 1930s. We are interested in the period after 1940 for the historical, institutional aspects, or certain particular cases endowed with remarkable characteristics, but the effort will relate mainly to the study of recent cases with measures.

1.3 Methodology

1.3.1 Tasks and work logic

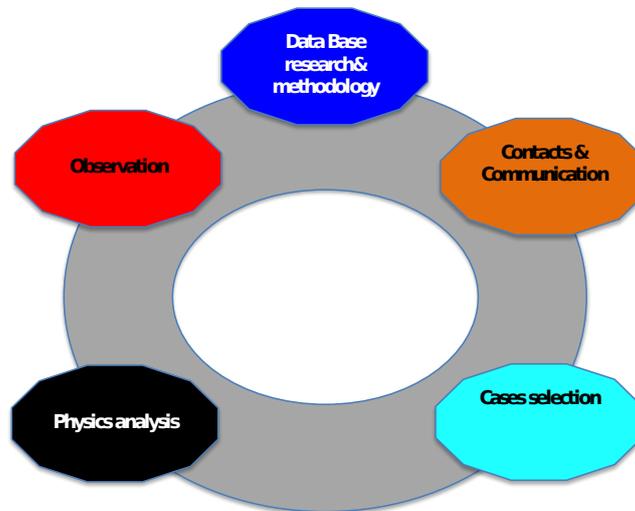


Figure 1.3.1.1 - Methodology

5 workshops to try to better understand the UAP in France and outside France over a two-year schedule with a report objective issued in early 2016, participation in exchanges of technical analyzes in particular with the Chilean CEFAA (Cougar case) but also with NARCAP US and SCU US. The latter provided us with information on the Aguadilla case (Puerto Rico) as well as on a case of EM interference on equipment (smartphone, camera) that occurred in the State of Ontario near the US-Canada border during a close encounter with a UAP. It is analyzed in this report among cases that have occurred with EME effects.

Some communications have already been published in the 3AF³ Letter as well as position papers on the 3AF / SIGMA2 website. This includes a situation update on the disclosure of the AATIP program and IR videos by TTSA (early 2018⁴), the analysis of the Cougar case (2017⁵) for which 3AF / SIGMA2 contributed to the identification of the Airbus A340 d 'Iberia in 2017, not to be confused with a UFO. The techniques for radar and IR analysis of PANs were explained in the 3AF Letter article titled IR and Radar Cross-Views on UAP⁶.

3 <http://www.3af.fr/article/en-direct-de-3af/sigma-2>
<http://www.3af.fr/article/en-direct-de-3af/sigma2-un-mandat-une-structure-un-plan-de-travail-et-d-action>
<http://www.3af.fr/article/opinion/le-controle-local-de-la-gravitation-mythe-ou-perspective>
<http://www.3af.fr/article/en-direct/rencontre-sur-les-fenomenos-aereos-anomalos-paris>

4 <https://www.3af.fr/news/commentaires-3af-sigma2-sur-le-programme-aatip-vf2-1576>

5 <https://www.3af.fr/news/analyse-du-cas-pan-video-ir-gougar-cefaa-mars-2017-travail-collectif-1485>

6 https://www.3af.fr/global/gene/link.php?doc_id=4234&fg



Direct interventions took place at the colloquium on aeronautical mysteries organized by 3AF and Alumni ONERA on the theme “IR-radar cross-views on UAP”⁷ (November 2020), a presentation at INHEST on UAP (November 2019) or a participation in films or television debates related to the subject UFOs / UAP (CNEWS vent positif in 2018, UFOs: state affair in 2020⁸, UFOs in the lightning program of Agora News Sécurité at the beginning of 2021⁹).

1.3.2 Planning

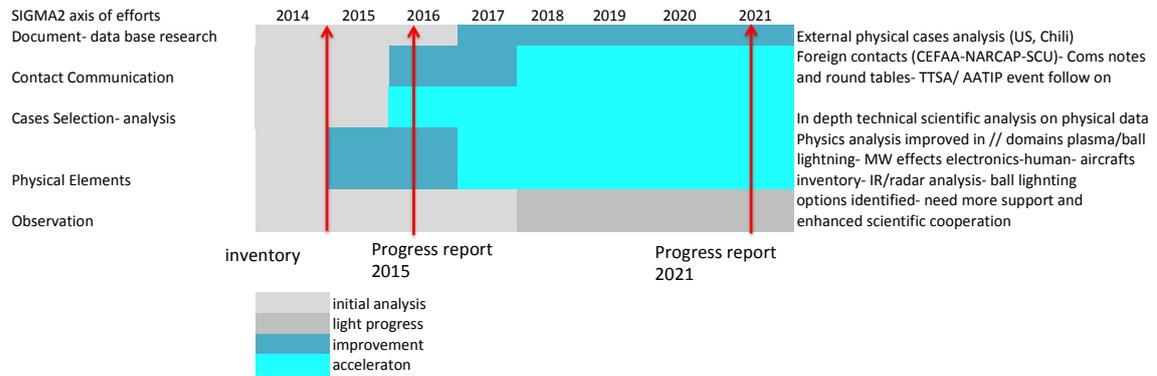


Figure 1.3.2.1 : Planning

⁷ <https://www.youtube.com/watch?v=LoDhtK6UCPA&t=6115s>

⁸ <https://www.youtube.com/watch?v=-8dIYR0XQg>
<https://www.amazon.com/Flying-Objects-Senator-Harry-Reid/dp/B08TQM2T4K>

⁹ <https://www.agoraneWS-securite.fr/eclairages-les-ovni-phenomenes-aerospatiaux-non-identifies/>



2 UAP environment: research and documentary base

2.1 UAP environment: research and documentary base

Research on UAP phenomena today remains very dependent on human testimonies and therefore, consequently, on the societies and contexts in which these testimonies are expressed. As such, within the framework of research work such as that undertaken by SIGMA2, it is essential to have a look at the historical contexts of UAP phenomena, both for example to measure the frequency of testimonies on a given phenomenon as well as to note any correspondence between changes in international contexts and certain government decisions.

A first glance at the historical data shows in a striking way an increase in the testimonies of UAP demonstrations after the Second World War. Of course, cases have been identified previously in Europe and Asia, some dating back to the 16th century, in the United States at the very end of the 19th century (1897-1898), but also during World War II (“foo fighters” observed by the pilots on the allied side but also on the German side) or just after (case of “ghost rockets” in Scandinavia in 1946). Concerning the “waves”¹ of observations bringing together a large number of testimonies and leading to investigations, most of the observations were made from 1947, also in the United States, before appearing in “waves” also during the following decade (in 1951 and 1954 in France, in 1952 in the United States, then in 1957 in South America). After another series of sightings in 1967 in the United States, it was not until 1977 to learn of the existence of a first wave of Russian sightings. Other multiple observations will be noted in the following decades (the famous Belgian wave of 1989-1990 then other more recent series of observations in the years 2007-2009 which remain to be compiled). If of course the GEIPAN archives show observations outside these same periods, these seem to be characterized by a high frequency of observations and by multiple testimonies. The creation of GEPAN in 1977 shows the accumulation of data and observations attested by the French Minister of Defense at the time, data dating back to the 1950s.

The temporal (Figure 2.1.1 and Figure 2.1.2) and geographical structure of the observations of these waves leads to some preliminary observations:

- Without making a causal link, it should be noted that the observations really began in the aftermath of World War II in the context of a strategic confrontation between the two blocs, the American and the Soviet. The UAP phenomenon is clearly a characteristic phenomenon of the Cold War period which, let us remember, opened historically with the Truman doctrine known as the Containment doctrine in 1947, which aimed to contain the USSR within

¹ See the bibliographical study of the waves by Vincente-Juan Ballester-Olmos published on site GEIPAN http://www.geipan.fr/typo3conf/ext/dam_frontend/pushfile.php?docID=11369 and the statistical study also published on site GEIPAN 2015-09-01_Spatial_Point_Pattern_Analysis_of_the_Unidentified.pdf



its territorial limits by means of 'a geopolitical and military “glacis”.

- It is even more astonishing to note the apparent simultaneity of the number of testimonies of UAP phenomena with the rise in power of nuclear arsenals and the frequency of tests, testimonies brought in geographical areas which are not the seat of tests. The first tests of a fission weapon will be carried out by the United States in July 1945 (followed by the USSR in 1949). It was not until November 1952 for the first American fusion weapon (1953 for the USSR), while France tested its first fission weapon in February 1960 (1968 for the first French fusion weapon, 1967 for China).

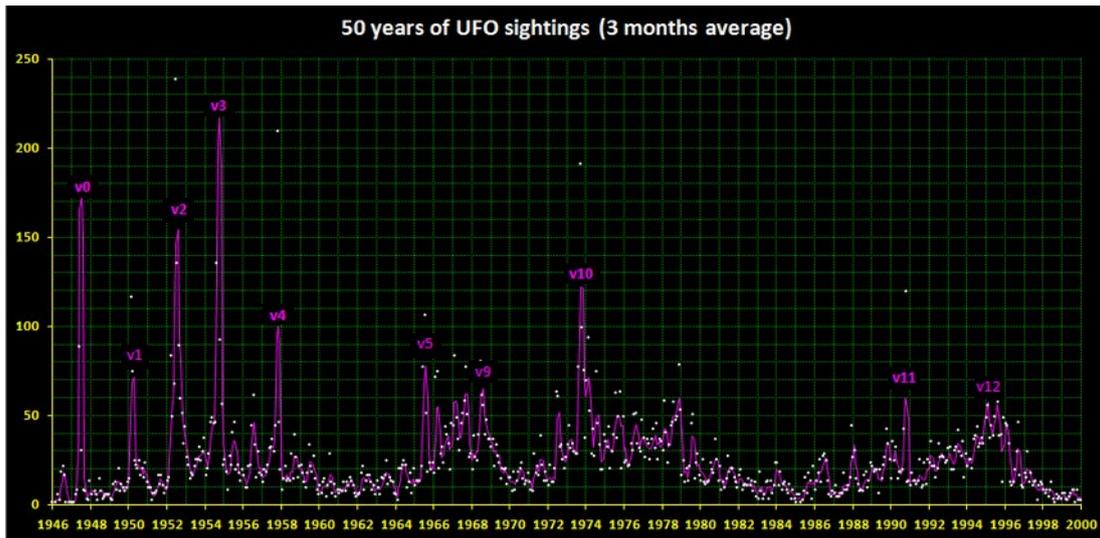


Figure 2.1.1 - Histogram of UAP observations over 50 years (U sphere.com statistical study) - correlation of UFO sightings with the sun Larry Hatch database ("U-Database", 17774 cases)

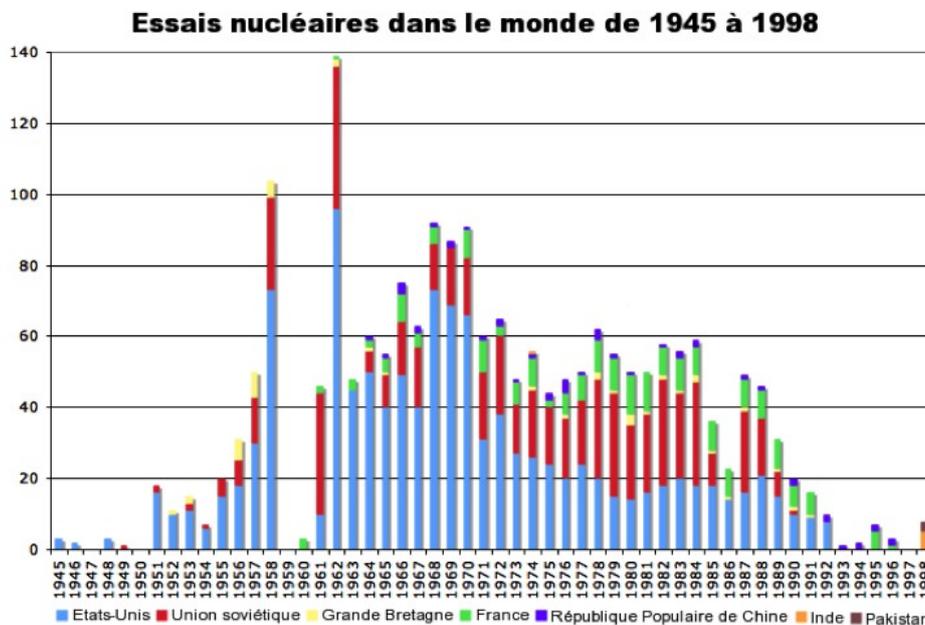


Figure 2.1.2 - Histogram of nuclear tests



The highest intensity of nuclear testing activity as represented temporally on the diagram above delimits a particularly active period in the observation of "waves" of observations of UAP phenomena and it is from the years 40, early 1950s that official investigations into UAP were launched in the USA. The instructions of the US Air Force (Air Force Regulations²) concerning the reports of sightings of UFOs will follow one another in time since April 1952, with the Letter AF 200-5, followed by variants, including the Air Force Regulation AFR 200 -2, classified under "intelligence activity", AFR 220-2, AFR 80-17 in 1960, and AFR 80-17A in 1966.

- Note also that the period when observations will multiply also correspond to the considerable rise in interest in rocket and ballistic technologies and in the wake of interest in the space environment and its uses, foremost among which besides military uses. The ballistic missile will be a direct legacy of the Second World War (German V2 rockets) which will spread both in the United States and in the Soviet Union. It should also be noted that observations of so-called ghost rockets, waves of luminous objects (several hundred) crossed the Scandinavian space (Sweden, Finland, Norway) from the 1930s ("Ghost Flier" in 1933-34, 1935 -36³) then in 1946, the "Ghost Rockets" hit the headlines, were the subject of unsuccessful investigations by the commissions of inquiry set up by the Swedish authorities. They see the presence of American representatives but also French interested in this phenomenon. The hypothesis of rocket fired by the Russians from Pennemünde (German launch base occupied by Russian forces) is initially considered, but the debris of V2 rockets from the time does not seem to have been found! The mystery remains unresolved, but Sweden will maintain a monitoring activity on the UAP since that time.

The United States will launch its first research programs (RTV-A-2-Hiroc) on the basis of the German V2 from 1946 with three partially successful launches in 1948. The main program, Atlas, will be in development from 1954 to 1958 with a first entry into service in 1959. For its part, the Soviet Union will mark the spirits with a first orbital launch on October 4, 1957, the launch of Sputnik as everyone knows. At the same time, the first anti-missile programs were set up with a first successful test by the USSR in 1961.

- Finally, alongside these military developments, the increasing number of observations of UAP phenomena accompanies the rise in the conquest and exploration of space. The intensification of launch and in-orbit activities naturally creates a favorable environment for certain observations that are sometimes difficult to characterize.

This set of events of strategic significance, described here in a very simplified manner, therefore represents a very specific context which corresponds almost exactly to the periods and countries concerned by the UAP observations which have been historically

² References of the American regulations as brought back in the Commission Report CONDON : <http://files.ncas.org/condon/text/s5chap02.htm#s4>

³ See the book UFOs and Government: A Historical Inquiry by Michael Swords, Robert Powell, chapter 16, from p.361 .



recorded. The geostrategic environment has evolved considerably since the 1940s with agreements in related fields: strategic / nuclear (cold war), space, space surveillance, proliferation, space and planetary risks in near space (debris, reentry asteroids). At the same time, air traffic has intensified significantly, including at low altitude with the more recent appearance of drones, and even mini drones.

It is a question of sharing here a simple observation which is first of all historical interest showing, on the one hand, the increase in observations of UAP waves, on the other hand, an evolution of aerospace technologies, nuclear in the context of the cold war. The observations are therefore made in a context where tests are multiplying and which leads to an increase in air and space traffic. Beyond that, and despite the knowledge acquired, the questioning of the UAP persists, even if some puzzles have been solved in the light of military programs that are finally unveiled, but which cannot explain everything. The intensification of the UAP waves in the 1940's, 50's, 60's until recent years remains an open question.

2.2 An international context which continues to raise some questions

This period is also that of the appearance of a certain number of national procedures or international texts which refer to the possibility of detection of unidentified phenomena and which provide for the action to be taken in this case. This is for example the case of the Joint Army Navy Air Publications JANAP 146⁴ procedures in the United States which establish instructions for the transmission of classified reports of observation of flying objects from air or land platforms (CIRVIS code) or else maritime (MERINT code). This bilateral agreement between the United States and Canada, established within the framework of NORAD on December 4, 1956⁵, concerned the surveillance of American and Canadian airspace, also pointing out the need for reports concerning aircraft intrusions (planes, groups of planes, missiles, etc.) than reports of observations of unidentified (unknown) objects. As early as the 47s, Canada set up national archives on UAP observations, based on reports and projects under the control of the Ministry of Transport (Magnet Project in 1950⁶ on the magnetic detection of UAP), or a research committee interdepartmental coordinated by the Defense Research Board (Second Story Project⁷).

Beyond that, while this period sees the long-term structure of the relationship between the two superpowers, the taking into account of incursions of unidentified objects into airspace then becomes a subject on the agenda (would not be - what to avoid any mistake about a launch) within the framework of the armaments limitation agreements (in particular within the framework of the SALT-1 agreements⁸). The establishment of

4 document JANAP 146 - National Security Agency https://www.nsa.gov/public_info/files/ufo/janap_146.pdf

5 Letter of agreement Canada-USA Joint Communications Electronics Committee (Can-US JCEC), Department of Transport RG12 acc. 1980-81/303 700-20 pt. 2 Telecommunications & electronics Reporting of Vital Intelligence Sightings (Cirvis/ Merint), <http://www.collectionscanada.gc.ca/ufo/002029-2001-f.html>

6 <https://www.collectionscanada.gc.ca/ufo/002029-1700-e.html>

7 <https://www.collectionscanada.gc.ca/ufo/002029-1800-e.html>

8 One of the Soviet proposals related to for example in 1970 the following point : « Mutual exchange of information on



space surveillance networks and their junction with warning and anti-missile surveillance systems (as was the case in 1971 for the USSR) then took place on both sides, several cases of overflight of strategic bases and interference with communication and control systems are listed without any apparent explanation being given⁹.

The Russian-American agreement concluded in 1971¹⁰ relating to the risks of accidental launching specifies in the same article both the detection of unidentified (unknown) objects and the risks induced by possible interference affecting missile launch facilities. Without mentioning the causes of such phenomena (see § 4.2.5), this demonstrates a mutual concern with regard to risks that have nothing to do with the risks of characterized intrusion into the airspace or of a preventive strike of the installations. launch, but rather the need to put in place alert and mutual information procedures ("red telephone") from the beginning of the 1970s. This concerns the risks affecting the launch bases, which could lead to firing. missiles caused by a misinterpretation linked to the presence of an unknown object, or by the effect of interference. Various incidents are reported in § 4.2.5 on the Electromagnetic Effects of UAP.

2.3 National work towards a new international perception

2.3.1 The observation of a lack of consideration at the international level

At the same time, the late official positions on these subjects or their mention in international organizations can sometimes surprise and paradoxically reinforce the impression of a relative lack of transparency. Thus, attempts at international cooperation to exchange information have indeed taken place, but ultimately with little success.

Thus, the cooperation attempts between the United States and the Soviet Union at the end of the 1960s, when the two countries had set up teams (under the aegis of the physicist Edward Condon in the United States¹¹, and in Soviet Union under the direction of the Academy of Sciences), ultimately did not lead. Likewise, at the same time, scientific contact projects between the United States and Canada did not come to fruition, again for lack of support and sufficient interest, particularly on the Canadian side, while military cooperation concerning surveillance of NORAD airspace was indeed effective.

Moreover, some plans to involve the United Nations in a collective investigation process will not meet with support either, or even arouse strong opposition.

detection of unidentified objects by early warning systems, or notification of signs of interference with these warning systems or with corresponding communication facilities". An agreement on this point "would not pose a problem" for the American part. It is interesting to refer on this point with the official story of discussions SALT-1 reported in *Foreign Relations of the United States, 1969-1976, SALT-1 1969-1972, Volume XXXII, Department of State, 2010.*

9 One can refer for example to the data gathered within the framework of the project Blue Book of the Air Force. At the same time incidents of the same type were reported in Soviet Ukraine side.

10 <http://www.state.gov/t/isn/4692.htm>

11 Work which will give place to famous "the Condon Report" which expresses a strong skepticism for the indexed phenomena but which did not win unanimous support in the scientific community



In 1967, for example, a proposal to allow the UN Office for Outer Space Affairs to investigate PAN (UFO) phenomena, an initiative taken by a professor at the University of Arizona, James McDonald, will have some resonance, in the press. Informal discussions will take place but will not actually lead to any official position being taken, which the United Nations will be quick to confirm.

The subject will come to the fore at the United Nations almost 10 years later, this time in a more formal way. We must cite here decision 33/426 brought to the United Nations General Assembly, which will arouse the indifference of some of the countries present but will also provoke strong British and American opposition.

This decision was taken on December 18, 1978 during the 87th session of the General Assembly on the proposal of the island of Grenada to create an international research agency on UAP or the grouping of experts placed for example within the Committee Peaceful Uses of Outer Space (CUPEEA, COPUOS) to share data and knowledge on NAPs.

This decision was the subject of actions against the international sharing of data, reported in particular in the archives of the British MOD, on the pretext of the unnecessary expenses that would be induced, a position it seems also reported and shared on the American side (point under verification). The decision was ultimately reduced to a simple invitation from "the member states concerned to take the appropriate steps to coordinate at the national level scientific research and investigations into extraterrestrial life, including Unidentified Flying Objects (UFOs), and to inform the Secretary-General for observations, research and evaluations of such activities ". Some states have finally published or given access to their previously classified archives from the 2000s, or even before (Australia¹², Brazil, Chile, Denmark, Spain, France, Mexico, Sweden, UK, etc.). In Europe, Germany does not seem to have conducted official investigations into these phenomena, although some recent articles report hypothetical Bundestag archives on the subject UAP in connection with airspace surveillance, during the cold war, on the border between the two Germanies, often overflowed by reconnaissance vehicles.

We can only note that these initiatives remained strictly national and did not allow official exchanges of information between experts. It is interesting to note, however, that the place of this decision in the debates of the GA (General Assembly) is also to be found among the debates relating to weapons of mass destruction, priority subjects, concerning for example nuclear weapons, chemical weapons and peaceful use of nuclear power.

From a strictly historical point of view, we simply note that this period of the 70s, led not only to the first Russian-American nuclear arms limitation and verification agreements, but also to the first international agreement on the control of proliferation of nuclear weapons, which is an event of historic significance, still valid today, at least for the signatory countries. It is obvious that the international effort at that time focused on controlling the risks associated with weapons of mass destruction and that the subject UAP remained of very relative interest. It still is.

¹² See the book UFOs and Government: A Historical Inquiry par Michael Swords, Robert Powell, chapter 17, starting from p.402



2.3.2 American references: past and present

The US references concerning the study of the UAP are mainly linked to the studies carried out by the USAF reported in the “Blue Book” file, work deemed to have been completed on the conclusions of the Condon Commission in 1969: no proven risk for American airspace . End of the work. Maybe on the surface, because the news since 2016 might show otherwise, as one might assume.

In fact, the CIA has been publishing since 2016¹³ archives on UAP as part of FOIA (Freedom Of Information Act) requests showing that an American watch continued on the observations of UAP and atmospheric re-entry made by other countries. , embassies relaying the facts observed around the world by diplomatic telegrams (link with the Moondust project¹⁴) in particular to recover data or materials linked to fallout or traces of spacecraft, of different origins (including Soviet). The records published by the CIA on US CIA CREST reveal many documents, much of which is difficult to read or of limited interest, but a few of which are more interesting. More recently, TheBlack Vault put online in January 2021¹⁵, the collection of these CIA archives in pdf format allowing easier research (use of keywords) In particular, certain documents analyzed from US CIA CREST are listed in the Appendix. They concern different subjects in relation to our historical or scientific research:

- attempted contact on UFOs with foreign countries (France, Russia) by Carl Sagan (founder of SETI) at the end of the 1960s, under the control of the US Air Force;
- contacts between Russian and Chinese experts near the Sino-Russian border regarding UAP appearances after 1990;
- facts related to Russian soldiers intervening at a site in the Urals where a UFO allegedly landed, showing signs of memory loss and disorientation ... etc. ;
- facts recounted concerning the intervention of the Moscow air defense in a UFO hunt in 1989, relating the particular behavior of UFOs undetectable by radar and observed in infrared, facts recounted in Russian accounts (1989).

So it seems that the US has continued some work on UAP beyond the 1960s, which seems to emerge from statements made since late 2017 on the Pentagon's AATIP research program¹⁶, supposedly interested in UAP. Since then, the Pentagon has not only recognized the existence of the AATIP program, but following numerous testimonies from pilots, officially announced in August 2020, the creation of a Task Force on Unidentified Aeronautical Phenomena (UAPTF)¹⁷ which must make accounts

13 <https://www.cia.gov/library/readingroom/document/cia-rdp79b00752a000300130001-1>

14 <https://www.theblackvault.com/documentarchive/project-moon-dust/>

15 <https://www.theblackvault.com/documentarchive/ufos-the-central-intelligence-agency-cia-collection/>

16 AATIP : Advanced Aerospace Threat Identification Program

17 <https://www.defense.gov/Newsroom/Releases/Release/Article/2314065/establishment-of-unidentified-aerial-phenomena-task-force/>



to Congress and the National Intelligence Council.

Let's go back to December 16, 2017 where several articles (written in the “New York Times”, “Politico”, articles with the participation of journalist Leslie Kean of the “Huffington Post”) appeared on a US Pentagon research program on UAP (Unidentified Aerial Phenomena, UAP in English) called AATIP. This “hidden” Pentagon program dates from 2007 and was stopped in 2012 according to the Pentagon. These articles raise questions and lead people to turn to 3AF / SIGMA2 for their views on this program and related statements. The objective of our analysis (see §3.5) is to provide some answers to the main question: what do these revelations bring to the AATIP program and to American research relating to UAP, in the current state of knowledge?

Recent developments since 2020 show an inflection in American communication policy and an acceleration of events. First with the announcement of the creation of a UAP Task Force by the Pentagon in August 2020. Then with the confirmation not only of the authenticity of the IR videos broadcast in 2017, but also more recently of photos and recordings UAP carried out by the US Navy in 2019.

These data, which seem to “leak” from the Task Force, intervene in what seems to be a progressive communication dynamic since 2017, with a series of contradictions systematically followed by confirmation of the authenticity of the information. These are being brought together right now to culminate in a report to Congress by the Pentagon in June 2021.

It is a question of pronouncing on the existence of unknown objects in American airspace, on the corresponding risks from a security and defense point of view. So this is not trivial.

On June 3, 2021, the NY Times published an article¹⁸ after reading the UAPTF report to Congress, titled: “U.S. Finds No Evidence of Alien Technology in Flying Objects, but Can’t Rule It Out, Either.” In other words: cases of UAP or unidentified objects are cited, 120 cases over the last two years.

No evidence is given of technologies of “extra-terrestrial” origin, ie confirming the Extra-Terrestrial Hypothesis (ETH); but we cannot rule out this “ETH” hypothesis because of the abnormal behavior of these objects. No further mention is made at this stage, acknowledging that classified, therefore undisclosed, data exist in appendices to the report.

The questions about incursions by Chinese or Russian aircrafts are still being asked. But at the same time, the observation is made of a kinematic behavior (brutal speeds and accelerations) inexplicable by known technologies, as well as the change of air-sea environment without interaction with the environment (absence of aerodynamic and acoustic effects. , ...).

We can therefore conclude, after three years of questioning US communication, to a

¹⁸ <https://www.nytimes.com/2021/06/03/us/politics/ufos-sighting-alien-spacecraft-pentagon>



new fact. The report doubly contradicts the conclusions of the Condon report of 1969. The safety of airspace is questioned by unexplained incursions and beyond the technologies mastered by the United States. The origin of phenomena does not refer to natural phenomena.

2.4 The paradoxical observation of the lack of interest in the scientific community

More broadly and in the space domain register, the SIGMA2 commission notes the general acceptance of the possibility of detecting or encountering extra-terrestrial life within the framework of distant space exploration activity (at point for example to provide in the United States the action to be taken in the event of discovery of extraterrestrial life¹⁹ during the space conquest and the Apollo program in particular) while we note the absence of a similar interest in listing and investigating on the possibility of unusual phenomena in the space and atmospheric environment near the Earth in the same period, even though investigations have been carried out for several decades on this subject. This remains the case for large intergovernmental structures of the CUPEEA (UN) type, but note that it is also the case for the most prominent private initiatives such as the “Breakthrough Initiative” by Yuri Milner (Russian billionaire) with Stephen Hawking who wanted to encourage the search for extraterrestrial life, an approach which is exclusively oriented towards deep space. Based on the observation that many exoplanets are frequently discovered, this “Breakthrough initiative”, endowed with a discovery bonus of US \$ 100 million, was launched in July 2015 and brings together a scientific committee initially aiming to select and support projects to speed up the effort to process the large amount of data collected by radio telescopes in order to detect signals from space. In the event of a discovery, this “Breakthrough Initiative” committee would then examine the action to be taken and the advisability of issuing an equivalent terrestrial signal, a subject which is also debated, including from an “ethical” point of view.

This initiative is in line with private initiatives such as the US SETI institute program²⁰. Created in 1984 with private funds, it is interested in the search for extraterrestrial life by the detection of radio signals from space, following the first American research dating back to 1960 (Ozma project). In 2005, it received a grant from NASA for the Allen telescope (see Figure 2.4.1). At the same time, SETI also includes the Carl Sagan center for research and detection of chemical traces of life in space. Despite all these scientific initiatives which contribute to the search for extraterrestrial life and to the application of the Drake equation, the efforts of observation and research in the near environment seem devoid of interest for the scientific community which has yet a major interest in the study of earth and atmospheric sciences, and the interpretation of the causes and prevention of natural hazards. The Fermi paradox opposed on the one hand the high

¹⁹ Let us also quote the American federal law decided on July 16, 1969 at the time of the Apollo program, relating to the regulations with regard to the exposure of an individual to extraterrestrial life, with risks of introduction of viruses into the terrestrial environment. authorized NASA to take various measures including quarantine (Title 14, Section 1211 of the Code of Federal Regulations). This law was withdrawn from regulation in 1977 and repealed in 1991

²⁰ Search for Extra Terrestrial Intelligence (<http://www.seti.org>)

probability of the presence of life in the universe, on the other hand the absence of visible manifestation in our environment. We can only note the lack of interest in the scientific community in capturing and processing data from our close environment while it remains committed to research into exobiology.

However, this observation made in 2015 does not take into account other initiatives that have since appeared with the American news which highlights research carried out between 2008 and 2012 by:

- Bigelow Aerospace (NIDS) on private funds between 2005 and 2008 including a merger with MUFON, one of the challenges of which concerned databases,
- as well as the AATIP US program which has been unveiled since 2017 and in which Bigelow Aerospace also participated.

The scientific content of the work carried out under contract by the DIA is new. It will be explained in § 3.5.

An effort to collect and share data on UAP among scientists would be useful. Peter Sturrock, renowned American scientist (inventor of the free electron laser) had also gathered scientists in 1998 for a seminar in Pocantico to examine the physical elements found following the observation of UAP. No follow-up was given, although very concrete elements were discussed.



Figure 2.4.1 - SETI Allen Radio Telescope Array at Hat Creek Observatory
(NASA funded this project in 2005)

2.5 Despite the proliferation of space surveillance systems

Today, the topic of surveillance of the space environment has become an essential subject of international diplomacy. The evolution of the uses of space as well as the proliferation of active systems and debris have made consultation necessary and the international community is discussing the various legal and technical frameworks to implement it. At the same time, more and more countries are developing means of monitoring the space environment, whether this involves ensuring the proper use of Earth's orbits or identifying "near-Earth" asteroids, that is to say likely to collide with Earth.

Today, the United States, Russia, China, Japan or a few countries in Europe, foremost among which France, are implementing radar and optical sensors (sometimes spectral analysis) for monitoring space objects.

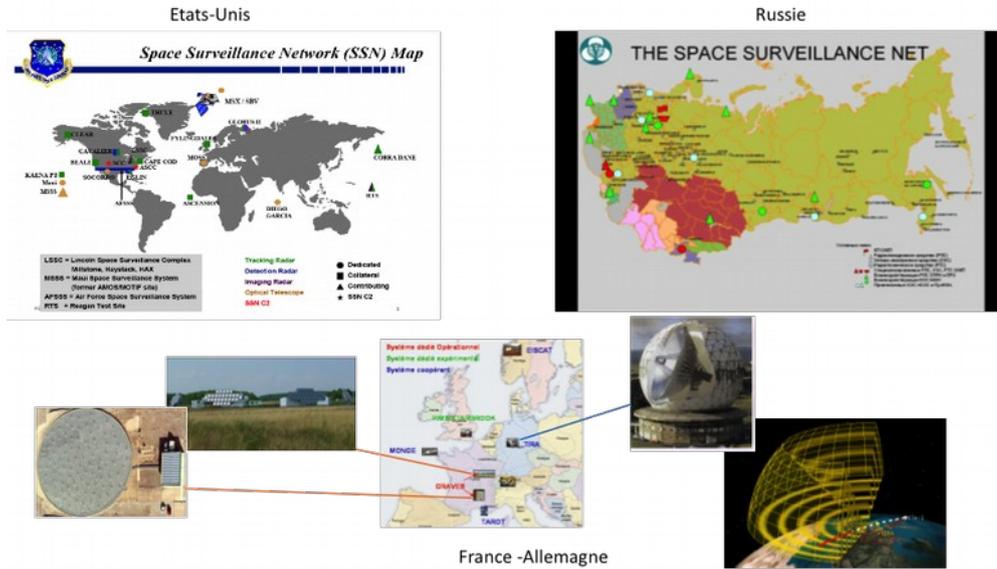


Figure 2.5.1 - Examples of existing national networks

Moreover, in recent years we have witnessed the emergence of specialized industries that can provide a data collection and processing service, mainly aimed today at governments or satellite operators. This is particularly the case in the United States with an industrial player Analytical Graphics Incorporated (AGI) which now offers a real service for tracking spatial objects and analyzing data as shown in the diagram below.

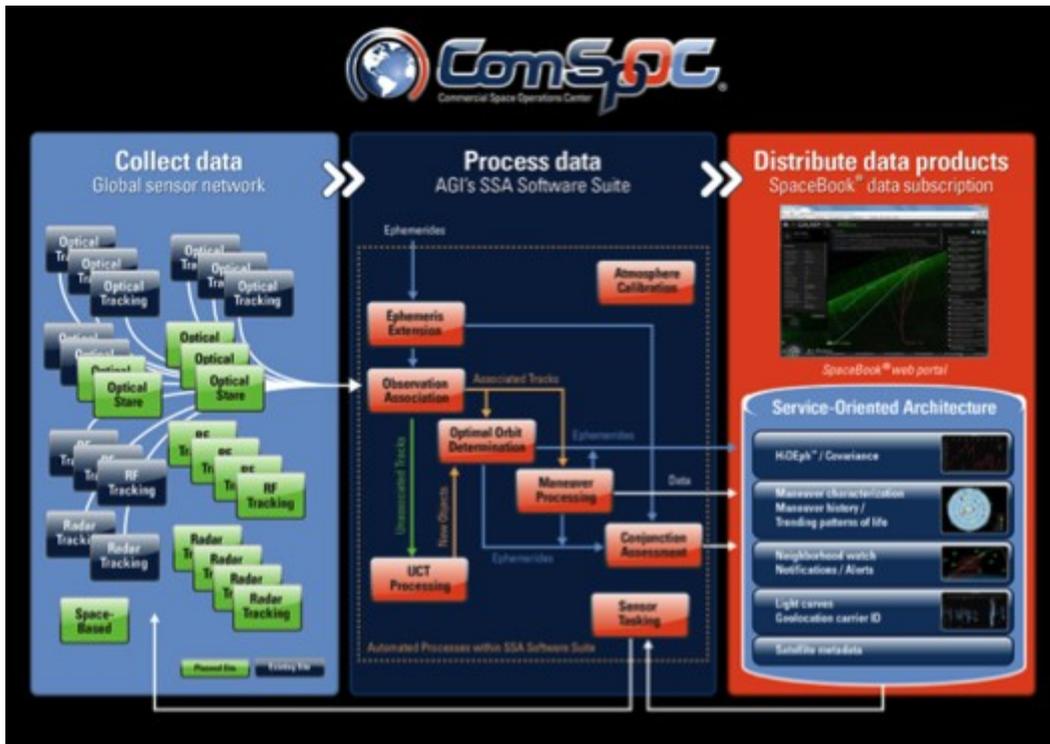


Figure 2.5.2 - Data collection process for space monitoring from sensor networks (source Analytical Graphics Inc)

Finally, initiatives linked to international non-governmental organizations are emerging such as the Russian IGMASS²¹ initiative with the support of the International Academy of Astronautics (IAA). We can also mention the establishment of the international network of ISON²² telescopes under the aegis of Vladimir Agapov, of the Academy of Sciences in Russia, and which offers the possibility of a global automated monitoring tool distributed in 11 countries across the world.

21 International Global Monitoring Aerospace System

22 International Space Optical Network

ISON observatories location

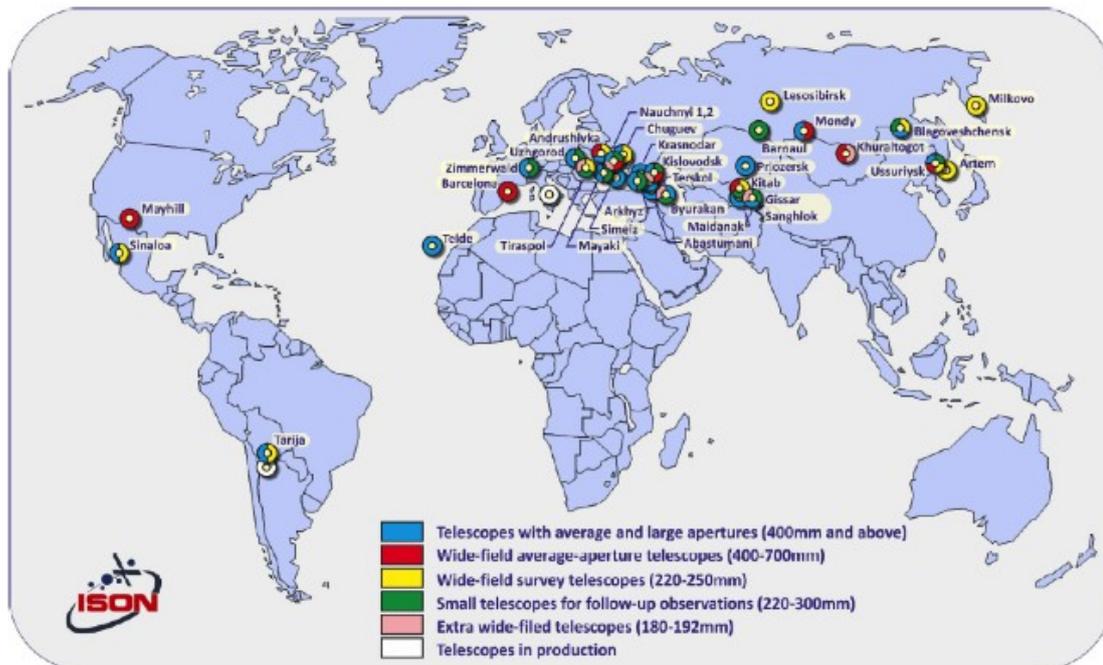


Figure 2.5.3 - ISON space observation network

However, these developments today contain a very sensitive dimension and do not in reality lend themselves to the establishment of a global network for the observation of UAP phenomena. The theme of space surveillance remains addressed primarily through government-to-government relations, while the United Nations, through the CUPEEA, now only deals in practice with the question of the “sustainable development” of space activities. long-term. The commission's work is based in particular on the results of a working group of government experts set up under the auspices of the United Nations Secretary-General and which submitted its results in July 2013, insisting in particular on the establishment of greater transparency in the exchange of information on the spatial situation.

The difficulties that arose in 2015 in putting in place a non-binding text incorporating these principles of transparency (in the form of a non-legally binding "code of conduct") in reality showed the limits of this exercise ... On the other hand, the networks of optical and electromagnetic observation of meteors unfold.

2.6 Documentary search and classification method

Only a few countries have started official research since the 1950s and set up observation reporting procedures (United States, France, Great Britain, Russia in particular). Then some countries decided to stop later official investigations or at least to cease all communication on these subjects (this was the case of the United States, Russia, Great Britain for example).



However, non-governmental organizations have sprung up and stand out from all the many groups on these subjects. Some associations such as NARCAP or SCU in the United States for example, have given themselves a scientific purpose and have patiently listed a set of documents which form a first organized base of documentary references. More broadly, there are many databases established by such organizations (NARCAP, CUFOS, RRO, Chilean CEFAA or the Argentinian CEFAE, dependent on the Argentine Air Force now the CIAE (Aerospace Identification Center) in 2019, or that of the British Ministry of Defense) which allow to highlight occurrences or particularly discussed cases. These databases can include aeronautical incidents, observations of traces on the ground, aerial, luminous and electromagnetic phenomena. For example, official documents listed in the US Air Force's Project Blue Book relate the overflight of US strategic bases.

Our work also focused on the UK MoD report regarding the presence of UAP in UK airspace. This remarkable report, summarizing 20 years of research on UAP, confirms their existence without any doubt, their polymorphism and their astonishing kinematics: hovering, instantaneous accelerations, apparent absence of inertia. The work concludes that there are no proven risks, in particular for air traffic and defense, by emphasizing the possible origin of these phenomena in connection with atmospheric plasmas of natural origin. Artificial origin linked either to confidential aircraft or to an "ET" origin is considered unlikely. Physiological effects associated with close encounters with UAP are also described. Some interesting cases are discussed in the report and are described, including the observation of a craft surrounded by blue radiation, from RAF Tornado planes flying over the English Channel, as numerous and diverse observations were recorded over French territory on November 5, 1990.

Russian studies over the period 1950-1990 show a peak in research in the period 1970-1986 with a civilian program (SETKA-AN) for the study of phenomena called "anomalies" and a military program (SETKA-MO) for defense work concerning the sensitivity of defense systems to these phenomena or the use of research for the purpose of military technological fallout. Among the military works, the role of the Soviet navy seems to have been important in view of the very numerous observations of flying or aquatic objects (nicknamed Quakers) brought together by their reinforced observation network between 1977 and 1980. Cases of material collection with particular properties are also mentioned on certain sites such as Dalnegorsk. This work seems to have stopped or to have been greatly slowed down after 1990. What about today?

We have not conducted any investigations into Chinese work so far, but we have noted in the archives published by the American CIA, meetings between Russian and Chinese experts in the early 1990s and the holding of symposia with the research environment around 1994. In addition, the Chinese research sector publishes numerous publications on related subjects such as ball lightning, meta-materials, etc. China is also developing technologies for space vehicles, missiles and efficient drones.

It seems, however, that the research was maintained as we assumed in the USA, not only by the monitoring carried out by the CIA (whose archives disseminated show a



worldwide follow-up long after 1969 - see § 2.3.2) but also by the program. AATIP research project unveiled at the end of 2017. Its existence was confirmed by the Pentagon in 2019 (study program explained by the DIA - see § 3.5), reporting procedures were put into action within the US Navy and a UAP Task Force was formed within the Pentagon (August 2020), under the leadership of the Navy at the request of the Congressional Intelligence Committee. She must collect all the information on UAP and submit a report to Congress in June 2021. We can assume that an official organization is therefore activated to investigate UAP in the United States.

At the same time, Japan also established observation reporting procedures within all of its Self-Protection Forces in September 2020 by also signing an information agreement with the Pentagon²³. We await more specific information on the US program and the release of information on the UAP Task Force report. It is possible that one of the consequences is a clearer presentation of the research policy on UAP by the US, and by rebound effect, by other countries.

As a response to American questions, the People's Republic of China (PRC) responds to the Pentagon's report on UAP, with a statement²⁴ relating a similar observation of regular incursions into Chinese airspace, acknowledging that this poses a security problem. . The same observation is made of extraordinary kinematics for these "abnormal" atmospheric phenomena. The work carried out by a similar UAP Task Force, bringing together the academic research community with the armed forces of the PRC, refers to studies of UAP event recovery from analyzes of "weak signals" type data assisted by Artificial intelligence. It is also an important factor of change. The observation is therefore shared.

All the documents listed make it possible at least to organize the research by geographical area (see Figure 2.6.1) and chronologically since the 1940s. This research identifies the actors and areas active over the last sixty years. (see the table below including a non-exhaustive list) and using various publications²⁵.

23 <https://www.japantimes.co.jp/news/2020/09/14/national/japan-defense-ministry-ufo/>

24 <https://thedebrief.org/china-confirms-it-has-its-own-ufo-task-force/>

25 State of the Art in UFO disclosure worldwide, Vicente-Juan Ballester Olmos, disclosure update; UFOs and Government/ A Historical Inquiry - Michael Swords, Robert Powell

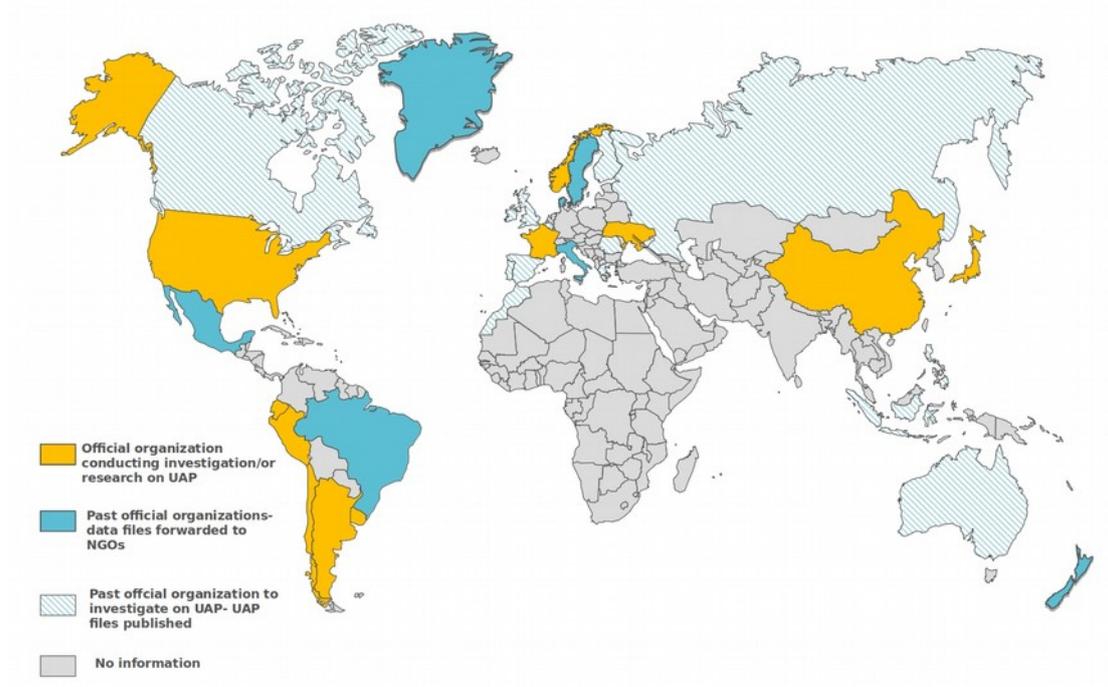


Figure 2.6.1 - Some research activities on UAP and UFO

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The following table 1 gives a non exhaustive state of the activities of the various countries.

| Country | Institutions | Date of creation | Date 1 st publication | Associations on UAP and archives |
|------------------|--|------------------|--|--|
| ARGENTINA | Navy | 1965 | 1965 | Antartica case data forwarded to NICAP CITEFA work with civil Ufology groups CEFAE works with civil Ufology groups (Dewey, Ferguson, Brunetti, Lurchuk, Diaz) Attached to the Air Force Staff |
| | Air Force –semi-official group CITEFA | 1991 | 1997 | |
| | Air Force- CEFAE (Center for study of UAP) | 2011 | yearly | |
| | CIAE (Center for aerospace identification) | 2019 | | |
| AUSTRALIA | RAAF | 1965 - 1996 | 1965-1980 | |
| | Department of Supply | 1965- 2000 | 1982-1984-1991 2002-2003-2008 | |
| BELGIUM | Air Force- Gendarmerie | 1989-1991 | 1989-1991 | SOBEPS/ COBEPS |
| BRASIL | Brasil Air Force | 1954 | 1954-1958-1967 | Brazilian UFO Researchers Committee (CBU) |
| | SIOANI (<i>Sistema de Investigação de Objetos Aéreos Não Identificados</i>) – <i>service from Air Force</i> | 1969 | 1984-1985-1988 2000-2001-2009 2010 | |
| | <i>Navy and army archives</i> | | ? | |
| CANADA | Minister of transport – Magnet- Commission | 1947 | 1968 | |
| | Interministerial Defense Research Board | 1952 | 1978-1980-1985 1997 2007-2009 | |
| CHILI | DGAC/CEFAA | 1984-1998 | 1984-1985 | Video and case to UFO magazines |
| | | 1997 | 2007 2011 | |
| CHINA | Interest from the academy of science –centre of atmospheric studies (Ball Shape Lightning et Earth Light)- study of ionized medium and effects on drag | | | China UFO Society- interest seems to raise in 70s or 90s |
| DENMARK | Air Force- Denmark Defense Command | | 1972-1980 2009 | Cooperation between the Air Force and Ufology group SUFOI |
| SPAIN | Air Force | 1968- 1999 | 1976 | |

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| | | | | | |
|-----------------------|--|-----------|------|--|--|
| | Civil Guard | | | 1983-1984-1988 1992 à 1999 | |
| EQUATOR | Equatorian investigation commission on UFO (CEIFO) | 2005 | | 2005-2008 | CEIFO investigation with civil Ufology groups |
| FINLAND | Military authorities | 1933 | | 2009 | FURORA |
| FRANCE | Air Force (BPE)- Gendarmerie | | | 1976-1977-1978 | |
| | CNES/GEPAN-SEPRA-GEIPAN with support of Gendarmerie and Air Force for investigation | 1977 | | Since 2007 | |
| | | 2008 | | 2010 | 3AF/PAN-SIGMA |
| | | 2013 | | 2016 | 3AF/ SIGMA2 |
| | | | | 2021 | |
| United Kingdom | MoD DI55 and UFO desk au RAF Defense Intelligence Air staff (DIAS) Condign Project | 1950 | 2009 | 1983-1985-1987 1993-2006 1999-2005 2006 2008 to 2013 | DUFORO (Devon UFO Research Organization) Doc to D. Clarke, G. Anthony et A. Roberts Condign File to D. Clarke et G. Anthony National Archives on line |
| GREECE | Air Force | | | 2007 | Investigations back to the ghost rockets |
| INDIA | | | | | |
| INDONESIA | Air Force National Aerospace Agency (LAPAN) Dir Salatun in charge of investigation on UFO | 1960 | | 1960 | Publication by LTC Salatun |
| | | 1963 | | 1963-1982-1977 | |
| IRELAND | Army | | | 2007-2013 | Irish Time recovered from army after FOIAA procedure (1947-1985 then 1993) |
| ITALY | Minister of general security Air Force | 1978 | | 1978 1986-1988-2001 Since 2001 | Data provided to CUN, CISU |
| JAPAN | | | | 2010 | Publication of cases (1968-1986) by LT General Sato (ex chief of Air Defense) |
| | UAP Reporting procedure for the Auto-Protection Forces 2020 Accord cooperation | 2020 | | | |
| | USA-Japan agreement | Sept 2020 | | | |
| | UAP Task Force | June 2021 | | | |
| MAROCCO | Request from Marocco Forces on UFOs information to the USA on 05/10/1976 | | | | Numerous cases lay in Blue Book. –base FOTOCAT- cases from 50, voire avant (années 30 évoquées). |
| MEXICO | Air Force | 2004 | | 2004 | |
| NORWAY | Ministry of Foreign Affairs-Police – Air Force | | | 1987 | Ghost Flies et Ghost Rockets 1934-1946 |

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| | | | | | |
|--------------------|--|----------------------|--------------|-------------------------------------|---|
| NEW ZEALAND | Air Force | 1952-2009 | | 1993 1975-2009 2010 | Files on Unknown submarines? |
| PERU | Air Force- OIFAA (Institute for search on abnormal phenomena) DIFAA (service for investigation on abnormal phenomena) with support of military | 2001 | 2013 | 1980 | DIFAA works with civil Ufology groups |
| PHILIPPINES | PAGASA (Philippines Atmospheric Geophysical and Astronomical Services Administration) –of DOST Department of Science and Technology | 1984 | 2000 | 2000 | Philippine Center for Aerial Phenomenon Studies (PCAPS) |
| PORTUGAL | Air Force | 1957 | | 1990 1957-1977-1982 | Archives to CNIFO (1957-1982) |
| ROMANIA | Ministry of Defense | | | 2008 | |
| RUSSIA | Research F. Ziguel Stoliarov Committee (Ziguel, Stoliarov) SETKA/AN (Academy of Science, Migoulin, Platov, Guindilis, Menkov) Troïtsky/ Mordvin-Choro SETKA/MO (Ministry of Defense-Col Sokolov) NLO research—Russian Navy- NI-22- Citadel project (CMI) | 1962 1967 1978 | 1967 1982 | 1991 1993 | Publication 1 ^{er} volume UFO in USSR UFology Union Russia UFOS (1992) chaired by Boris Chourinov Archives KGB (1982-1990) to P. Popovitch Archives from Col Sokolov to MUFON |
| SWEDEN | Sweden Army Defense Staff FOA UFO investigation Department | 1933 | | 1968-1975 1983-2009 2010-2011 | AFU (1980, Nörrköping) |
| SWITZERLAND | Air Force | | | 1994 | Archives (1971-1987) |
| UKRAINIA | Ukrainian Scientific-Research Center of anomalous phenomena "Zond" Kiev Polytechnic Institute, Department of Aviation | | | | Ufologiske Ukrainien (UFODOS) publication en 2009 International Development research center |

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| | | | | |
|----------------|--|-----------|----------------------|---|
| | and Space Systems. | | | RIAP (Research Institute on anomalous phenomena), Kharkov, Ukraine. CRIDOVNI works with civil Ufolology groups |
| URUGUAY | Air Force- Committee for study and analysis of UFO reports (CRIDOVNI) | 1979 | 1979 2000 2009 | |
| USA | US AIR FORCE Sign- Grudge/ Blue Book Project, Commission CONDON CIA Commission Robertson, DIA, FBI, NSA, GAO AATIP Project (DIA) | 1948-1969 | 1948 à 2015 | CUFORS, MUFON , NARCAP, SCU |
| | Pentagon UAP Task Force (under Navy lead) | 2007-2012 | | Rssearch program on advanced ait threat inc UAP- exotic research themes |
| | | 2020 | | |



2.7 The existence of a mass of official information

Regardless, the mass of evidence from various origins constitutes in itself a material that must be taken into account and studied by SIGMA2. As such, in addition to the documents emanating from GEIPAN and forming a traceable documentary set, information from other countries is listed and, if necessary, studied by SIGMA2 (see §3. Contacts - Scientific Network - Communications). For example, an agreement has been made with the Chilean CEFAA, an official body which has agreed to share its information on national cases for further analysis.

At the same time, the objective of collecting observable and measurable elements has led SIGMA2 to approach the national projects in progress developed by specialized services of the CNRS (IMCCEE) for the operation of an automatic collection system of signatures intended for surveillance of bolids. Other recently created international groups (UFODATA project) with similar technical ambitions will be the subject of similar contacts when the time comes.

Of course, SIGMA2 also takes into account the information collected by the many specialized groups, especially in the United States, which sometimes do a very effective archiving job. Within the limits of well-established and traceable documents, and taking into account the relations followed between SIGMA2 and the managers of these groups, these sources of information thus allow access to official documents.

2.8 Implementation of an architecture and a documentary methodology for SIGMA2

SIGMA2 has a documentary database (BDD) which lists and notes all of these documents, discriminating according to the traceability and the seriousness of the origin that can be attributed to each part. This tool allows the committee to continuously filter the reliability of the information available and to allow SIGMA2 to work knowingly on the data provided to it (article to be published in the 3AF Letter).

The constitution of this database is based on taking into account a set of documents which must reflect the diversity of sources. It is necessary to put these sources into perspective beforehand. The first step is to identify the national or international, institutional or non-governmental organizations in charge of the study of the UAP, but also to better identify the historical development of these organizations and the associated national or international legal frameworks. . As shown above, this first parallel is essential to identify possible correlations, correspondences, etc.

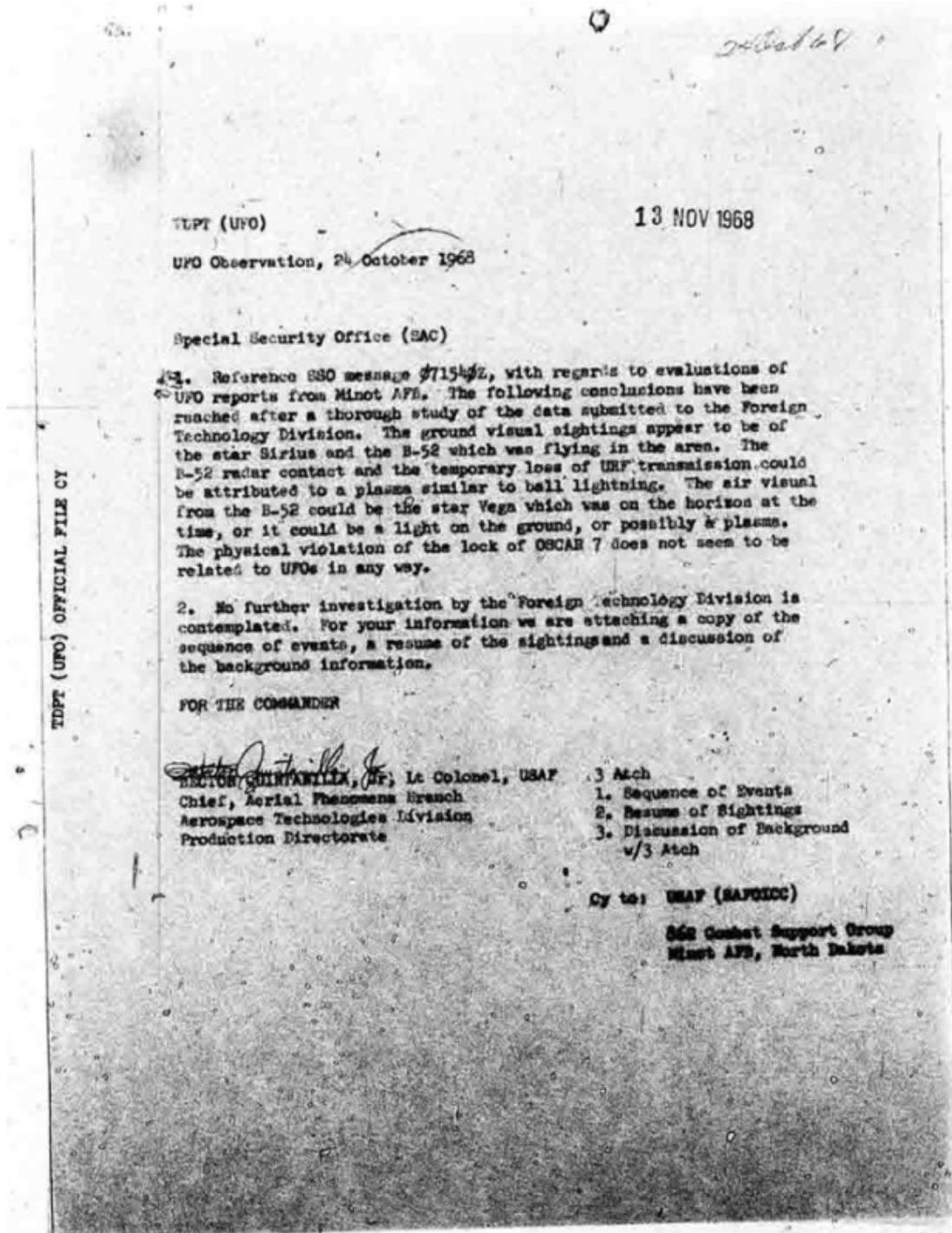
On the basis of this initial documentary organization, the database itself thus makes it possible to sort and archive all the data collected by the group by assigning a documentary reliability score to each of the elements entered in the database. The database works in the classic way using a data sheet for each document listed. This file allows both indexing in the database from traditional fields (type of document, author, date, etc.) but also an evaluation of the quality of this document by the existence of



specific fields which allow to produce an index of reliability of the document concerned. This index is made up of both common sense elements that any document analysis specialist uses (type and reliability of the source, traceability, type of author, etc.) but also more specific elements, inspired by techniques for collecting testimony with, for example, a notation of the time difference between the observation of the phenomenon and the statement made by the witness (in the Gendarmerie in particular) or the duration of the observed phenomenon (from a few seconds to several hours, or even over several days on a recurring basis for example).

This classification of a strictly bibliographic nature is completed in each file of a classification on the form and nature of the information transmitted. Again, it is not at this stage to undertake the scientific analysis of the data contained in the documents. It is simply a matter of evaluating the context of the information transmitted with, for example, the identification of the dates mentioned. A gendarmerie report mentioning a testimony collected two hours after the phenomenon will be "better noted" than an identical report relating to a phenomenon that took place twenty years earlier!

Obviously, the SIGMA database considers a vast set of documents, even beyond the sole national and official framework. Thus the base also sets itself the objective of indexing the documents relating to some of the most famous cases such as for example that concerning the numerous testimonies of overflight of a Minuteman missile base, the American base Minot in North Dakota, during the night of October 24, 1968 by a luminous object endowed with a high speed, spotted at the same time from the ground by the whole of the personnel of the base and giving rise to an overflight by a plane B-52 returning to the base. These testimonies have obviously been the subject of several official reports made known to the public as part of Project Blue Book. At the same time the number, the quality, even the precision (drawings, 14 recordings on the "radar scope" of the B-52 photographed, documents exchanged between official investigators) make these documents unique pieces testifying to a singular phenomenon which seems difficult to confuse with the manifestation of a natural phenomenon. As such, the examination of these documents is important to identify all the data that can be compared with other cases. However, the nature of the documents and their modes of transmission (declassification requested by groups of enthusiasts by FOIA procedure, presence of non-traceable documents on blogs) cannot attest to their full authenticity, which the SIGMA database indicates by through a relatively low documentary score.



TDPT (UFO)

13 NOV 1968

UFO Observation, 24 October 1968

Special Security Office (SAC)

1. Reference SSO message #71549Z, with regards to evaluations of UFO reports from Minot AFB. The following conclusions have been reached after a thorough study of the data submitted to the Foreign Technology Division. The ground visual sightings appear to be of the star Sirius and the B-52 which was flying in the area. The B-52 radar contact and the temporary loss of UHF transmission could be attributed to a plasma similar to ball lightning. The air visual from the B-52 could be the star Vega which was on the horizon at the time, or it could be a light on the ground, or possibly a plasma. The physical violation of the lock of OSCAR 7 does not seem to be related to UFOs in any way.

2. No further investigation by the Foreign Technology Division is contemplated. For your information we are attaching a copy of the sequence of events, a resume of the sightings and a discussion of the background information.

FOR THE COMMANDER

Walter Quintanilla, Jr.
Lieutenant Colonel, USAF
Chief, Aerial Phenomena Branch
Aerospace Technologies Division
Production Directorate

- 3 Atch
 - 1. Sequence of Events
 - 2. Resume of Sightings
 - 3. Discussion of Background
- w/3 Atch

Cy to: USAF (SAFOICC)

362 Combat Support Group
Minot AFB, North Dakota

Figure 2.8.1 - Document taken from the US Air Force's Blue Book investigation on the USAF Minot Base case, 1968



0800. Object S/E of N-7 moving toward site with brilliant light like the sun. Lights flashing on and off. Its too brilliant and big for an aircraft now moving south and hovered over N-7, turned green, amber off than on.
 0818. Below 1,000 feet, hovers somewhat, makes no turns like a jet -- straight forward shot.
 0819. Moving NW white light on.
 0820. Object now appears one mile away and moving in on them.
 0821. Object now reversed direction and moving toward site, now 600 feet from site and lower from 800 feet.
 0828. Two are seen now. Jet engines heard now very clearly.
 0829. Moving S/W of site and gaining altitude.
 0830. Just are in sight now when it passed over site it looked like two high headlights. Moving real slow when oversight - could hear engines.
 0833. Disappeared - moved S/E to far from eyesight.
 0836. Disappeared for 3 minutes then reappeared. Same spot and moving back toward N-7.
 0838. Coming out of S/E once more.
 0840. Hovering 3 miles away 1 to 2000 feet very dim white light.
 0841. Moving toward N-7 again, light getting brighter. Hovering.
 0842. In one position.
 0844. White lights went out, green light on and moving rapidly now. Green light gone out and white light coming back on.
 0850. Object N/W, reversed and moving off again S/E.
 0856. Disappear then reappears and coming back N-7 from S/E, lights getting brighter.
 0856. Still moving from S/E.
 0856. Object now West 1 to 2000 feet.
 0857. Now approximately 600 feet. Red flashing light moving N/W.
 0858. Now white light hovering 500 to 1000 feet. Lights now flashing white.
 0926. Object direct S/W of N 1 moving north then lights went out. A B-52 went out to location of sighting and saw object and had on radar 20,000 feet. Object followed B-52 to fifteen miles from base. During this time B-52 lost radio contact on all frequencies. At this time N-7 lost sight of object. B-52 went around again and negative contact.
 0940. B-52 landed.
 0940. N-7 picked up object again 3 miles west of site. Stationary - seems to be on the ground - lights bright orange then illuminated to white then white disappeared and green came on.
 0944. Disappeared.
 0945. In sight - stationary position.
 1004. Object has moved - still west of N-7. Now stationary once more.
 1010. 2 miles E of N-7 - object still 5 miles west of him approximately 50 feet off ground stationary green lights.

Figure 2.8.2 - extract from the Blue Book Project file, Minot 1968 case²⁶

26 Fold3_Page_29_Project_Blue_Book_19471969.pdf, accès <https://www.fold3.com/image/7170605>



Liste des documents

| Ajout d'un document | Rechercher dans la liste | se déconnecter |
|---|--------------------------|----------------|
| L'AMARANTE, GEPAN/CNES, ENQUETE 86/06, Note Technique 17, Toulouse, 21/03/1983 | X | |
| COLLAHUASI (CHIL.D, Mi-Avril 2014 | E | |
| Les DC3 d'Air France, 17/18-02-1956, ORLY | E | |
| NARCAP Technical Report 10, Report of an Unidentified Aerial Phenomenon and its Safety implications at O'Hare International Airport on November 7, 2006 | E | |
| UFO - Alleged UFO Incident 31st March 1993 | E | |
| Unidentified Flying Objects (U.F.O's) report of Sighting, Rendelsham Forest, 27 Décembre 1980. | E | |
| Fiche de lecture détaillée - 22/05/2015 (Sigma - KIDT) | E | |
| AUTHON DU PERCHE, 1980, D | E | |
| SAINT-REMAN (29) 1983, (Finistère), D | E | |
| SAINT-REMY DE PROVENCE (13), 1980, 18-02-1980, Bouches du Rhône, D | E | |
| MINOT AFB, (Etats-Unis), 24 octobre 1968 - Dec. 13 Novembre 1968 | E | |
| ETRELLES (25), 2014, 02-06-2014, Ille-et-Vilaine, DI | E | |

| | | | |
|---|--|--------------------|-------------------------------|
| Nature du document | • Cris (Archive Bleu Book (récupéré site Internet spécialisée)) | | |
| Pays d'origine supposé du document | ETATS-UNIS | | |
| Pays d'origine physique du document | FRANCE | | |
| Origine du document | Gouvernemental militaire (Special Security office (SSC), Air Force) | | |
| Auteur | Personnel officiel (Chief, Aerial Phenomena Branch Aerospace Technology Division Production Directorate) | | |
| Date d'origine par rapport à l'événement répertorié | Immédiate (15 - 20 jours (?)) | | |
| Situation du cas | • Aéro (Boule lumineuse sur Minot AFB) | | |
| Nature de l'information | Témoignages qualitatifs (Compte-rendu de témoignages de soldats en poste et d'un équipage de B-52) | | |
| Contenu | Sur la base de documents traités | | |
| Mots-clés | Chronologie | plusieurs heures | |
| | Catégorie | Photo | Photos de radarscope évoquées |
| | Catégorie | Radar | Traces radar (méta) évoquées |
| | Catégorie | Oral | multiples témoignages |
| | Noms | Entités concernées | Air Force |
| Noms | Acteurs | Témoin | Soldats AFB et équipage B-52 |
| Noms | Acteurs | Intervenant | Investigateur Air Force |
| Fichier | blue-book-final-case-report.pdf | | |
| Coefficient de pondération | 25 | | |

Figure 2.8.3 - BDD SIGMA2 sheet - US AFB Minot case

Other documents from international databases from specialized organizations may also enter the database. This is the case, for example, of the report on a sighting case recorded in Great Britain in the Channel Islands (Jersey and Guernsey), which was the subject of visual observations and radar signals. Of course, the source itself is evaluated, the interest also for SIGMA2 being to continue collecting more technical data that may be available. Some recordings have been disclosed.

Liste des documents

| Ajout d'un document | Rechercher dans la liste | se déconnecter |
|---|--------------------------|----------------|
| VOL AIR FRANCE 3552 NICE-LONDRES, COULOMMIERS (77), 28-01-1994, D | X | |
| LAC CHAUVET (63) 1952, 18-07-1952, PUY-DE-DOME | E | |
| TRANS-EN-PROVENCE (83) 1981, 09-01-1981, Var, D | E | |
| METZ (57), 1998, 29-08-1998, Lorraine, B | E | |
| L'AMARANTE, GEPAN/CNES, ENQUETE 86/06, Note Technique 17, Toulouse, 21/03/1983 | X | |
| COLLAHUASI (CHIL.D, Mi-Avril 2014 | E | |
| Les DC3 d'Air France, 17/18-02-1956, ORLY | E | |
| NARCAP Technical Report 10, Report of an Unidentified Aerial Phenomenon and its Safety implications at O'Hare International Airport on November 7, 2006, Date Doc. 2007 | X | |
| UFO - Alleged UFO Incident 31st March 1993 | E | |
| Unidentified Flying Objects (U.F.O's) report of Sighting, Rendelsham Forest, 27 Décembre 1980. | X | |
| Fiche de lecture détaillée - 22/05/2015 (Sigma - KIDT) | E | |
| AUTHON DU PERCHE, 1980, D | E | |

| | | | |
|---|---|--------------------|---|
| Nature du document | • Public | | |
| Pays d'origine supposé du document | GRANDE-BRETAGNE | | |
| Pays d'origine physique du document | FRANCE | | |
| Origine du document | Mode de publication | | |
| Auteur | Internet spécialisé (http://vro.org/time/2/0/0/8/02/ChannelIslands/Summary/index.html) | | |
| Date d'origine par rapport à l'événement répertorié | Après plusieurs années | | |
| Situation du cas | • Autres (aérien ou maritime) | | |
| Nature de l'information | Données physiques (transcriptions d'échos radar ATC) | | |
| Contenu | Sur la base de documents traités | | |
| Mots-clés | Catégorie | Radar | transcriptions d'échos radar ATC |
| | Chronologie | | minutes (15-20) |
| | Pays concerné par le phénomène | | Grande-Bretagne, France |
| | Noms | Entités concernées | Contrôle aérien britannique, Société FlyBe, Armée de l'Air |
| | Noms | Acteurs | Témoin |
| Noms | Acteurs | Intervenant | Ministère de la défense britannique, Armée de l'Air, GEIPAN |
| Fichier | report_on_channel_islands_uaps_23.04.07.pdf | | |
| Coefficient de pondération | 13 | | |

Figure 2.8.4 - BDD SIGMA2 sheet - Channel Island 2006 case

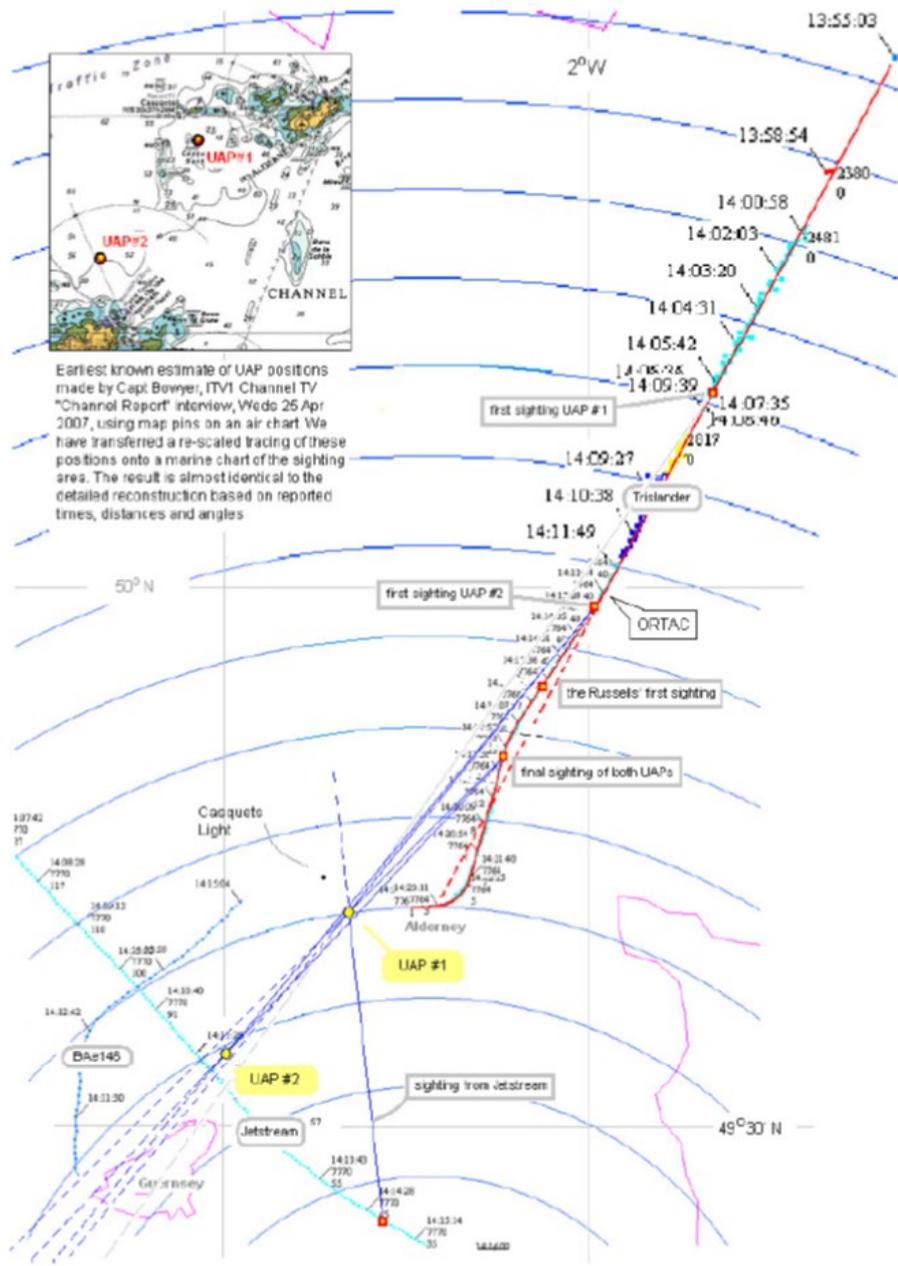


Fig 7. A first best-fit triangulation of possible UAP positions based on Trislander and Jetstream observations. Range rings at 5nmi.
 (See <http://video.aol.com/video-detail/2-pilots-spot-big-ufo-over-guernsey-uk-april-23-2007/597794936> for ITV interview)



We can mention, among others, the emblematic case of the analysis of testimonies concerning the case of the O'Hare international airport in Chicago, where, on November 7, 2006, several witnesses deemed reliable (airlines, mechanics) witnessed for several minutes the overflight and the immobilization of a "metallic, gray, round machine" above terminal 17 of the airport. One of the peculiarities of this case is the observation of a trace (a hole) left in the cloud mass after the departure of the machine. This case was the subject of an in-depth investigation by NARCAP which published a report in May 2007 on the matter.

This report is archived in the database. It has a relatively low score obviously linked to its unofficial origin but this score does not prevent it from being listed, given the interest presented by certain characteristics of the observed phenomenon.

Ajout d'un document
Rechercher dans la liste
se déconnecter
X

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|--------------------|--------|------------------------------------|------------|-------------------------------------|------------|---------------------|---------------------|--------|--|---|-------------------------------------|------------------|---|-------------------------|-------------------------------------|---------|----------------------------------|-----------|--|---------|----------------------------------|----------------------------|---|
| LAC CHAUVET (63) 1952, 18-07-1952,PUY-DE-DOME | E X | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Nature du document</td><td>Public</td></tr> <tr><td>Pays d'origine supposé du document</td><td>ETATS-UNIS</td></tr> <tr><td>Pays d'origine physique du document</td><td>ETATS-UNIS</td></tr> <tr><td>Origine du document</td><td>Mode de publication</td></tr> <tr><td>Auteur</td><td>Internet spécialisé (www.narcap.org/files/NARCAP_TR-10.pdf)</td></tr> <tr><td>Date d'origine par rapport à l'événement répertorié</td><td>Dans l'année (6 mois (14 mai 2007))</td></tr> <tr><td>Situation du cas</td><td>Aéro (Rapport d'enquête d'un groupe privé spécialisé (NARCAP) au sujet de témoignages concernant l'apparition et l'immobilisation pendant 3 mn au moins d'un objet d'apparence métallique, rond et gris au dessus du terminal 17 de l'aéroport de Chicago (O'Hare). Cette vision a été partagée par des témoins répertoriés (employés de lignes aériennes, mécaniciens) et fait état d'un départ de l'objet laissant un trou dans la masse nuageuse. Aucun signal radar n'est enregistré)</td></tr> <tr><td>Nature de l'information</td><td>Témoignages qualitatifs (9 témoins)</td></tr> <tr><td>Contenu</td><td>Sur la base de documents traités</td></tr> <tr><td>Mots-clés</td><td>Chronologie <input type="text" value="minutes (16h15-16h33)"/></td></tr> <tr><td>Fichier</td><td>narcap_tr-10.pdf</td></tr> <tr><td>Coefficient de pondération</td><td>8</td></tr> </table> | Nature du document | Public | Pays d'origine supposé du document | ETATS-UNIS | Pays d'origine physique du document | ETATS-UNIS | Origine du document | Mode de publication | Auteur | Internet spécialisé (www.narcap.org/files/NARCAP_TR-10.pdf) | Date d'origine par rapport à l'événement répertorié | Dans l'année (6 mois (14 mai 2007)) | Situation du cas | Aéro (Rapport d'enquête d'un groupe privé spécialisé (NARCAP) au sujet de témoignages concernant l'apparition et l'immobilisation pendant 3 mn au moins d'un objet d'apparence métallique, rond et gris au dessus du terminal 17 de l'aéroport de Chicago (O'Hare). Cette vision a été partagée par des témoins répertoriés (employés de lignes aériennes, mécaniciens) et fait état d'un départ de l'objet laissant un trou dans la masse nuageuse. Aucun signal radar n'est enregistré) | Nature de l'information | Témoignages qualitatifs (9 témoins) | Contenu | Sur la base de documents traités | Mots-clés | Chronologie <input type="text" value="minutes (16h15-16h33)"/> | Fichier | narcap_tr-10.pdf | Coefficient de pondération | 8 |
| Nature du document | Public | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pays d'origine supposé du document | ETATS-UNIS | | | | | | | | | | | | | | | | | | | | | | | | | |
| Pays d'origine physique du document | ETATS-UNIS | | | | | | | | | | | | | | | | | | | | | | | | | |
| Origine du document | Mode de publication | | | | | | | | | | | | | | | | | | | | | | | | | |
| Auteur | Internet spécialisé (www.narcap.org/files/NARCAP_TR-10.pdf) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Date d'origine par rapport à l'événement répertorié | Dans l'année (6 mois (14 mai 2007)) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Situation du cas | Aéro (Rapport d'enquête d'un groupe privé spécialisé (NARCAP) au sujet de témoignages concernant l'apparition et l'immobilisation pendant 3 mn au moins d'un objet d'apparence métallique, rond et gris au dessus du terminal 17 de l'aéroport de Chicago (O'Hare). Cette vision a été partagée par des témoins répertoriés (employés de lignes aériennes, mécaniciens) et fait état d'un départ de l'objet laissant un trou dans la masse nuageuse. Aucun signal radar n'est enregistré) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nature de l'information | Témoignages qualitatifs (9 témoins) | | | | | | | | | | | | | | | | | | | | | | | | | |
| Contenu | Sur la base de documents traités | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mots-clés | Chronologie <input type="text" value="minutes (16h15-16h33)"/> | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fichier | narcap_tr-10.pdf | | | | | | | | | | | | | | | | | | | | | | | | | |
| Coefficient de pondération | 8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| TRANS-EN-PROVENCE (83) 1981, 09-01-1981, Var, D | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| METZ (57), 1998, 29-08-1998, Lorraine, B | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| L'AMARANTE, GEPAN/CNES, ENQUETE 86/06, Note Technique 17, Toulouse, 21/03/1983 | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| COLLAHUASI (CHILD), Mi-Avril 2014 | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| Les DC3 d'Air France, 17/18-02-1956, ORLY | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| NARCAP Technical Report 10, Report of an Unidentified Aerial Phenomenon and its Safety implications at O'Hare International Airport on November 7, 2006, Date Doc. 2007 | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| UFO - Alleged UFO Incident 31st March 1993 | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| Unidentified Flying Objects (U.F.O's) report of Sighting, Rendelsham Forest, 27 Décembre 1980 | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fiche de lecture détaillée - 22/05/2015 (Sigma - KDT) | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| AUTHON DU PERCHE, 1980, D | E X | | | | | | | | | | | | | | | | | | | | | | | | | |
| SAINT-RENAN (29) 1983, (Finistère), D | E X | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 2.8.6 - BDD SIGMA2 file - Chicago O'Hare Airport case, November 7, 2006 NARCAP survey document (May 2007)



Preface

This report presents the results of an extensive analyses of data surrounding a multiple witness visual sighting of a single object hovering above O'Hare International Airport on the afternoon of November 7, 2006. The authors are not as concerned with the nature or identity of the object as with aviation safety. It was abundantly clear that the Federal Aviation Administration (FAA) not only did not detect the presence of this object but also did not take seriously any of the eye witness reports from United Airlines. This situation is serious because it shows a gap in our nation's aeronautical radar detection system, a gap where an apparently solid object of twenty feet diameter (or larger) could hover for many minutes over the nation's busiest airport and not be detected. This report calls loudly for an official inquiry not only into the nature of the aerial phenomenon that can do these things but also into what improvements are needed in our technology to adequately detect them and prevent such an occurrence from happening in the future.

A word is in order concerning how time is referred to in this report. In all documents from the Federal Aviation Administration (FAA) time is given in Universal Coordinate Time (UTC), formerly called Greenwich Mean Time (GMT) or sometimes Zulu (Z) time. Since Chicago O'Hare International Airport is located six time zones to the west of the Greenwich meridian (i.e., earlier), all UTC times must have six hours subtracted from them to yield local Central Standard Time (CST). Finally, a twenty-four hour clock notation is sometimes used which also must be converted to local time when necessary. Thus:

| UTC (hr:min) | Local Time at ORD (CST) | | |
|---------------------------|-------------------------|---------------------|-------|
| | 24 Hr. Clock | am. | pm. |
| 00:00 day 2 (midnight) | 18:00 day 1 | | 6:00 |
| 06:01 day 2 | 00:01 day 2 | 00:01 (midnight) | |
| 12:00 day 2 (noon) | 06:00 day 2 | 06:00 | |
| 18:01 day 2 | 12:01 day 2 (noon) | | 12:01 |

Richard F. Haines
Senior Editor
Oak Harbor, Washington

Figure 2.8.7 - Extract and standard output of the NARCAP document (Cas O'Hare), archived in the SIGMA2 database

Finally, the database makes it possible to archive analysis notes produced within the SIGMA2 commission itself, for example in the form of reading sheets. It thus makes it possible to classify all the working documentation of the Commission, archiving work currently in progress.



Liste des documents

Ajouter un document Rechercher dans la liste se déconnecter

| | | | | |
|--|---|---|---|--|
| Unidentified Aerial Phenomenon and its Safety implications at O'Hare International Airport on November 7, 2006, Date Doc. 2007 | E | X | Nature du document | Gris |
| UFO - Alleged UFO Incident 31st March 1993 | E | X | Pays d'origine supposé du document | FRANCE |
| Unidentified Flying Objects (U.F.O's) report of Sighting, Rendelsham Forest, 27 Décembre 1980. | E | X | Pays d'origine physique du document | FRANCE |
| Fiche de lecture détaillée - 22/05/2015 (Sigma - KDT) | E | X | Origine du document | Origine connue (Interne Sigma) |
| AUTHON DU PERCHE, 1980, D | E | X | Auteur | Témoignage seconde main répertorié (Réf. GEIPAN sur enquête de la gendarmerie de l'air APT-SAINT-CHRISTOL_84_1980_T-M_PV_T_S_A_1980308460-365-1980-R) |
| SAINT-REMAN (29) 1983, (Finistère), D | E | X | Date d'origine par rapport à l'événement répertorié | Après plusieurs années |
| SAINT-REMY DE PROVENCE (13), 1980, 18-02-1980, Bouches du Rhône, D | E | X | Situation du cas | Aéro (Des boules lumineuses oranges, statiques ou en mouvement, sont observées se déplaçant seules ou en groupe vers les zones de lancement, par les militaires gardant la base, taille apparente d'un ballon a quelques km, fusionnant ou se séparant au dessus de la base aérienne. A quelques km. La lumière est clignotante pulsée (période 6s), mouvement descendant oscillant avec traînée lumineuse, mouvement ascendant. Aucun trafic aérien connu.) |
| MINOT AFB, (Etats-Unis), 24 octobre 1968 - Doc. 13 Novembre 1968 | E | X | Nature de l'information | Témoignages qualitatifs |
| ETRELLES (35), 2014, 02-06-2014, Ille-et-Vilaine, D1 | E | X | Contenu | Sur la base de documents traités |
| Fiche de lecture - Cas 'Cognac' | E | X | Mots-clés | Observation visuelle, aucun enregistrement connu, aucune mention d'interférence EM, aucun bruit, temps orageux, éclairs |
| Fiche de lecture - Cas 'Espinasse' | E | X | Fichier | fdl_st_cristol.docx |
| Fiche de lecture - Cas 'St-Cristol' | E | X | Coefficient de pondération | 12 |

Figure 2.8.8 - Example of archiving of a reading sheet

At this stage, the database is therefore being set up, with the objective of integrating both the most significant contemporary cases and most of the historical cases listed in all the countries considered.



3 Contacts - scientific network - communications

SIGMA2 also seeks to develop a scientific and technical network made up of international experts from different disciplines to exchange technical analyses on duly referenced physical cases. Many contacts were made in order, on the one hand, to collect data on UAP cases and, on the other hand, to build a scientific and technical network.

3.1 French institutions

Priority contact was made with CNES / GEIPAN, with which cooperation began at the end of 2013 to investigate unexplained cases (case D, around 4% of cases investigated) in France, and to examine new cases. The complementarity of roles between SIGMA2 and CNES / GEIPAN was specified in § 1.2.2. GEIPAN is the French official body in charge of investigating and informing the public about UAP in France, based on civilian testimonies. 3AF / SIGMA2, technical commission of 3AF, the French aeronautical and astronautical association, brings together researchers and former armed forces personnel carrying out studies on French and foreign UAP. Some of these researchers are part of the GEIPAN college of experts. GEIPAN can take advantage of studies carried out by SIGMA2 on cases already investigated by GEIPAN.

In addition, SIGMA2 made other contacts in France, in particular with the Air Force (CDAOA¹), which led to a visit to the CNOA (National Center for Air Operations) and the Cosmos center (space operations center) in Lyon Mont Verdun in July 2015 and enabled a better understanding of the CNOA's missions and resources, in addition to evoking the principles of cooperation in relation to GEIPAN. These procedures will need to be refined in the future depending on the cases of UAP that arise. In addition, preliminary contacts have been made with the Historical Defense Service (SHD), as part of a joint approach concerning research on defense archives preceding the creation of GEPAN.

In terms of observation means, SIGMA2 recently contacted the IMCCE (Institute of Celestial Mechanics and Ephemeris Computation of the Paris Observatory). The IMCCE is in charge of the deployment of the FRIPON network (network of cameras and HF receivers) which interests SIGMA2 and GEIPAN, as a means of observation of UAP complementary to conventional air control and air defense means. Initiatives have been taken with the IMCCE to study a project (Trillian) aiming to improve the use of data from scientific networks of the Fripon type, by establishing detection classes distinguishing, for example, meteorites from PLT (Transient Luminous Phenomena), ball lightning or UAP. Efforts should be made to develop such treatments with the help of researchers.

SIGMA2 also established contacts with the research laboratory on lightning and participated in the international conference on lightning in Aurillac in 2017. This

¹ CDAOA : Commandement de Défense Aérienne et des Opérations Aériennes

laboratory contributed to the work of SIGMA2 on ball lightning and related phenomena.

3.2 CEFAA

For contacts abroad, a technical cooperation agreement was concluded with the Chilean CEFAA (see Figure 3.2.1) in 2013, which has already started cooperation and exchanges with South American countries (see Figure 3.2.2). The CEFAA, a government organization dependent on the Chilean DGAC, also gave an official point of view on UAP during a press conference in 2014 (see Figure 3.2.3), confirming the existence of UAP, the absence of proven risks for the field of air traffic while recommending a deeper study of these phenomena. A meeting took place between CEFAA and 3AF / Sigma2 in Paris at the end of 2014 (see Figure 3.2.4).



Figure 3.2.1- CEFAA logo



Figure 3.2.2- CEFAA and CEMAA Peru meeting (photo provided by CEFAA)



Figure 3.2.3 - DGAC and CEFAA conference in July 2014: no proven aeronautical risk but an interest in carrying out the study of UAP (presence of Defense Attachés). Photo provided by CEFAA



Figure 3.2.4 - CEFAA and 3AF / SIGMA2 meeting 28/10/14 - agreement signed in November 2013 on UAP studies. CEFAA plans to provide cases with physical data to 3AF, and encourages 3AF / SIGMA2 to international scientific initiatives

3.3 NARCAP US work

Another agreement was prepared with the US NARCAP in 2015. The non-governmental US NARCAP gathered technical capacity and conducted scientific case studies. A very



interesting document² bringing together 600 aeronautical cases was given to us by Mr. Dominique Weinstein. It establishes a description of the cases and the associated statistics in the form of a grid (AIRPANC).

3.4 SCU

SIGMA2 was also contacted by another American scientific group (SCU: Scientific Coalition for UFO) for a case study regarding an event that occurred in Puerto Rico in 2013, according to the report sent to us and the data collected by the SCU. The SCU also provided us with data on a more recent EME case involving a video camera and smartphone disturbed by the presence of a UAP at close range.

3.5 Works by TTSA and Bigelow Aerospace (BAASS)

3.5.1 Introduction

The following analysis is based on the one hand on the facts reported in the articles published at the end of 2017 (subject of the 3AF / SIGMA2 note published in early 2018), on the other hand on a complementary analysis carried out from 2019 from various statements made by TTSA, the Pentagon and the US Navy, US Navy pilots and finally on the basis of documents on AATIP published on sites like the Black Vault in 2018 and 2019. A particular analysis is also given in § 4.2.3 on the SCU report concerning the observations of the “Nimitz” in 2006, entitled **A Forensic Analysis of CSG 11 Encounter with a AAV**.

The confusion persists due to contradictory communications on the AATIP program since the end of 2017. Indeed, we are first faced with a recognition by the Pentagon of the existence of the AATIP program (between 2007 and 2012) including research on UAP. This declaration is concomitant with a recognition by the US Navy of the authenticity of the IR videos (whose disclosure was not authorized - see Figure 3.5.1), of the non-identification of the observed phenomena (deemed to be still misunderstood by the US Navy in 2019, 15 years after the “Nimitz” affair in 2004), and the strengthening of UAP observation reporting procedures by the US Navy, announced in April 2019³. The US Navy also initially claimed that TTSA was prohibited from showing IR videos to the general public. These statements are consistent with testimonies of sightings by F18 pilots and radar operators of “Nimitz” and “Princeton” broadcast on US television by TTSA. They confirm visual and infrared observations, but also radar, of objects evolving by defying the laws of gravity, not only during the “Nimitz” events in 2004 off San Diego, but many times again in 2014 and 2015⁴, on the US East Coast. This time, new IR and radar observations are mentioned (including with the new F18 radars, very modern radars with active antenna) which, according to the pilots, would have

² <https://pdfslide.tips/documents/narcap-ir-4-2012-french-edition-1.html>

³ <https://www.politico.com/story/2019/04/23/us-navy-guidelines-reporting-ufos-1375290>

⁴ <https://www.thedrive.com/the-war-zone/28627/recent-ufo-encounters-with-navy-pilots-occurred-constantly-across-multiple-squadrons>



finally allowed us to see in detail “cubic objects in spheres”!. We will find these facts and photos disclosed in 2021 in the final part of this §3.5.



Figure 3.5.1.1 - Infrared video Gimbal published by TTSA

<https://www.theblackvault.com/documentarchive/wp-content/uploads/2019/09/9-9-2019-10-02-01-PM>

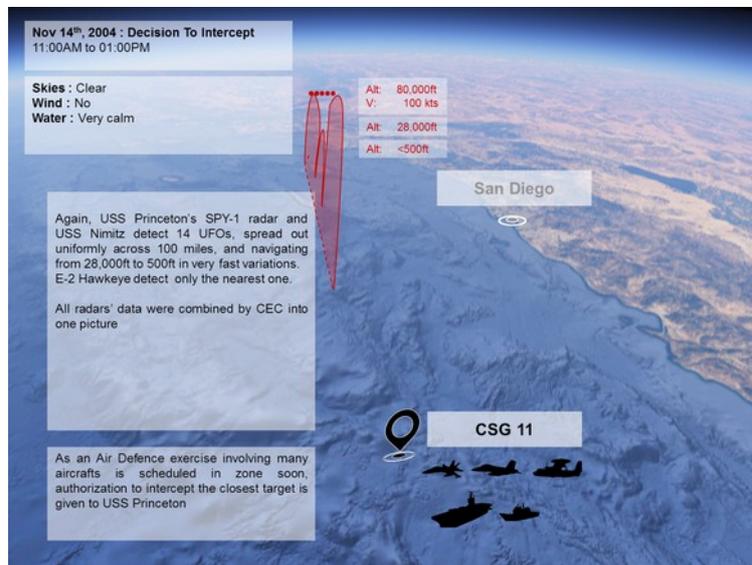


Figure 3.5.1.2 - Reconstruction in progress of the Nimitz case by SIGMA2 from the SCU Forensic analysis report and IR videos

However at the same time, the Black Vault disclosed the security documents of the AATIP⁵ program in October 2019 (see copy in Appendix A 3.5.3), authorizing Mr. Elizondo to access data from a research program on advanced air threats, concerning the fight against drones (C-UAS without explicit mention of UFO or UAP). The Pentagon (according to Pentagon spokeswoman Susan Gough) also returns in December 2019 to previous statements about the AATIP program⁶, this time specifying that it actually concerned confidential research on futuristic aerospace threats to the United States by the year 2050 (AATIP or AAWSAP program for Advanced Aerospace Weapon System

5 <https://www.theblackvault.com/documentarchive/u-s-navy-investigated-circumstances-behind-leaked-ufo-footage/>

6 <https://www.theblackvault.com/documentarchive/the-pentagon-corrects-record-on-secret-ufo-program-2019/>



Program), this in the context of an arms race with China and Russia (aerospace warfare, hypersonic missiles, end of the INF Treaty, nuclear-powered missiles, etc.). This document therefore does not make any link with research on UFO or UAP although the DIA had published for its part a letter⁷ of January 16, 2019 responding to a FOIAA request on the content of the AATIP program. This document discusses certain themes that may be related to drones, but other subjects such as space propulsion using vacuum, wormholes, research on other dimensions of space, seem to concern other research areas, the same ones cited by TTSA as related to research on UFO, including meta-materials. For its part, TTSA also reports a research agreement (CRADA) signed with a department of the US Army on the study of special ultra-light and resistant materials, in October 2019. This may be surprising when we see the differences in statements by TTSA on the one hand, the Pentagon and the Navy on the other hand, on these IR videos deemed to be authenticated but not authorized for public disclosure, while TTSA simultaneously signed a cooperation agreement with a Department of the US Army. This document is also very detailed, including on the intellectual property of the data and their use. It is amazing to see a reputable company divulging confidential Pentagon data without authorization, at the same time signing an agreement with another department of this institution!

Due to these communications which can be qualified as confused, and the absence of disclosure of any extract or summary of the results of the AATIP program, despite a communication campaign by TTSA reinforced since the end of 2017, our point of view on all of these elements at the end of 2019 and the beginning of 2020 encourages us to be careful, to study the available elements and to express our questions. It is difficult to form a definitive conclusion on these bouncy communications.

While it is not surprising to observe a communication race of the Pentagon or of politicians in the current strategic environment with Russia and China, against the backdrop of the development of new weapons intended for aerospace warfare and development of hypersonic missiles, on the other hand, it is astonishing to see so many contradictory statements. Other interpretations also appear from the pen of those who ultimately suggest that the observations of the “Nimitz” (and the pilots) correspond on the contrary to experiments (in 2004) of the US Navy's NEMESIS project (see appendix A 3.5. 2) to test confidential jamming technologies creating ghost targets for the Navy's radar and infrared sensor arrays. We can only take a technical and objective look at the elements reported, within the limits of what is disclosed (or even leaked), that is to say mainly the infrared videos and the report provided to us by the SCU group on the Nimitz case (see analysis in § 4.5 of the report A Forensic Analysis of CSG 11 Encounter with a AAV). We also analyzed the publications on the NEMESIS project. While it is true that the US Navy's CEC (Collaborative Engagement Capacity, see Figure 3.5.1.3) sensor network system was being tested in 2004, notably on the “Princeton” destroyer, the development of NEMESIS jamming technologies is posterior. This research dates back to 2014 (according to the Naval Research Laboratory - see Figure 3.5.1.4, details in

⁷ <https://fas.org/irp/dia/aatip-list.pdf>



appendix A 3.5.2) with a phase of sea trials in 2016-2018... therefore well after the observations of the “Nimitz”. This NEMESIS project is combined with research programs related to the use of drone swarms (SOSITE project). The same is true of research carried out by the US Navy on IR radar decoy techniques by laser energy deposition (creation of LIPF plasma filaments - Laser Induced Plasma Filament) in order to protect airplanes against missiles, in creating false targets a few tens or hundreds of meters away. We are far from seeing radar tracks and infrared signals several tens of NM away. In addition, the lack of reaction of the US Air Force during the 2004 observations of unknown objects entering American airspace, that is to say three years after September 11, also raises questions, considering the numerous efforts deployed by the USA to control their airspace. The elements below describe our analysis, part of which was put online in January 2018.

The following paragraphs return first to our analysis at the start of 2018 and then to the situation in 2020, due to the acceleration of press releases.

However, one can also wonder contradictorily, on the official declarations of the Pentagon this time on August 14, 2020, creating an official organization UAP Task Force (UAPTF)⁸, under the leadership of the US Navy reporting to the Secretary of Defense, for very officially investigating Unidentified Aerospace Phenomena. It is useful to note a similar parallel step taken by Japan accompanied by a cooperation agreement between the USA and Japan on September 8, 2020⁹. The US Air Force still seems absent from the debate, but Northern Command and NORAD have nevertheless reports¹⁰ on the Shield Homeland Defense project for the North American continent, this time to improve the processing of data between Air Defense Command Centers and sensors, to better ensure the security of American airspace against incursions by aircraft from Russian and Chinese origin ...

8 <https://www.defense.gov/Newsroom/Releases/Release/Article/2314065/establishment-of-unidentified-aerial-phenomena-task-force/>

9 <https://www.the-unidentified.net/japan-and-the-united-states-have-an-alliance-over-unidentified-aerial-phenomenon-uap/>

10 **NORTHCOM retooling homeland defense for Russian, Chinese threats with SHIELD modernization plan**
By [Jason Sherman](#) / September 10, 2020 at 2:27 PM

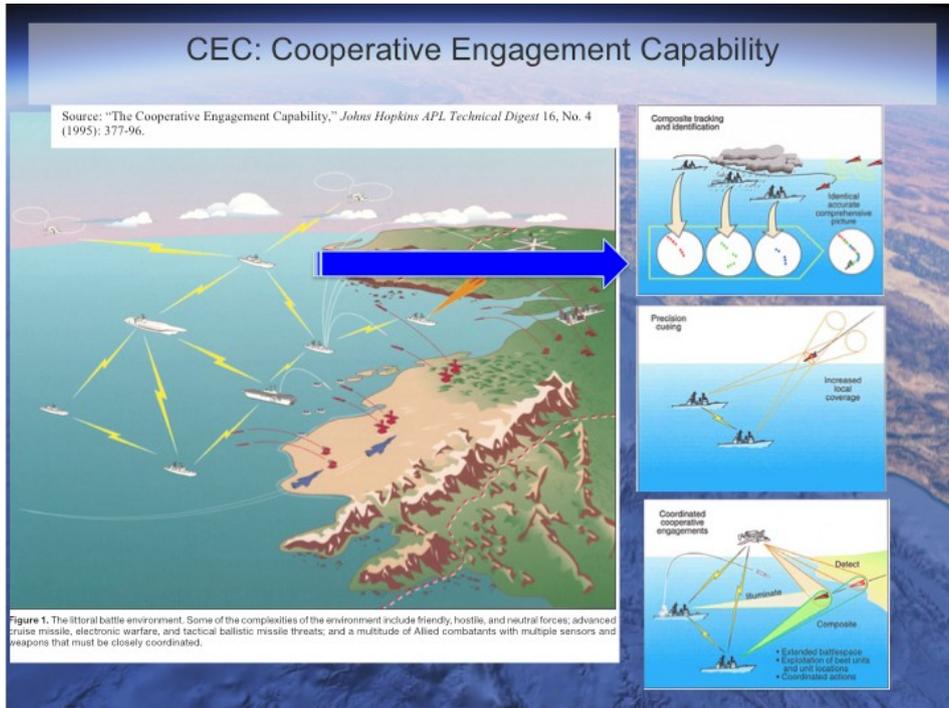


Figure 3.5.1.3 - CEC: Cooperative Engagement Capability - US Navy multisensor network intended for collaborative anti-aircraft-anti-missile combat between naval platforms (AEGIS system and air systems). Radar and IFF identification data are shared between the different combat systems of the ships.

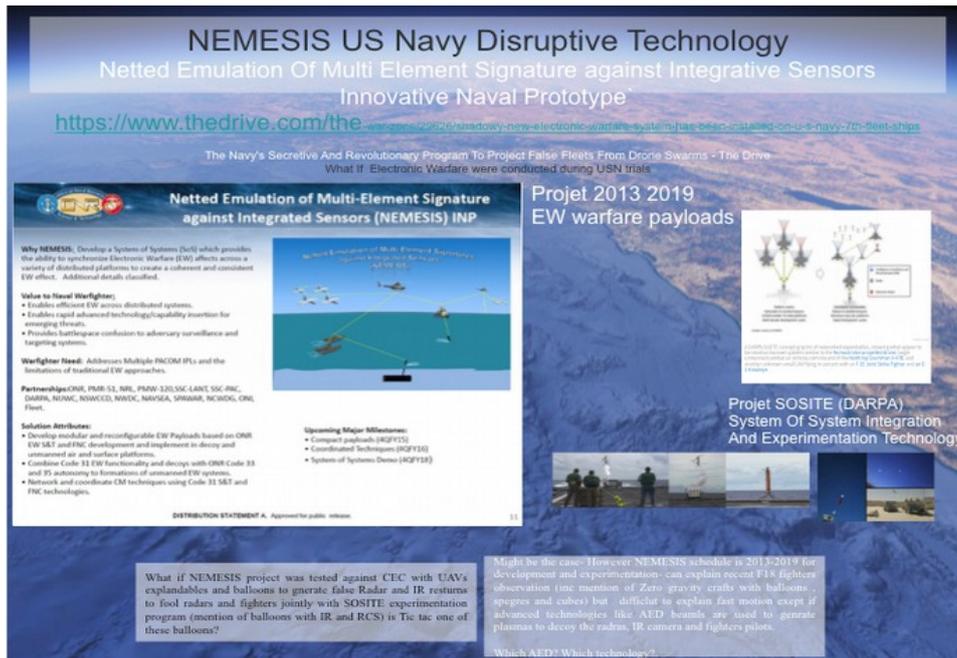


Figure 3.5.1.4 - The NEMESIS project is part of the disruptive technology projects developed by the US Naval Research Laboratory since 2013. It is based on the use of jamming and cybernetic attack means of radar networks, communications and CEC system information systems. It is also based on the use of synchronized transmission facilities carried by drone networks. It is not impossible that the multiple radar echoes observed by the "Princeton" are the effect of such interference, but this neither explains the IR images of the objects (are they the same?), nor the fact that these technologies did not exist in 2004.

More details in appendix.



3.5.2 A look back at the analysis of the facts by SIGMA2 in early 2018

Introduction to the facts revealed at the end of 2017

On December 16, 2017, several articles (written in the New York Times¹¹, Politico¹², articles with the participation of reporter Leslie Kean of the "Huffington Post") appeared on a US Pentagon research program on UAP (Unidentified Aerospace Phenomena) called AATIP (Advanced Air Threat Investigation Program). This "hidden" Pentagon program dates from 2007 and was stopped in 2012 according to the Pentagon. These articles reveal that, not only the research of the American DoD did not stop in 1969 with the end of the "Blue Book" file, but also that new cases were observed and investigated since. In addition, an infrared video filming a UAP from two F18s in 2004 is exhibited as one of the examples of strange cases studied, made available and authorized for publication by the Pentagon for the benefit of a private UFO research company and paranormal phenomena (TTS / AAS: To The Stars / Academy of Arts and Sciences). One of the ex-officials of the AATIP program, Mr. Luis Elizondo (formerly of the Defense Intelligence Agency DIA) allegedly resigned from the Pentagon in October 2017 to join the TTS / AAS¹³ UFO research group which has since uploaded the infrared video "Gimbal" for the Community of Interest (COI¹⁴), as well as the observation report made by the four F18 pilots. Mr. Elizondo cites a lack of support from the US government¹⁵ to continue the research. The program would study observations of objects endowed with extraordinary kinematics with no apparent sign of propulsion, a subject also under study by the TTS / AAS group. The link is made with the company of Mr. Robert Bigelow, American billionaire, working with NASA on future space vehicles (Expandable Space Module B330) and close friend of Senator Reid (Nevada) at the origin of this AATIP program. Mr. Bigelow is known to be convinced that the ET Hypothesis (Extra-Terrestrial Hypothesis) is true¹⁶, which motivates his patronage of research on UFOs and exotic propulsion technologies.

The company of Mr. Bigelow BAASS (Bigelow Aerospace Advanced Space Studies) systematically collects observation reports made by pilots or any other object or observation concerning UAP in accordance with the instructions of the FAA, US civil aviation¹⁷. She had ties to the US MUFON¹⁸ organization which has been doing work on UFO for years, with some case studies funded by BAASS.

These articles raise questions and lead people to turn to 3AF / SIGMA2 for their views on this program and related statements. The objective of this text is to offer some

11 <https://www.nytimes.com/2017/12/16/us/politics/unidentified-flying-object-navy.html?register=google&r=0>

12 <https://www.politico.com/magazine/story/2017/12/16/pentagon-ufo-search-harry-reid-216111>

13 https://www.huffingtonpost.com/entry/inside-knowledge-about-unidentified-aerial-phenomena_us_59dc1230e4b0b48cd8e0a5c7

14 <https://coi.tothestarsacademy.com/gimbal/>

15 The yearly budget is 22 M US \$ over 5 years, is a drop in the budget of US defence

16 https://www.huffingtonpost.com/entry/robert-bigelow-ufos-aliens-on-earth_us_592ca03ce4b0065b20b7bfb7

17 <https://www.faa.gov/documentLibrary/media/Order/7110.65TBasic.pdf> - chapter 9 special flight- section 8 UFOs reports

18 MUFON also contributed to communication campaigns on UFOs (see TV show on Hangar one) which were caricature of the subject and fed thesis on conspiracy on HET, not inviting scientists to join the UAP study.



answers to the main question: what do these revelations bring about the AATIP program?

- Is there a new communication from the US administration on UFO, a shift from the silence dating back to 1969 since the closure of the USAF "Blue Book" file?
- Does this research program provide access to new databases on UAP, some declassified?
- Are there any new revelations, completely new cases, on the issue of the Extra-Terrestrial Hypothesis (ETH).

The SIGMA2 Technical Commission is interested in Unidentified Aerospace Phenomena, on which it conducts research by bringing together experts in aeronautics, space, former pilots or astronauts, doctors, engineers or retired armed forces personnel, specialists in air defense, missiles, planes. Being a Technical Commission, it is only interested in the technical study of UAP cases which are also the subject of field investigations by CNES / GEIPAN. GEIPAN has been working with the Gendarmerie and the Air Force on French UAP cases since 1977 and has published them since 2007. SIGMA2 is interested as much in observation problems as in the analysis of observed physics, including the effects of electromagnetic radiation and in particular microwaves observed. The technical nature of the work totally excludes reflections of a philosophical or societal nature which may be of interest to other experts. The EHT question is treated from the angle of observations and their cross-referencing with known phenomena or devices. All these elements are explained in the summary report of the SIGMA2 Commission published in 2016 and in the interview of the SIGMA2 Commission by Jean-Pierre Troadec, published in November 2016 in the "Nexus" magazine.

SIGMA2's research actions lead to the identification of the physical databases on UAP, and therefore all the organizations carrying out scientific work on this subject. As such, the AATIP program and its spinoffs are interesting.

Is there a new communication from the US administration on UFO? A change of course?

Since the USAF's "Blue Book" dossier was closed in 1969, the Pentagon and USAF have consistently reported that the UFO topic was closed. Only the CIA seems to have kept an active watch on the subject internationally. Recent archival publications (recalled in the SIGMA2 report of 2015) in January 2016, then in January 2017 (see the CIA CREST website) show that the subject has remained of interest. On the other hand, the announcement on December 16, 2017 of the existence of an official research program on UFO seems to constitute a rupture in the communication of the US administration on the subject. However, transparency is not completely rigorous: the report (490 pages) has not yet been published, and the former head of the AATIP program, Mr. Luis Elizondo, who resigned due to insufficient resources, leaves room for doubt on the authorities' interest in the work carried out. The program would have been stopped for



financial reasons by the Pentagon which however authorizes the disclosure of the IR videos of F18 on the site of TTSA... It looks like a communication campaign for purposes not yet identified between the official US services and the sphere of private research. We come back to this below in light of the latest statements from the Pentagon (April 2020) and Congress.

Does this research program provide access to new databases on UAP?

SIGMA2 is obviously interested in the work that could be published by the AATIP program, or even in the scientific data that could be made available on this occasion by TTSA. For now, the report remains classified. The video of the Nimitz case (observation by the F18) is not a recent revelation¹⁹, and while it is of journalistic interest, it cannot be used directly, despite some interesting technical details of the "Gimbal" case. Recent work by SIGMA2 shows how much infrared video requires additional data to be used efficiently.

The existence of the To The Stars company of Mr. Luis Elizondo and other experts, including former Pentagon alumni, could provide an opportunity for cooperation with SIGMA2.

Are there any revelations? what about the ETH question?

Mr. Luis Elizondo's statements are those of a private person, admittedly retired from the Pentagon, but not speaking officially. No direct statement from the Pentagon on the matter supports his or Mr. Bigelow's positions on ETH other than a statement on the work termination. The content of the AATIP report is not made available to the public. Other reports of the same type, such as that of the British MOD entitled "Unidentified Aerial Phenomena in the UK Air Defense Region", declassified and published in 2008, show the proven existence of the phenomena but do not clearly conclude on their origin and even less on ETH or on a threat, while recommending precautionary measures for pilots in the event of a surprise effect.

SIGMA2 studies all cases of UAP, whether their origin is natural (atmospheric phenomena, ball lightning, plasmas), artificial (stealth aircraft or drone type devices with a change of environment) or else unknown. Certain behaviors of phenomena or objects presenting sudden accelerations after a passage in hover or surprising changes of shape (see the case of Lakenheath²⁰, case published by the CIA and observed in 1956 by the RAF in Great Britain), highlight extraordinary kinematics. Are these cases the reflection of phenomena that are both luminous and detectable by very fast maneuvering radar, or do they reflect real intelligent devices with unknown technology more elaborate than what we know?

For now, the lack of data is slowing the progress of the analyses, but SIGMA2 does not despair of being able to collect new data with new means of observation. Will AATIP

19 Un post d'un ancien marin du Nimitz, remontant à février 2007, évoque la mise en état d'alerte du Nimitz survolé par un UFO, les CR des pilotes et l'existence de vidéos IR <http://www.abovetopsecret.com/forum/thread265697/pg1>

20 <https://www.cia.gov/library/readingroom/docs/CIA-RDP81R00560R000100010010-0.pdf>



provide such data? We can express a certain optimism, realistic. None of the data obtained by the FOIA process in the USA so far results from projects classified or declassified to date.

3.5.3 What's new from 2019?

Regarding the US Navy

US Navy statements in 2019 attest not only to the authenticity of the IR videos, to the lack of understanding of the phenomena observed and recorded, but also to the strengthening of the procedures for reporting sightings of unknown objects by the pilots of the US Navy. The US Navy further specifies that TTSA's release of the (genuine) videos was not permitted.

US Navy pilots confirm their observations of the 2004 era, but also frequently thereafter of 2014 and 2015 with infrared recordings (published videos) and radar contacts with the new radars fitted to the F18s. These radars with active antenna would have made it possible to visualize objects of cubic shape in spheres, which could recall balloons equipped with radar reflectors (balloons whose kinematics are a priori slow). We can understand that more powerful active antenna radars allow the F18 to more easily catch a target at a longer distance, but they do not allow to "visualize" the shape of an object, such as an image (with shapes) and even less to see a cube in a sphere (which can be done with the naked eye or even with a camera).

No report of the sightings made by the US Navy has been published either for the Nimitz case (2004, a report which must have been around for a long time), or for the more recent cases discussed above.

Reference is made to the extraordinary kinematic behavior of these objects by the pilots (interviews in communications series edited by TTSA) but without any reference to detailed official observation reports (as in the "Blue Book" file) which would allow a technical and scientific use of videos and reports.

Patent publications of supposed gravitation control technologies developed by the US Navy have appeared ... in which no real and serious solutions are described. The patent seems questionable to us.

Republican Senator Walker sent on July 16, 2019 a request for an explanation to the Department Of Navy (DON) on incursions into American airspace, on the risks to safety and the control of highly maneuverable craft technologies (control gravitation) by the USA or China or Russia.

He received a response dated July 31, 2019 (see Figure 3.5.2.1) indicating that the NAVY was investigating numerous air incursions into its airspace, investigated with other US agencies. The explanation put forward concerns the possibility of overflight of test and sensitive areas by drones which proliferate. We have already addressed this subject in the context of the Aguadilla case and have identified the performance of



certain drones (micro- or mini-drone class) which are nothing extraordinary, even if some can be very fast over fairly short durations. (class 300 to 500 km / h)... MALE medium altitude drone technologies could be developed with an increased maneuver capacity, but our knowledge of advanced vehicles, even hypersonic (see § dedicated to hypersonic missiles) does not relate any similar maneuver to those observed by the pilots, with an altitude change of 80,000 ft at sea level in a few seconds.



THE UNDER SECRETARY OF THE NAVY
WASHINGTON DC 20350-1000

31 JUL 2019

The Honorable Mark Walker
U.S. House of Representatives
Washington, DC 20515

Dear Representative Walker:

Thank you for your July 16, 2019 letter regarding the unidentified aerial phenomena (UAP) featured in recent media reports.

There have been a number of reports of unauthorized and/or unidentified aircraft entering various military-controlled training ranges and designated air space in recent years. The Department of the Navy (DON) takes these reports very seriously and continues to log sightings and fully investigate the accounts. The wide proliferation and availability of inexpensive unmanned aerial systems (UAS) has increasingly made airspace de-confliction an issue for our aviators. Naval aircrews have been provided reporting guidance to determine the frequency and location of UAS operating in training areas. The guidance supports objective, data-driven analysis of incursions. The DON continues to dedicate resources to the tracking and investigation of reports that could affect the safety of our aircrews.

The DON is aligned with the Department of Defense (DoD) and interagency partners on this effort. The DON is leveraging established relationships with sister Services, other DoD offices, the U.S. Intelligence community and other U.S. government agencies that will help us to better understand these incursions into training areas. We will continue to ensure our efforts are closely coordinated with these organizations in this increasingly complex aviation environment.

The Department remains committed to providing Congress with updates on our efforts in the most proactive and transparent manner possible. We will continue consultations with the House Armed Services Committee, which continues to be our primary entry point in the House for all updates related to this topic. I appreciate you taking the time to share your thoughts on this issue and your continued support to our mission.

Sincerely,

Thomas B. Modly

Figure 3.5.3.1

Copy of response from Dpt Of Navy to Congressman Walker

More recent information was published by the US Navy comprising the testimonies of multiple observations made by the pilots²¹ in the period 2014-2015, which attests to repeated observations of slow objects (100 kts, flying between 12,000 and 19,000 ft above sea level) apparently unknown and unidentified by the US Navy, which seeks to cross-reference its information with other government agencies.

Along with the Pentagon's April 2020 statements acknowledging not only the existence of the IR videos but also their official disclosure, the Navy is posting open access to these IR videos on its official website.

²¹ <https://www.thedrive.com/the-war-zone/33371/here-are-the-detailed-ufo-incident-reports-from-navy-pilots-flying-off-the-east-coast>



About the Pentagon

The Pentagon reacted to the initial statements by successively acknowledging the existence of the AATIP program (completed in 2012), that this program was linked to UFOs (05/22/2019), to finally recognize the confusion of statements and give explanations in December 2019.

Indeed, the last statement made to Black Vault on 12/08/2019 (see Appendix A 3.5.3.1) by Pentagon spokesperson Gough, concerns the **Advanced Aerospace Weapon System Applications Program (AAWSP)** otherwise known as **AATIP**, notified by the Defense Intelligence Agency in 2007 to Bigelow Aerospace which had responded to a call for tenders. This program was intended for classified research on future aerospace threats (40 years ahead) including UAV.

This version, which puts UAV in the crosshairs of aerospace threats, is quite consistent with the Program's Security Annex (clearance by Luis Elizondo - see Annex A 3.5.3.1) and with the experiments of the Naval Research Laboratory. We can also note that among the breakthrough technologies linked to UAV, the Naval Research Laboratory was also experimenting with an underwater cargo UAV carrying underwater drones, the shape of which closely resembles the "tic tac" of the Nimitz case (see Appendix A 3.5.2)... even if this cargo drone remains in an aquatic environment and does not fly (to our knowledge).

However, one of the cover pages of the report (Appendix A 3.5.3.1) deemed classified on 38 subjects, reveals research on "warp drive", on dimensions beyond the 4 well-known dimensions of our space-time, which is interesting but very exotic and a priori far removed from research on UAV.

Likewise, Senator Reid's letter (see Appendix A 3.5.3.2) dating from January 2009 clearly raised the question of access to research on the AATIP program concerning space propulsion, special materials, human effects, subjects quite distant from UAV. The same also applies to the letter from the DIA dating from January 2019 which outlines the AATIP program (see Appendix A 3.5.3.3).

On January 10, 2020, the Pentagon finally reconsiders its contradictory statements²² in a statement to Black Vault and admits some confusion (which has not ceased).

Dr Harold Puthoff (Scientific Fellow of TTSA and formerly BAASS) gives an outstanding presentation on the history of AATIP and UAP research in February 2020 in Berkeley. He explains the work on vacuum energy, warp drive, meta-material samples²³...

The USAF OSI (Office of Special Investigation of the US Air Force), for its part, had

22 The Pentagon Explains WHY They Changed Past UFO Statements
<https://www.theblackvault.com/documentarchive/the-pentagon-explains-why-they-changed-past-ufo-statements/?fbclid=IwAR1WIXrnuM-4rRDmfdtmi2ajPF1Bz5MZc6DudL0ohrZ6Ilt8I8m5wTV6i08>

23 https://m.youtube.com/watch?feature=share&v=-199qc_6090



launched an investigation procedure in early 2018 for the disclosure of confidential information (IR videos) by a private firm. It concluded on 04/21/2018 that the investigation was closed, the videos not being classified. However, until April 2020, the Pentagon explained that the videos were confidential and should not have been disclosed.

Finally, the Pentagon makes new statements on 04/27/2020²⁴ officially recognizing the authenticity of the leaked IR videos and their declassification, which ultimately removes the risk of prosecution and accreditation on the firm TTSA and its members who had broadcast them. It is recognized that these videos represent unknown objects. In addition, the April 2020 statements by the Pentagon re-launch requests this time from Congress, whose National Intelligence Council (CNI) is calling for a debate on the subject with a work plan to clarify the subject of UAP and the various observations made²⁵.

About TTSA and the Army

- **TTSA Research Program**

Luis Elizondo evokes a TTSA research program on materials: ADAM program, knowing that samples of meta-materials (possibly coming from UAP) which would have been collected and stored by the company BAASS, also in charge of recovering all the testimonies of pilot in accordance with US Civil Aviation (FAA) guidelines.

- **CRADA agreement with the US Army**

TTSA has signed a CRADA cooperation agreement with the US Army (see Annex A 3.5.3.4) relating in particular to special materials.

Conclusion on the situation at the start of 2021

What about the questions asked by SIGMA2 in January 2018

- Is there a new communication from the US administration on UFO, a shift from the silence dating back to 1969 since the closure of the USAF "Blue Book" file?
- Does this research program provide access to new databases on UAP, some declassified?
- Are there new revelations, completely new cases, on the issue of the Extra-Terrestrial Hypothesis (ETH).

²⁴ <https://www.defense.gov/Newsroom/Releases/Release/Article/2165713/statement-by-the-department-of-defense-on-the-release-of-historical-navy-videos/>

²⁵ <https://www.politico.com/news/2020/06/23/senators-ufo-government-reports-336021>



The situation today:

Communication

- Yes there is a new communication, a series of very contradictory press releases and interviews ... between different entities of the Pentagon ... with a strange silence from the US Air Force.
- This communication attests to the existence of a research program carried out by private firms (BAASS and TTSA) on behalf of the Pentagon (DIA) on future aerospace threats. Which ones? It seems that this research concerns very advanced technologies related to vacuum physics, quantum physics, modes of propulsion and very exotic materials, far from the drones that are invoked elsewhere.

The numerous, contradictory and complex statements do not make it possible to draw a single conclusion but rather to identify three hypotheses that we related to Global Geo News (see article by Marie Corcelle).

It would be the result either of internal contradictory actions between supporters and opponents of communication, or of communications in a broader context of geostrategic competition. "These could be communications actions between opposing trends, whether or not to disclose information about the AATIP program and associated data. Or, it is part of a global transmission, apparently contradictory, but which leads to the recognition of the program, of the reality of the videos and possibly other revelations, but perhaps progressive, which is consistent with the point of view expressed by Alain Juillet in the film "UFOs affairs of state" by Dominique Filhol.

In another context, geostrategic this time, disseminating these videos would amount to "an outbidding by some to promote defense technology research programs, for example in the context of the Space Forces or very advanced propulsion technologies and to affirm an American leadership".

Recent developments since 2020 now show an inflection in American communication policy and an acceleration of events.

First with the announcement of the creation of the UAP Task Force by the Pentagon in August 2020. Then with the confirmation not only of the authenticity of the IR videos broadcast in 2017, but also more recently, the disclosure of Navy pilot reports (2014-2015 sightings), then photos and UAP recordings made by the US Navy in 2019.

These data, which seem to "leak" from the Task Force, intervene in what appears to be a progressive communication dynamic since 2017, based on information that



disseminates to the public, and whose authenticity is then confirmed by the Pentagon. The protagonists of TTSA, formerly American defense staff, who work in concert with the Task Force act as "alerters"²⁶ and announce the imminent disclosure of the reality of UFOs including to the public with the publication of the report in Congress. The communication policy has therefore changed, which answers question 1.

It is a question of pronouncing on the existence of unknown objects in American airspace, on the corresponding risks from a security and defense point of view and on what UAP are in reality, possibly objects relating to unknown technologies. So this is not trivial.

The NY Times article published on June 3, 2021²⁷ complements this communication. The Pentagon attests to the presence of unknown phenomena or objects of artificial origin in American airspace. The hypothesis of non-American technologies is attested. The question of Russian or Chinese machines is asked. But the kinematic behavior and change of medium (air, water) leaves the door open to other hypotheses of the ETH type, without concluding at this stage. In any case, encouragement for research seems to be emerging.

Content - access to databases?

- This work would relate to UFO, others say about drones (contradictory statements)... but the themes addressed and cited in the document distributed by the DIA show subjects such as multiverses, space propulsion from a vacuum... very exotic subjects for UAV...
- The AATIP program transferred access to data and information collection on UAP sightings in the US to a private firm (BAASS).
- US researches, acknowledges this, but remains unclear on UAP content and topic.
- And no data has been communicated to date.
- In addition, IR videos taken from US Navy F18s have been broadcast, reportedly without authorization, by TTSA, which is risking its clearances. Navy pilots and radar operators ("Nimitz" or "Princeton") attest to astonishing sightings. The Navy Department acknowledged, in a letter to Congress, unidentified incursions into American airspace, which is not a trivial statement ... (cf 09/11), and finally made available on its site the IR videos, but no report has been released so far.

However, TTSA officials, former Pentagon or National Security Council officials, left TTSA to join the UAP Task Force. They now play a role closer to the US administration and regularly inform the public about the existence of particular new data, photos of UAP, gradually leading to more decisive communication on revelations concerning these phenomena and their nature.

²⁶ <https://nypost.com/2021/04/24/pentagon-ufo-report-its-a-reality-whistleblower-says/>

²⁷ <https://www.nytimes.com/2021/06/03/us/politics/ufos-sighting-alien-spacecraft-pentagon>



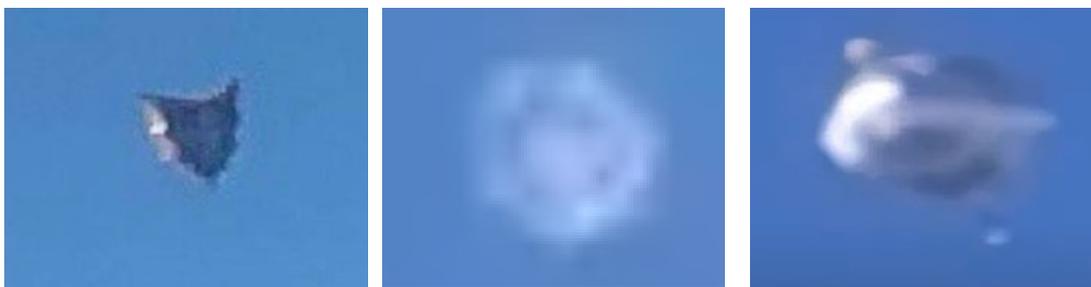
Photos²⁸ and recordings were released recently, leaked via Black Vault, or TV shows but soon recognized as genuine²⁹.

These photos (see below) are not enough on their own, like IR videos, to demonstrate the existence of unknown phenomena. However, they attest to the reality of the images, proven by the Pentagon, and therefore of the questions asked, pending further explanation.

During various televised interventions, Luis Elizondo addressed the issue of data sharing and cooperation, first with Japan (US-Japan agreement in 2020), then with the “5 Eyes” intelligence community (Australia, Canada, UK, New Zealand, USA). Cooperation extended to other countries was also mentioned, which could be one of the recommendations of the Task Force to Congress.

If this were the case, and if authorization were given to share data on UAP within the framework of cooperations, this would therefore answer question 2 positively. We can hope so.

At this point, comments on the UAPTF report by the NY Times do not yet point to such a proposal.



«acorn»

«sphere»

«metal blimp»

Figure 3.5.3.2
Photos taken by F18 pilots (US Navy) off Oceana (03/04/2019)

28 <https://www.extraordinarybeliefs.com/news4/navy-filmed-pyramid-ufos>

29 <https://www.theblackvault.com/documentarchive/pentagon-confirms-recent-uap-ufo-leaks-as-genuine/>



Figure 3.5.3.3 "Pyramid-type object"
USS Russel- recording with night vision device (near San Diego- July 2019)



Figure 3.5.3.4 "Trans-medium sphere type object"
USS Omaha - observation of a sphere passing from the air environment into the sea (2019)

Are there any new revelations, completely new cases, what about the Extra-Terrestrial Hypothesis (ETH)

There are conflicting revelations, statements in interviews, but no actionable objective data ... even videos can't prove anything.

However, no report has been disseminated by TTSA or anyone (except the Scientific Coalition for Ufology - SCU), which allows us to analyze IR (2D) videos with context information, and in particular radar ... We are in the inability to give an opinion due to lack of data even if, of course, what is reported is difficult to explain (these are infrared observations but also radar and visual).

Under these conditions, we remain reserved on the conclusions relating to the extraordinary nature of the devices observed, for lack of technical elements to give an



expert opinion, regardless of the curiosity aroused by the information on the AATIP program and the videos.

We are therefore waiting on this subject and hope that contacts can be made subsequently with the UAP Task Force to access certain data.

The various recent interventions by Messrs. Elizondo and Mellon on the one hand endorse recent images and testimonies deemed extraordinary and without technological explanation for some. On the other hand, they suggest that a desire to share information would exist, leaving the members of the Commission perplexed. If the technical interest of the sharing of information is undeniable, questions arise on the deep motivations of the American administration in the conduct of this turnaround on these subjects.

The finding of SIGMA2, drawn from the comparison of old and recent UAP cases, sheds light on very advanced technologies that were unknown in the 1950s, or even still unknown today due to the kinematics observed. They are unrelated to the natural phenomena that we have listed.

While the SIGMA2 Commission remains cautious about invoking exogenous technologies or the ET hypothesis, it remains open to any hypothesis, including ETH. It appears that the Pentagon's UAPTF report concludes a similar position, which is also a very new point in American communication.

The Chinese position seems more withdrawn simply noting the extraordinary character of the kinematics of the objects, while specifying that the Americans do not themselves conclude with certainty at the origin of the observed phenomena.

But these various observations are likely to evolve with time and with the information revealed.

3.6 Russian research on abnormal phenomena (In Russian: A. YA)

3.6.1 General

The Russians are very discreet about research activities concerning UAP. However, some information filtered from the 80s and the files were partially disclosed (transmitted to US Ufologists, Mufon in particular, in the 95s), more or less officially. Let us cite a few interesting sources.

First, an article in the New York Times of June 14, 1983, itself referring to a Pravda article of June 6, 1983 devoted to the KGB UFO files.

A very interesting article was published on October 18, 2002, in the PRAVDA, signed by



Nicolay Subbotin³⁰ and translated into English by Maria Gousseva (see Annex A 3.6.1.1).

The Central Department of Armed Forces Intelligence issued a Directive as early as 1952 which launched, among other things, work that sought to determine the origin of the UAP crossing the air border of the Soviet Union; were these natural phenomena not yet explained, spy machines sent by foreign powers, or devices piloted by extraterrestrial intelligences (the question has arisen in all countries)?

Russian work on the research program on UFO (otherwise called Anomalous Phenomena - symbol A. YA) was carried out by the Academy of Sciences of the USSR but also by the Ministry of Defense on the initiative of the Military/Industrial Complex (CMI) from 1978.

A report, entitled "History of Studies Concerning UAP in the Soviet Union", signed by two prominent figures in this field, was published by Yury Platov (USSR Academy of Sciences) and Colonel Boris Sokolov.

The launch meeting of the civil SETKA-AN and SETKA-MO research programs (one on physics, the other on military effects and applications) took place on October 18, 1978 at the Academy of Sciences with the main protagonists (cf. Annex 3.6.1.2 Setka: A Secret Soviet UFO Research Program³¹), among which:

- The Izmiran Institute, institute of the Academy of Sciences in charge of terrestrial magnetism and the diffusion of radio waves: Prof. Vladimir Vasilyevich Migulin and Yury Victorovich Platov who was the head of research, Izmiran being the leading institute for the academy of sciences.
- The Institute of Space Studies of the USSR Academy of Sciences: Prof. Georgiy Stepanovich Narimanov and Inna Gennadyevna Petrovskaya.
- Moscow Institute of Technology: Prof. Rem Gennadiyevich Varlamov.
- The Department of General Physics and Astronomy of the USSR Academy of Sciences: Prof. A. N. Makarov.
- The Schternberg State Institute of Astronomy represented by Prof. Lev Mironovich Gindilis which can be found cited in the archives of GEIPAN³² (see Annex 3.6.2.1.3).
- The NI-22 or 67947 military research unit: MM Victor Petrovich Balashov and Vladimir Ivanovich Volga.
- Air defense forces: Colonel Zaytsev.

The Soviet Navy will also be involved from 1977 (07/10/1977) in research on abnormal phenomena. It issued guidelines for investigating and gathering information on UFO to fleets and flotillas, by order of Admiral Smironov Deputy Chief of Staff of the Navy. This will then be extended on January 20, 1978 by Vice-Admiral Ivanov, Chief of the Intelligence Directorate of the Navy, who will give instructions to the Oceanographic Commission, with the assistance of Dr V.G. Ajaja. According to The KGB

³⁰ <https://rense.com/general30/xfiles.htm>

³¹ <http://www.ufoinfo.com/news/setka.shtml>

³² Note d'information N°1, 15/02/1980, Note d'information sur l'observation des phénomènes anormaux en URSS



UFO File Book, the guidelines will be updated again on March 7, 1980, by order of the Deputy Chief of Staff of the Russian Navy, Vice Admiral Saakyan, assisted by Dr. Ajaja.

Colonel Sokolov will coordinate the military and civilian programs.

All the testimonies unveiled in the book published in 2019 under the title "The KGB UFO file" allows us to better understand the way in which Russia and the former USSR approached the UFO subject with a peak of research between 1977 until the mid-1980s, followed by a virtual halt after 1990, although it seems that some research was continued.

The SETKA-AN and MO programs on UFO would have changed their name several times thereafter, Galactika MO and AN in 1981, then Gorizont AN and MO in 1986. The program would have been greatly reduced from 1990 to end in 1996.

According to the book, research into space anomalous phenomena (thus renamed by research teams at the Academy of Sciences) brought together civil and military research, with several military research units and an important role for the Soviet Navy in research of information :

- Civilian research: STEKA-AN linked to physics (phenomenology, EM effects, atmospheric).
- STEKA-MO military research on the effects of phenomena on military equipment including:
 - the KGB including the laboratories and research units - the KGB security test centers.
 - Research carried out by military intelligence services including the Soviet Navy intelligence service, which has set up a vast network for collecting information and obtained numerous testimonies on abnormal phenomena, especially aquatic

3.6.2 Civilian research on anomalous spatial phenomena

The civil research program was to focus primarily on natural, atmospheric and physics-related phenomena.

Felix Ziegel was a famous Russian ufologist who summarized the issues related to UFO (abnormal phenomena) in a document dating from 1967 "UFO what are they", published with the CIA archives on UAP (see Appendix A 3.6.2 CIA UFO archives what are they 1967).

This document shows that the UFO research program in the USSR actually predates the years 77-78, when the SETKA AN and MO programs were launched in form, linked to the repeated observation of phenomena.

One of the reasons is linked to the risk of warning on the occasion of the appearance of



sprites (see § 5.13), phenomena of stormy origin manifested by an electric discharge in the ionosphere, which electromagnetic and visible signature is very energetic. It could be mistaken for that of a nuclear explosion. One of the known cases is that of Petrozavodsk³³, which occurred on September 20, 1977, mistaken for a UFO. Likewise, the acoustic and radio interferences observed by the navy would have been more frequent at that time.

Military research (SETKA-MO) concerning these phenomena sought in particular to define the discriminating signatures in relation to the detection of nuclear launches and explosions carried out by warning satellites or other types of sensors, notably acoustic, EM etc. ...

The link between different EM interference phenomena resulting from the appearance of UFO, and the detection of radiation of nuclear or natural origin (Sprites), through the detection of missile launches, up to the military surveillance of space (unknown objects, atmospheric re-entry), can explain the grouping under the name of the generic program SETKA. These subjects were brought together in any case for the alert and surveillance of space, from the period 1971-72. This is consistent with the alert / verification of events missions from space related to launches, explosions etc ... which have been the subject of reciprocal information between Russians and Americans as mentioned previously (1971).

We thus see emerging a set of research both scientific on the phenomena of the atmosphere but also military overlapping the anti-missile warning, the surveillance of space, space defense, electromagnetism, the surveillance of explosions for the aeronautical and space sector. Beyond the aeronautical and space fields, research was extended to the maritime sector under the leadership of the Soviet Navy, which brings together a vast network for information collection and studies, including with civilian research organizations, such as the hydraulic acoustics research institute of the Academy of Sciences.

Felix Zigel, summarized the objectives of research on abnormal phenomena as follows:

- 1) they are a pure invention (or a hoax) of individuals
- 2) they exist but are of natural origin and linked to particular conditions of light in the atmosphere.
- 3) they are of artificial origin, special foreign secret devices. According to him, this hypothesis is contradicted by photos of phenomena taken from an airplane, changing shape (polymorphism) which does not correspond to any known technology.
- 4) they are linked to completely new natural phenomena, such as kinds of plasmas electrified with dust, under the influence of light. It looks like ball lightning type phenomena but cannot explain all the phenomena including shape changes. In addition, witnesses who experienced eye burns assumed it was caused by UV radiation, but there is evidence that eye or dermis damage may as well be related to microwaves emitted by UAP.
- 5) they come from another planet. This hypothesis is not proven but is not

33 <http://www.ufoexperts.net/petrozavodskufo.html>



rejected.

Despite this research, it seems that the branch of scientific research has mainly concluded to a link between atmospheric plasmas, the subject of abnormal phenomena being a sulphurous subject.

The main effects identified for abnormal phenomena are:

- Polymorphism of flying objects with spontaneous appearance and disappearance.
- Abrupt change of direction, without inertia.
- High speed with blast effect.
- Silent movement.
- Impact on electricity, radios, watches, electric or gasoline motors.
- Effects felt on living organisms.

SIGMA2 Commission comment: as with the British findings, Russian civilian research appears to be moving towards atmospheric luminous phenomena approximating floating plasmas or ball lightning occurring under particular conditions, such as solar flares. Our comment remains similar with regard to the kinematics observed with supersonic or even hypersonic speeds and non-standard accelerations, incompatible with atmospheric plasma-type phenomena, even if these phenomena exist, are better known and can explain confusion. On the other hand, the skills of the SIGMA2 Commission do not make it possible to give an opinion on the underwater phenomena that we have not understood so far. But the effects involved seem surprising enough to have preoccupied the Soviet Navy.

Finally, the diversity of phenomena observed in the air and under the sea cannot conclude from a single natural phenomenon, atmospheric or underwater, even if certain constants are observed. This constancy relating to abnormal kinematics, weak interactions with the environment and EM disturbances could on the contrary be in favor of objects that may be artificial, transmedium (or indifferent to the medium crossed), generating similar disturbances.

3.6.3 Laboratories and military research units on abnormal phenomena

It was in the years 77-80 that special units were created to repel possible attacks from space.

A secret laboratory is said to have been dedicated to the study of UAP and installed at Kapustin Yar, the Russian cosmodrome, as well as in others test centers.

An important incident occurred in June 1971; the teams of this laboratory observed a black object, shaped like a cigar, which flew 800 m above the clouds. It was about 25m in length and 3m in diameter; it seemed to have no engine, ailerons, or wings.

Various incidents probably motivated the signing of the Russo-American agreement of



1971³⁴ (see Annex A 2.2 Agreement) concerning the information and reciprocal alert of the risk of accidental launching linked to the presence of an unknown object in the airspace inducing interference effects.

The book UFO File of the KGB reveals the existence of the Citadel³⁵ UFO investigation program initiated by Yuri Andropov (president of the praesidium of the USSR 1983-84) to deal with the threat of asteroids likely to strike the Earth (subject which we will find in the IGMASS program of the 2000s - see § 2.5) but also that of UFO as aerospace threats in general. This program, which was almost stopped by Michail Gorbachev, actually continued following the evidence gathered after the Borisoglebesk³⁶ accident in April 1984.

Two SETKA-MO military research units were particularly responsible for military research from 1977. They are the NI-22 research unit (or military unit 67947) based in the city of Mitischi (Moscow region), and Unit 62728 (Leningrad). These units were specialized in the study of serious cases associated with physical traces of abnormal phenomena, the death of personnel following a close encounter or technological breakdowns. The NI-22 unit was involved in the Borisoglebsk EME incident (April 1984) and appears to have subsequently played a role in the development of microwave-based EM jamming devices according to the KGB UFO File book.

At the same time, research was therefore carried out by the Soviet Navy³⁷ on aquatic objects (nicknamed "Quakers" for croaking echoes) or with a change of environment (air-submarine). They are recorded in archives declassified in 2008, notably from the following organizations:

- Commission for Oceanographic Inquiry of the Academy of Sciences on UFO SETKA AN SSR-section for the study of abnormal underwater phenomena (KAYA PGO)
- Secret archives declassified in the BD KAYA PGO database

These aquatic objects would have been observed at the end of the 2nd World War then with an intensification in the 70s. The anomalous KAYA PGO phenomena would have been confused at the start with a hypothetical active sonar detection network of American origin intended to detect the Soviet submarines.

After the end of the cold war, from 1991, American scientists would have worked for the Pentagon on recordings made in the Sixties. In 2006, Robert Spindel, physicist of the University of Seattle would have assembled a series of unusual sounds captured by the US Sonar system³⁸...

The Soviet Navy drew up a map of the sea areas where these phenomena occur. In the 1960s, they identified a high density of cases mainly in the Atlantic, then in the Pacific,

34 <http://www.state.gov/t/isn/4692.htm>

35 le dossier OVNI du KGB-P.121

36 le dossier OVNI du KGB- P.122

37 le dossier OVNI du KGB p.273 à 325

38 le dossier OVNI du KGB- P.293



more than half of which in the Sea of Japan, the Mediterranean, the Arctic Ocean ...

The main characteristics of underwater phenomena are as follows:

- Emission of sounds on different frequencies (similar to croaking).
- High speed movement underwater (200 knots and more) and at great depths around submarines.
- Propensity to change environment, transition between the aquatic or air environment with or without interaction with water (displacement).
- Permanent or temporary interference with electronic and acoustic equipment (acoustic and EM emissions).
- Polymorphism, change of shape (balls, circles, light wheels) mimicry behavior like chameleons.

Investigations into these phenomena have been carried out on an army-wide scale, in particular with the military laboratories of Unit NI-22. They also overlap with the activities of a Soviet Navy surveillance network, in connection with ocean surveillance and the acoustic detection of phenomena linked to "Quaker" OANI (aquatic) objects.

3.7 UK MOD works

3.7.1 General

The UK archives have been published by the UK Ministry of Defense (MoD UK). These are first of all the reports " *Unidentified Flying Objects*³⁹, Ministry of Defense, Directorate of Scientific Intelligence (DIS) and Joint Technical Intelligence Committee, Report n ° 7, June 1951, then the report " *Unidentified Aerial Phenomena in the UK Air Defense region* " accessible in the national archives⁴⁰ which results from work launched in 1996 and published within the framework of the FOIAA MOD Freedom of Information Publication Scheme⁴¹. The introductory summary of the 2000 report is given in Figure 3.7.1.1.

39 Ministry of Defence, Directorate of Scientific Intelligence and Joint Technical Intelligence Committee, Report n°7, June 1951

40 National Archives, UK Ministry of Defence ([N°55/2/00](#))

41 <http://webarchive.nationalarchives.gov.uk/20121026065214/http://www.mod.uk/DefenceInternet/FreedomOfInformation/PublicationScheme/SearchPublicationScheme/UnidentifiedAerialPhenomenauapInTheUkAirDefenceRegion.htm>

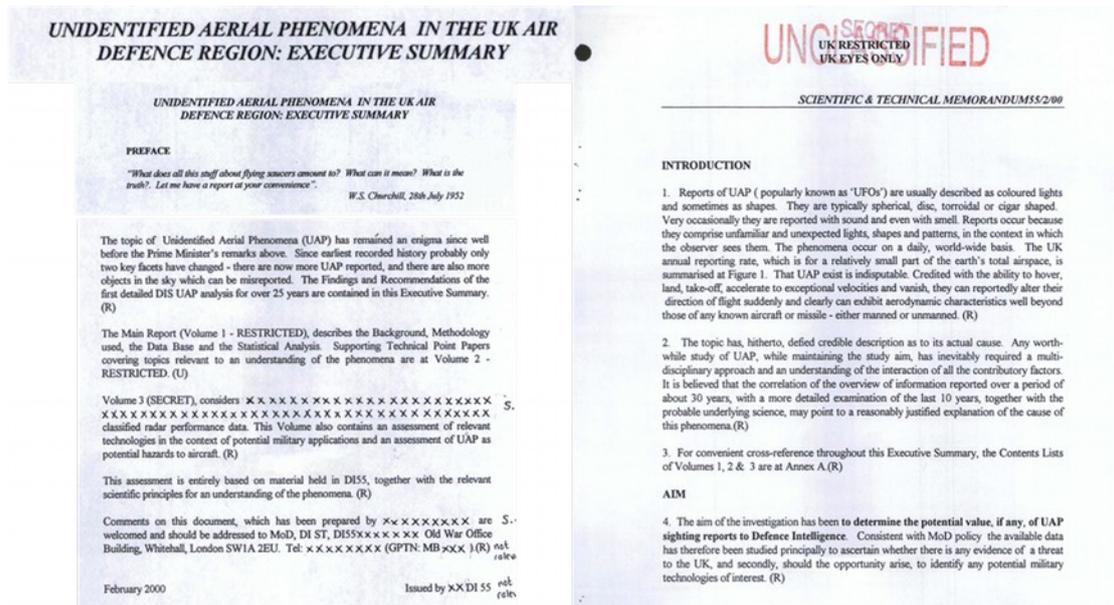


Figure 3.7.1.1 - Introduction of the summary of the report “Unidentified Aerial Phenomena in the UK Air Defense Region” published by the British Ministry of Defense in 2000 (uap_vol1_pgs1to13_ch1.pdf)

It was written and titled N ° 55/2/00 "Unidentified Aerial Phenomena in the UK Air Defense Region", by the MoD Air Command-DIAS (Defense Intelligence Analysis Staff) in 2000 from the 1996 study which was published in 2008, with updates through 2013. The 1951 report is of historical value, reporting American cases and a few uninteresting British cases.

3.7.2 2000 DIS document

We focused on the analysis of report N ° 55/2/00 UAP in the UK Air Defense Region, now available with its three volumes (Annex):

- Vol 1, main report, background, methodology, database, statistical analysis, analysis of foreign work (initially restricted);
- Vol 2, technical point papers (initially restricted);
- Vol 3, performance data radar (initially secret).

We immediately notice that the report is interested in unidentified aerial phenomena (UAP) and not in UFO, these phenomena mainly appearing in the form of colored lights sometimes marrying shapes (sphere, disc, toroid, cigar, etc.) and very rarely manifested by noise and smell.

The existence of UAP is not questioned and their supposedly exceptional characteristics in certain cases (ability to hover, landing and take-off, accelerations and high speeds, sudden change of direction) are cited even if they can be debated in certain cases.

The objective pursued by the DIS is twofold:

- determine whether the events observed pose a threat to the UK;
- identify whether there is a potential for technological innovations that could be of use to the military.



Volume 1 focuses on statistical analyses. These analyses notes appear in Annex A 3.7.2.1, including the original volumes.

The UK database has 30 years of reporting. A change occurred in 1997 when it was decided that the DIS would henceforth only consider testimony from "credible" people (the "credibility" criteria are not mentioned). It is estimated that many civilian crews made sightings but did not report them, for fear of ridicule or in order not to damage their careers (an internationally prevalent attitude). The frequencies and places of observations are not higher in the vicinity of strategic installations, but it is noted that the observations are more numerous near isolated, electrically charged objects, whether they are industrial or military sites, from lines to high voltage, land or air vehicles (assumed in connection with the theory of electrically charged gaseous masses).

Volume 1 also includes a watch chapter on foreign work, the French (GEIPAN), the work of the Russian Academy of Sciences, the SETKA program etc., some related to Defense research. The work done on all the subjects of the physics of phenomena is vast and remarkable although the text is only a summary of the work, the conclusions being reported without giving details. Many British cases have also been recorded in the Defense archives grouped together in the Black Vault files⁴². The cases cited below are mentioned in the archives of the British Ministry of Defense, and occasionally in American archives.

Volumes 2 and 3 include analyses with scientific ambitions on themes listed below (see analysis in Appendix A 3.7.2.2).

These analyses tend to attribute the origin of UAP to physical, electrical and magnetic causes in the atmosphere, mesosphere and ionosphere. However, the mechanisms leading to the formation and evolution of these electrified or plasma-formed gaseous masses are not fully known and understood. A distinction is made between electrically charged masses of gas floating in the air, visible but not detectable by radar, and masses of plasma giving a radar echo. The non-inertial nature of the "things" observed would be consistent with the proposed explanation. No systematic SIGINT, ELINT, IMINT, radiation measurements are available to support the theory. The only radiation effects reported on very rare occasions are skin burns or damage to land objects.

⁴² Archives du MoD, United Kingdom UFO documents, *Black Vault* (<http://www.theblackvault.com/documentarchive/united-kingdom-ufo-documents/>)



Contents of Volumes 2 and 3

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DIS SCIENTIFIC & TECHNICAL MEMORANDUM 55/2/00

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The conclusions can be summarized as follows:

- Are UAP a threat to the UK? The answer is clearly no, with the following justifications:
 - There is no evidence that the UAP detected by UKADR correspond to incursions by air objects controlled by an intelligence or that they have hostile intent;
 - There is no evidence that solid flying objects actually exist and that they could pose a risk of collision;
 - the likelihood of a face-to-face encounter with a UAP is low, but it is recommended that no life-saving maneuvers be undertaken;
 - the danger only affects low-speed aircraft;
 - There is no information to prove that the pursuit of an UAP provoked a victim.

- Is the study of UAP relevant to military intelligence and technology? The answer is again no, although there is reference to Russian military research on plasmas (these are presumably weapons aimed at creating plasmodia by very powerful lasers).

The consequences are as follows:

- the need to continue to manage UAP reports does not exist;
- the usefulness of maintaining the database does not exist, especially since it shows no significant difference between the Cold War period and the post Cold War period;
- no maneuver is necessary in the event of an encounter with a UAP; but it is recommended to avoid brutal maneuvers.
- the reasons for the variability of UAP radar detections must be studied by the specialized services;
- a central element of the report is the role attributed to plasmas and magnetic fields, it should be researched.

3.7.3 Comments from SIGMA2 Commission

The British position has the merit of expressing its conclusions clearly: UAP exist and are sometimes detectable by radar, UFO do not. The central explanation is the existence in the atmosphere of electrified gaseous masses or plasmas.

This hypothesis remains speculative insofar as the underlying physical mechanisms are not understood. Should UAP research primarily involve meteorologists?

Our report analyzes different types of plasmas, including those of electromagnetic origin. Our conclusion is that atmospheric plasmas of EM origin cannot a priori exceed the speed of sound nor show abrupt changes of direction. The main explanation of the British report does not allow to explain the case of Lakenheath where luminous balls are animated by sudden variations of speed from zero speed to supersonic speeds



almost instantaneously in groups or in isolation. It cannot be a floating atmospheric plasma.

Volume 2 has not been fully exploited, apart from a few extracts (detectability of plasma targets, exotic technologies, sightline rates of flying objects), whose scientific content appears to be quite poor. But a comparison has been made with our work.

The questions to be asked of a possible British contact should relate to the cases for which there would be physical elements, other than a radar detection (as at Lakenheath) proving the existence of a flying object with unusual characteristics (apart from the Rendelsham case).

3.8 CEFAE

During a meeting at CNES in 2017, SIGMA2 met the CEFAE (Center for the Study of Aerospace Phenomena), an institutional body dependent on the Argentine Air Force. The CEFAE became in 2019 the CIAE (Aerospace Identification Center), attached to a higher level within the General Staff of the Argentine Air Force. The CIAE is equipped with the IPACO image analysis software, provided by the IPACO team of Dr F. Louange.

3.9 International institutions: UN and UAP (COPUOS)

The UN includes some key organizations and projects related to outer space, around the management of certain risks, such as near-Earths, space debris, but also for international cooperation operations.

These structures could possibly play a role on the UAP subject, as was attempted in 1978 to obtain a UN resolution in favor of sharing information on the subject. This attempt failed but was concluded with a recommendation for access to national information which resulted in FOIA steps, leading to the disclosure of archives, including UK, US.

France, for its part, had already created an institution for the collection of testimonies and investigations, GEPAN, which later became GEIPAN in order to inform the public of the results. The GEIPAN archives are in fact freely available on the Internet and are therefore part of the same logic of making archives available.

The following paragraphs give some details on structures and projects while referring to Annex A 3.9 for more information.

3.9.1 UNOOSA (United Nations Office of Outer Space Activities)

This body is responsible for promoting international cooperation for the peaceful use of outer space. It serves as the secretariat of COPUOS (Committee for the Pacific Use of

Outer Space). It has been located in Vienna since 1993.

UNOOSA is also responsible for maintaining the UN Registry of Objects launched into outer space. It manages the UN platform for information from space resources. It also maintains a 24-hour hotline: it serves as the UN focal point for satellite image requests for disaster management and emergency responses (UN-SPIDER). **It is also the secretariat of the ICG** (International Committee on Global Navigation Satellite Systems).

UNOOSA is currently working to build indigenous capacities in space technologies and applications, particularly in developing countries. Its missions are in fact the space economy, the space society, space accessibility and space diplomacy⁴³.

With a scientific and technical sub-committee and a legal sub-committee (see Figure 3.9.1), the Committee relies on international cooperation on complex issues, including space debris, space exploration, overall planning in relation to near-earth objects and all other important concerns of a similar nature⁴⁴.

Chaired by Natália Archinard (Switzerland), the last assembly (April 19 to 30, 2021) focused in particular on the use of nuclear energy sources in space.



Figure 3.9.1.1 - UNOOSA organization chart

Through the UN Space Applications Program, UNOOSA organizes international workshops, training courses and pilot projects on various topics, such as remote measurement, satellite navigation, meteorology and satellites, TV -education and basic space sciences for developing nations.

43 <https://careers.un.org/lbw/home.aspx?viewtype=VP&PID=429&lang=fr-FR>

44 <http://www.un.org/apps/news/newsmakers.asp?NewsID=43>



3.9.2 Example of UN work: the dangers of NEO⁴⁵

At the UNISPACE III conference, the opinion was expressed that retroreflectors should be placed on all large objects, especially those that became inactive after launch, which would allow more precise determination of the position of orbital elements and improve the effectiveness of collision avoidance maneuvers...

COPUOS noted that the NEO Working Group had before itself recommendations for an international response to the risk of NEO impacts.

It should continue to update the Subcommittee on the progress made in establishing the two groups: the asteroid alert network and the space mission planning advisory group, which are expected to report annually on their work.

The sharing of information relating to the detection, monitoring and physical characterization of potentially hazardous near-Earth objects was recommended.

3.9.3 COPUOS (Committee for the Peaceful Uses of Outer Space)

In 1958, an ad hoc committee, COPUOS (Committee for the Peaceful Uses of Extra-Atmospheric Space), was created made up of 18 members.

It considers the activities and resources of the United Nations, specialized agencies and other international entities related to the peaceful uses of outer space and the organizational arrangements facilitating international cooperation within the framework of the United Nations as well as legal issues that may appear in outer space exploration programs. It ensures the non-militarization of space.

3.9.4 The UN and extra-terrestrial life

The United Nations is playing a role in the debate surrounding the exploration of space, the human presence in space and how to deal with the discovery of life on other planets. It developed a protocol for decontaminating equipment that may carry alien microbes, and worked on the kind of greetings humans should give intelligent alien life forms.

In 2010, a space ambassador could have been appointed by the United Nations to act as the first point of contact for aliens trying to communicate with Earth. Professor of space sciences, John Zarnecki explains why the Earth must prepare for a first contact, but in September 2010, the UN disavowed the director of UNOOSA (Ms. Mazlan Othman, director from 2010 to 2014), who claimed, given the recent discovery of hundreds of exoplanets, that the UN should prepare to coordinate humanity's response to any first contact. According to Mazlan Othman: "the continued search for extraterrestrial communication by different entities support the hope that one day humanity will receive signals from extraterrestrials, and the UN is ideal for this coordination".

Instead of this coordination, the UN will use the US conference to discuss the problems posed by the proliferation of space debris and near-earth objects (asteroids) and

⁴⁵ http://www.oosa.unvienna.org/pdf/gadocs/A_68_20F.pdf



coordination mechanisms for the use of space technologies in the United Nations system.

Professor Richard Crowther, an expert in space law and governance at the UK space agency believes that humanity's first encounter with intelligent aliens would be via radio or light signals from a distant planet rather than by the arrival on Earth of aliens and suggests that we should rather encounter microbes than extraterrestrials in the flesh.

To this day, we wonder, in the light of US communications on the UAP sighting, what data will be revealed and possibly made available to other nations. Will there be an incentive with a UN resolution using 1978 terms urging nations to share their information and data. Will there be any leadership or initiative from the United States, or even other countries? The airspace security issues presented by the USA undoubtedly suggest a separation of data, classified for national use on the one hand (the famous confidential appendices of the UAPTF report), from on the other hand more general information made available to the international community. Bilateral exchanges could also emerge.

3.9.5 UN Resolution 33/426 of December 1978 and Disclosure

3.9.5.1 American position on the UN conclusions

Initially, the US voted against Grenada's initiative for resolution 33/426.

However, by signing his memorandum on the FOIA⁴⁶ on January 21, 2009, President Obama had promised to guarantee the transparency of the Government⁴⁷ and opened the door to the transmission of information to the American people.

In a way, it is taking into account an expectation of the American population but also certain policies, as well as taking into account the resolutions submitted by Grenada at the 42nd and 43rd UN General Assemblies. Resolution 33/426 of the General Assembly of the United Nations, adopted on December 18, 1978, actually only "invites" "the member states concerned to take the appropriate measures to coordinate at the national level scientific research and surveys on extraterrestrial life, including Unidentified Flying Objects (UFO), and to inform the Secretary-General of observations, research and evaluations of such activities."⁴⁸

This UN Resolution is in international law one of the first expressions, formal and explicit, concerning extraterrestrial life and the UFO phenomenon. In diplomatic language, UNGA Resolution 33/426 must function as a system of "building mutual

46 <http://ovnis-usa.com/nouvelles-directives-foia/>

47 The Freedom of Information Act (FOIA) is an American law signed on July 4, 1966 by President Lyndon B. Johnson, and entered into force the following year. Based on the principle of the right to information, it obliges federal agencies to transmit their documents to anyone who requests them, whatever their nationality, not to be confused with the Freedom of Information Act 2000 is a British law enacted by the government of Tony Blair to allow and regulate freedom of access to administrative documents. The Information Commissioner's Office (ICO), a new name given by law to the Data Protection Commissioner, is responsible for enforcing the law.).

48 https://fr-fr.facebook.com/permalink.php?story_fbid=213353242086493&id=206882382733579

trust", which will allow member states like the United States (which have so far maintained a total embargo on their secret files concerning UFO and extraterrestrial life), to feel more protected when ready to disclose, by acting in a coordinated manner with the public measures adopted by its allies and other UN member states.

We will see what happens to the continuation of the FOIA process in the US based on this new report on UAP commissioned by the US Congress.



Figure 3.9.5.1.1 - Preparatory meeting at the UN, July 14, 1978, to evoke the need for United Nations support for the study of the UFO phenomenon. From left to right: Gordon Cooper, Jacques Vallée, Claude Poher, J. Allen Hynek, Sir Eric Gairy - Prime Minister of Grenada, UN Secretary General - Kurt Waldheim, and foreground to right: David Saunders.

3.9.5.2 Russian Proposals at COPUOS

At the 59th session of COPUOS, in Vienna, in June 2016, in Austria, a Russian delegation presented a practical mechanism to bring the UN platform to an information functionality on the security of operations in space. It proposes in two years (from 2012 to 2014) to bring the tools and operations on space debris to a level compatible with an awareness of the collaborative nature of space operations.

After considering the existing and its limitations and the lack of an international database of space objects (rockets, debris and events): insufficient data, insufficient data precision, duplicated and potentially conflicting information from multiple databases, the delegation offers guidelines for sharing information on objects and events in outer space, improving the accuracy of orbital information, combining and validating data from different sources, improving capabilities and distribution geography of old and new sensors and by improving aids for tracking objects in orbit.

The delegation advocates common standards for the presentation of information, sharing and dissemination of information on space debris.

The delegation is aware that the guidelines, while important, do not result in an ultimate solution for a true interaction to share information on objects and events in outer space. Nonetheless, it proposes to develop requirements for sharing this information.



At the time of writing this SIGMA2 report, Russia has yet to comment on the UAP Task Force report, the broad outlines of which were revealed in the US press by the NY Times on June 3, 2021.

3.10 Communications

Communications were published in the 3AF Letter⁴⁹ as well as position papers on the 3AF / SIGMA2 website. This includes a situation update on the disclosure of the AATIP program and IR videos by TTSA (early 2018)⁵⁰, the analysis of the Cougar case (2017)⁵¹ for which 3AF / SIGMA2 contributed to the identification of the Airbus A340 of Iberia in 2017, not to be confused with a UFO. The techniques for radar and IR analysis of UAP were explained in the 3AF Letter article titled IR and Radar Cross-views on UAP⁵².

Direct interventions took place: at the conference on aeronautical mysteries organized by 3AF and Alumni ONERA on the theme “IR-radar cross-views on UAP” (November 2020⁵³), during a presentation at INHEST on UAP (November 2019) and during participation in films or television debates related to the subject UFO / UAP (CNEWS “vent positif” -positive wind- in 2018; UFO: state affair in April 2020⁵⁴, followed by a debate on MaybePlanet; UFO in the show “éclairage” - lighting - of AGORANEWS Sécurité (March 2021⁵⁵).

A round table with the GEIPAN (R. Baldacchino) - SIGMA2 (L. Dini) was organized in May 2021 at the initiative of Pascal Fechner on Maybeplanet to explain the complementarity between the GEIPAN (survey, information on the cases of French UAP) and 3AF / SIGMA2, association for the study of UAP, French and foreign.

SIGMA2 has contacted some protagonists of the US AATIP program and is awaiting the release of the UAP Task Force report while remaining cautious about the meaning of the videos on which we lack information. We are nevertheless impatient and very interested to know the technical details of the preliminary findings and the possibility of a US initiative on data sharing and scientific cooperation.

The NY Times press release dated June 3, 2021 reveals the main conclusions of the report and therefore establishes the presence of unknown devices, with behavior

49 <http://www.3af.fr/article/en-direct-de-3af/sigma-2>

<http://www.3af.fr/article/en-direct-de-3af/sigma2-un-mandat-une-structure-un-plan-de-travail-et-d-action>

<http://www.3af.fr/article/opinion/le-controle-local-de-la-gravitation-mythe-ou-perspective>

<http://www.3af.fr/article/en-direct/rencontre-sur-les-fenomenos-aereos-anomalos-paris>

50 <https://www.3af.fr/news/commentaires-3af-sigma2-sur-le-programme-aatip-vf2-1576>

51 <https://www.3af.fr/news/analyse-du-cas-pan-video-ir-gougar-cefaa-mars-2017-travail-collectif-1485>

52 https://www.3af.fr/global/gene/link.php?doc_id=4234&fg

53 <https://www.youtube.com/watch?v=LoDhtK6U CPA&t=6115s>

54 <https://www.youtube.com/watch?v=-8dLYR0XQqg>

<https://www.amazon.com/Flying-Objects-Senator-Harry-Reid/dp/B08TQM2T4K>

55 <https://www.agoranews-securite.fr/eclairages-les-ovni-phenomenes-aerospatiaux-non-identifies/>



beyond known technologies. This observation is supported by data which is not communicated. China has also acknowledged similar findings.



4 Selection of cases

4.1 Case selection criteria

The selection of cases is carried out on the basis of criteria of reliability of sources and the existence of physical data such as recordings or a sufficiently precise description of the phenomenon to establish its characteristics or its "observable profile". These data are then used for scientific study and comparison between known cases and phenomena in order to extract discriminating characteristics or observables. Cases with usable physical data records are quite rare, despite the existence of numerous and very astonishing phenomena reported by the military or aeronautical professionals. In addition, new military and civilian surveillance means give hope for an improvement in the observations as well as the reactivity to collect the recorded data.

Among the selected cases we mention those recently reported by the US Navy dating from 2004 (Nimitz), without forgetting those much more recent (2019) on which only a few photos or videos are in circulation. However, although highly publicized and surprising, despite the disclosure of photos and infrared videos, these cases are not technically and scientifically exploitable until additional context and radar situation data is provided.

British cases are recalled including that of the emblematic and unresolved Lakenheath (1956), or the sighting carried out by Tornados pilots on November 5, 1990.

Conversely, the Chilean Cougar case (2011) was the subject of an exhaustive analysis using the complete data provided by the Chilean CEFAA. This case is exemplary to show the complementarity of the data for an in-depth study. The same is true for the Aguadilla case, which was initially exploited in a summary manner. It is explored in depth in this report by the crossing of radar (not cross-checked), infrared and laser data. If we cannot conclude with certainty on this case, simulation techniques could be used to generate different types of kinematic profiles responding to different classes of objects.

A new and particular use of EME (Electromagnetic) cases has been carried out with interesting cross-references between different cases and types of observations.

A few emblematic cases, very different, are cited below.

4.2 Case selection

4.2.1 French case

Selected among the D (less than 5% of the 2,500 cases investigated) or C cases from the



GEIPAN base, aeronautical or ground, these few illustrations show the diversity of observations, the serious but also very disconcerting nature of some of them due to the extraordinary nature of some reported facts. Some may be linked to physiological effects, others have been the subject of compelling data records.

4.2.1.1 Case of 07/12/1957, Cognac air base

This case of the GEIPAN base¹ (classified C) is established on a report from the General commanding the 3rd Air Region to the Secretary of State, in accordance with instruction note 1267 / IMFA / A / BS / DR of 22/10/1954 see § 1.2.1) which gives an account of “Mysterious Celestial Objects”. The operators of the SRE radar at the Cognac Air Base noted two round radar echoes, observed separately, in two sequences spaced 40 minutes apart. Each time, the echoes are detected over several antenna towers in two different directions, at a distance of 40 km, very fast approaching, estimated by calculation² at nearly 2800 km / h (see Figure 4.2.1.1.1 to 4.2.1.1.3).

667

3^e RÉGION AÉRIENNE

N° 1 / E. M. / 3/AN6 / DR
3^e R. A.

Clt: BORDEAUX, le 2 JANV 1958

Le GÉNÉRAL [redacted] Commandant la 3^e Région Aérienne

à Monsieur le Secrétaire d'Etat à l'Air
Etat-Major de l'Armée de l'Air
Bureau Scientifique - PARIS -

BORDEREAU D'ENVOI

| DESIGNATION DES PIÈCES | NOMBRE | OBSERVATIONS |
|---|--------|---|
| - Comptes-rendus du Sous-Lieutenant [redacted] et du Sergent [redacted] du Contrôle Local Aérien de la B.A. 135 COGNAC, relative à l'observation de Mystérieux Objets célestes..... | 2 | TRANSMIS CONFORMEMENT aux dispositions de l'instruction N° 1267/IMFA/A/BS/DR en date du 22 Octobre 1954 |

P.D. Le Sous-chef d'ÉTAT-MAJOR

6 JANV 1958

N° 20/DR

Figure 4.2.1.1.1 - Report of General CDT the 3rd RA to the Secretary of State

1 GEIPAN_AERO_CTR_COGNAC_16_17.12.1957_T-M_PV_T_D_S_A_1957309636-AERO-1957-R

2 The computation is made by comparing the range of radar plots regarding the antenna rotation period to estimate the plots velocity from one position to the following



Figure 4.2.1.1.2 - On December 17, 1957, a first passage was observed at 40 km
Figure 4.2.1.1.3 - A second track (4 echoes) is observed 40 minutes later: route 220 corresponds to the axis of one of the base tracks (05/23).

A few D cases were listed by GEIPAN in the south of France in Provence between February 1980 and January 1981:

4.2.1.2 Case of 02/17/1980, Saint-Rémy-de-Provence

This case taken from the GEIPAN database³ relates that two people observed a metallic sphere, orange, placed on the ground. This takes off, then separates into two spheres with a luminous point and disappears.

4.2.1.3 Case of 20/09/1980, Saint-Christol

This case of the GEIPAN base⁴ refers to a report by the Saint-Christol air gendarmerie (air military police) which notes the reports of observations made by the soldiers at the air base. For several hours, they observe silent orange luminous balls the apparent size of a balloon from a distance of a few kilometers, separating and merging above the launching areas. They move in groups, oscillating down and then up again, pulsating and emitting flashes lasting a few seconds. The weather is stormy without lightning. No air traffic is reported in the area. Is this a persistent and unknown atmospheric phenomenon of the ball lightning type or of the same family or something else? The subject is discussed in § 5.12.

4.2.1.4 Case of 08/01/1981, Trans-en-Provence

The GEPAN note⁵ N ° 13 of March 1, 1983, based on a police report and laboratory analysis, mentions a spherical metallic object, which is placed on the ground in a field. The object leaves mechanical and thermal traces on the ground; it then flies away quickly with a hissing sound. The vegetation would have undergone an accelerated aging, showing a browning in the upper part, with a base remained green, which shows, after biochemical analysis, the reduction of 33% of the levels of chlorophyll and pigments whatever the age of the plants leaves collected. If part of the chemical

3 SAINT-REMY_DE_PROVENCE_13_1980_T-M_PV_T_S_A_1980308542-224-1980-R.pdf

4 APT-SAINT-CHRISTOL_84_1980_T-M_PV_T_S_A_1980308460-365-1980-R

5 TRANS-EN-PROVENCE_83_08.01.1981_T-M_PV_T_S_A_1981308305-28-1981-R.pdf



analyzes is subject to caution due to poor conservation of certain plant samples, there is a concordance between samples taken at different distances from the site of the prints. This alteration of plants could be explained by the effect of a very energetic field of the electrical type compared to the EME effects on electronics discussed in §§ 5.10 and 5.11.

4.2.1.5 Case of 10/21/1982, Amarante case in Nancy

According to the GEPAN note⁶, the gendarmes (military police) noted the testimony of a man who observed a silent, circular and domed object (about 1.5 m wide by 0.8 m thick) surmounted by a luminescent blue lagoon upper part and a dark metallic lower part. The object descends from the sky and stabilizes in levitation for about twenty minutes near the ground and the amaranth massif. It then rises quickly, making the grass straighten up, without any noise or movement of air, then disappears into the sky. At the same time, the Amaranth flowers which were fresh and surrounded this area are found withered in their upper part, although green at the foot. The biochemical analyzes will not give any reliable results because of insufficient precautions for the conservation of the plants.

On the other hand, the behavior of the grass, 10 cm high, which straightened up under the object, suggests that it was subjected to the influence of a very intense electric field of at least several tens of kV / m, which could also explain the dryness observed.

4.2.1.6 Case of 05/11/1990, in the sky of France

GEIPAN is conducting an investigation⁷ following numerous sighting reports in the early evening (between 6:45 p.m. and 7:15 p.m.) on November 5, 1990 of light traces in the sky over France seen from the ground and by pilots. These observations correspond for the most part to a reentry of the third stage of a Proton rocket crossing the sky from the SW to the NE (see Figure 4.2.1.6.1 and Figure 4.2.1.6.2). However, other very different observations are also noted in France (see Figure 4.2.1.6.3) and in Europe.

At the same time, a report of the sighting of PAN (from the British MoD archives) was made over the English Channel by a British Tornado pilot at around 6:00 p.m. (local time). He observed a luminous object in the shape of an airplane "5 to 6 white lights and one bluish" while in flight under Dutch NATO control (MC6 zone). This case of 05/11/1990 is described in paragraph 4.2.2 relating to the British cases where SIGMA2 also found a certain resemblance between the French case of 05/11/1990 and that of 03/31/1993 of Shrewsbury, occurred in Great Britain and reported in the archives of the British MoD. This case also relates a satellite re-entry in a specific time slot, as well as a strange low-altitude overflight that lasts several hours with heavy air traffic suggesting simultaneous aerial searches. In France, although witnesses in good faith have observed strange aerial phenomena reported to the gendarmerie, these have never been confirmed or denied by the French authorities, or have been the subject of

⁶ Note technique GEIPAN_17_pdf du 21/03/1983

⁷ Rapport GEIPAN RENTREE_ATMOSPHERIQUE_5_NOVEMBRE_1990_T-M_PV_T_S_A_1990307203-351-90-R



aerial research, such as this was the case in the United Kingdom in 1993. The absence of more precise data on the observations made in France does not, however, allow a serious study to be started, beyond the confirmation of the re-entry, which is indisputable.

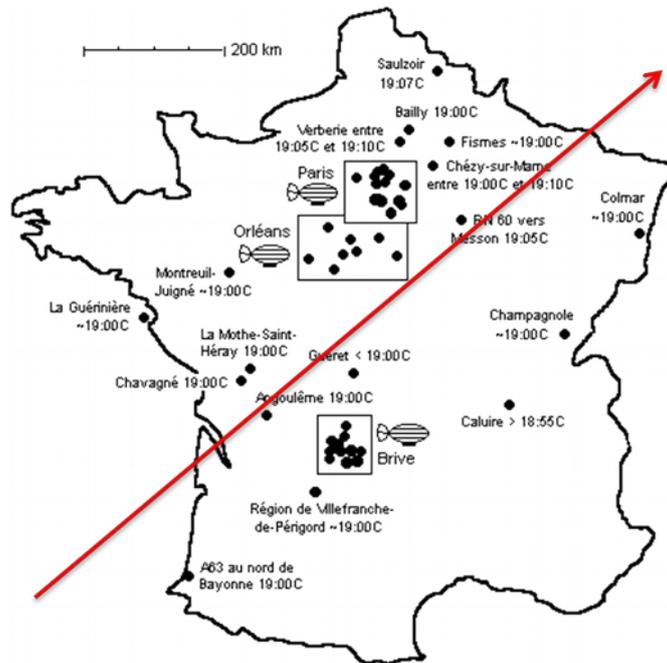


Figure 4.2.1.6.1 - Case of November 5, 1990.
An observation of the reentry of the third stage of a Proton rocket

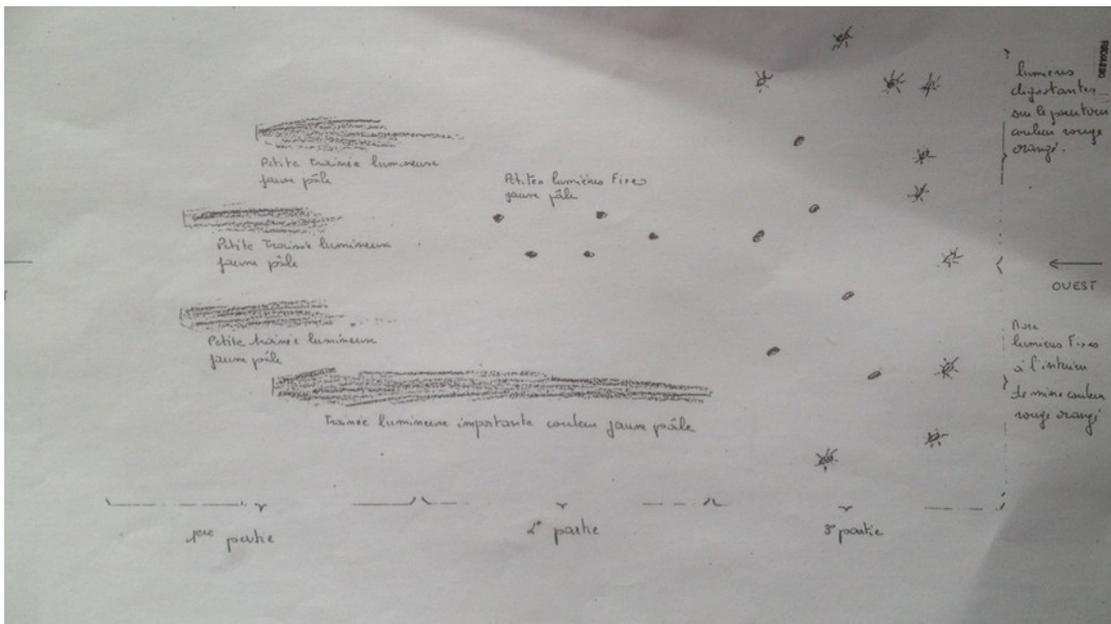


Figure 4.2.1.6.2 - Drawing made by a military pilot who renders his observation in flight

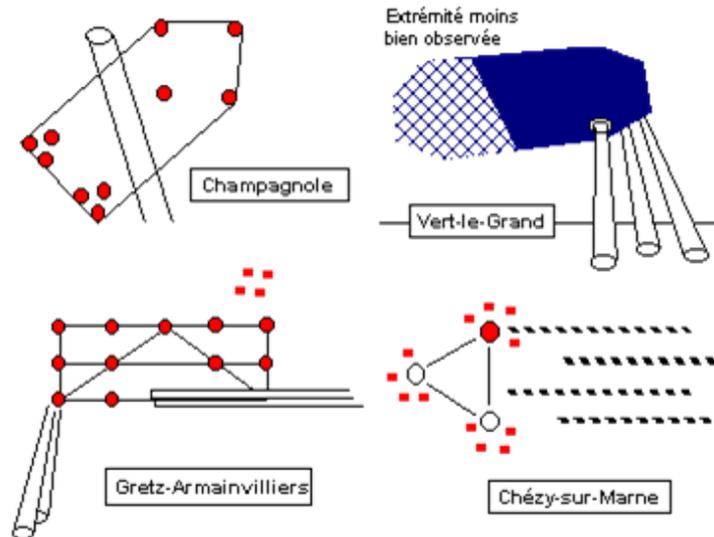


Figure 4.2.1.6.3 - Other apparently very different sightings were made in different areas during the same evening, but no recordings or physical traces could be found for further investigation.

4.2.1.7 Case of 08/01/1994, case of flight AF 3532 near Melun

According to the GEIPAN report⁸, the crew of flight AF 3532 Nice-London (see Figure 4.2.1.7.1 and Figure 4.2.1.7.2) observed in the Paris region, for nearly two minutes, a dark brown disc of very large dimensions (see Figure 4.2.1.7.3), which deforms by becoming blurred at the edges, to take the shape of an arrow, then to disappear. An unidentified radar trace, in the right sector of the aircraft but simultaneous (see Figure 4.2.1.7.4), was recorded by the air defense (Cinq-Mars-la-Pile control center). No explanation was found as the balloon hypothesis was rejected. The possibility of an unknown optical phenomenon or an artificial device remains open.

⁸ Rapport GEIPAN AERO_AF_3532_001_28.01.1994_E-Csep_Cl_CR_T_D_C_S_A_compte_rendu_enquete-R.pdf

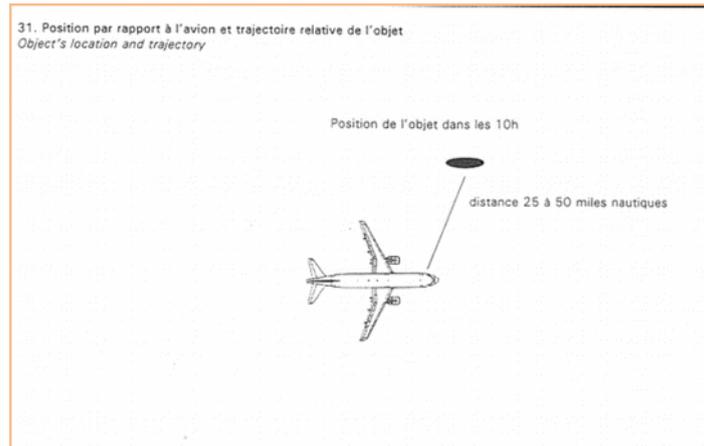


Figure 4.2.1.7.1 - Case of flight AF 3532 visually observing a UAP in the left sector of the aircraft

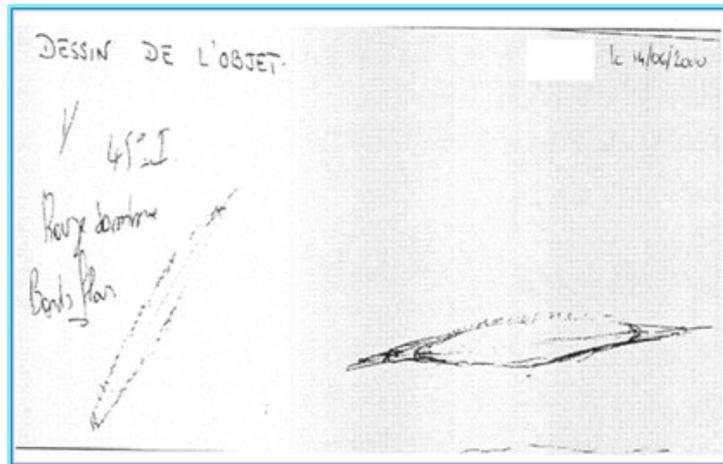


Figure 4.2.1.7.2 - Reproduction of the observation made by the CDT on Edge of a dark red disc, the edges of which become blurred, which deforms, lengthens and then disappears.

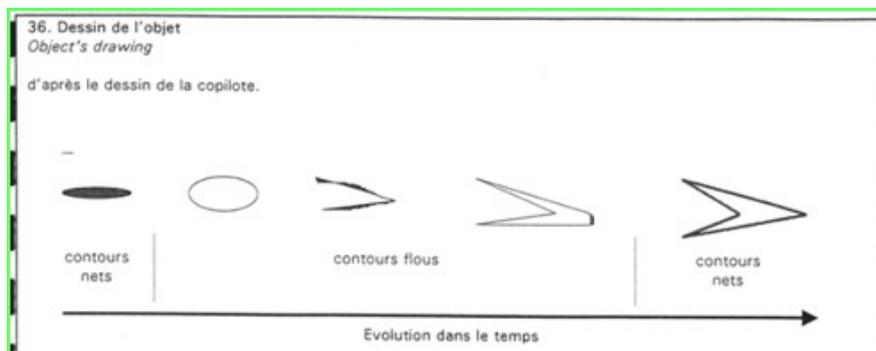


Figure 4.2.1.7.3 - Restitution of the observation by the co-pilot who also observes an object which takes the shape of an arrow and then disappears.

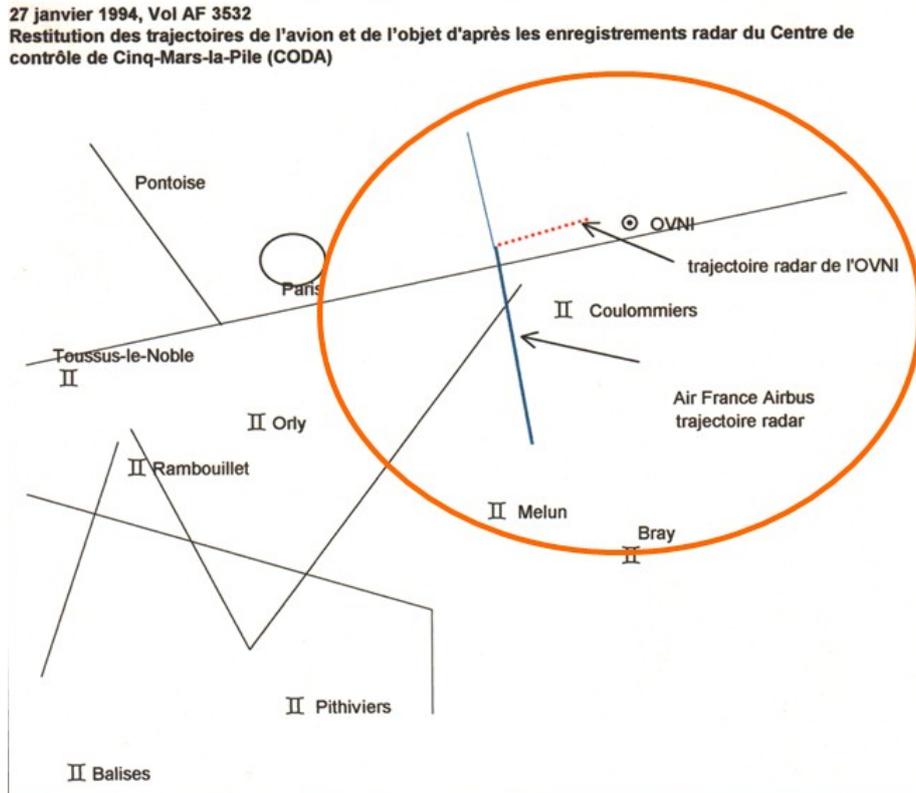


Figure 4.2.1.7.4- Return of the trajectory of flight AF 3532, the position of the visual observation in the left sector, and the radar track provided by the air defense center in the right sector and in approach.

4.2.1.8 24/10/2010: Golfech nuclear power plant

According to the GEIPAN report⁹ and other testimonies, a slow triangular object (Figure 4.2.1.8.1 and 4.2.8.2) silently flies over the plant with three white lights and a central red light. He turns and moves while accelerating. He is said to have been filmed by one of the guards (Figure 4.13). The GEIPAN concluded at the time that a plane passed because of the proximity of Agen airport and its interpretation of the video¹⁰ (four light points are identified, and not just three, which make one think of an airplane). A complementary study¹¹ dating from November 29, 2011 is being carried out for GEIPAN from an image analysis by Dr F. Louange using the IPACO software. She concludes that there is no central red light, that the white lights are fixed and not in motion, and that they could be simple street lights, the observed object being too inconspicuous to be recorded by the camera. Information from the gendarmerie (military police) and the Air Force does not link to an identified flight plan, nor the overflight of the plant by a low-altitude aircraft. The case remains classified B (probable aircraft).

The comparison of the characteristics should allow us to share this conclusion or to

9 Other documents http://fr.scribd.com/doc/70800322/enquc3aate-golfech-et-Rapport-GEIPAN-GOLFECH_82_06.10.2010_E-Cgei_CR_T_P_S_compte_rendu

10 Cas GEIPAN GOLFECH_82_06.10.2010_T2-Cgei_Cm_V_O_T2video_V061010_20.17.3gp

11 Rapport complémentaire du GEIPAN, du 29/11/2011 GOLFECH_82_06.10.2010_E-Cgei_Cm_CR_T_S_complement_enquete.pdf

identify an object whose type remains to be determined (a drone, for example).

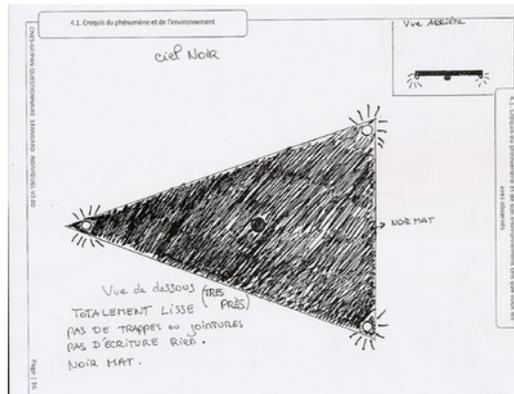


Figure 4.2.1.8.1- Golfch power station 24/10/2010 - restitution of the triangular shape of the object observed and filmed by the two guards

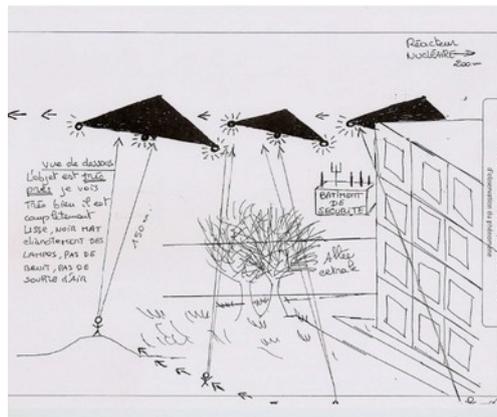


Figure 4.2.1.8.2- Golfch power station 24/10/2010 - restitution of the movement of the object by the guards who observed the phenomenon



Figure 4.2.1.8.3- Golfch case, photo taken from the video taken by the second witness with a smart phone

4.2.1.9 Other previous cases

Other cases prior to the creation of GEIPAN exist in the archives of the Defense but have

not been exploited until now such as cases which occurred in the North of France in 1973 and 1975 with photos of elliptical light shapes flying (see Figure 4.14 and Figure 4.15) or semi-spherical traces left in the ground (see Figure 4.16 and Figure 4.17) by a cigar-shaped object seen by a farmer who immediately notified the police.



Figure 4.2.1.9.1 - 1975, North of France. Two photographs showing two red-orange metallic objects static for 20 to 30 seconds.



Figure 4.2.1.9.2 - The two objects then fly away following an S-shaped trajectory.

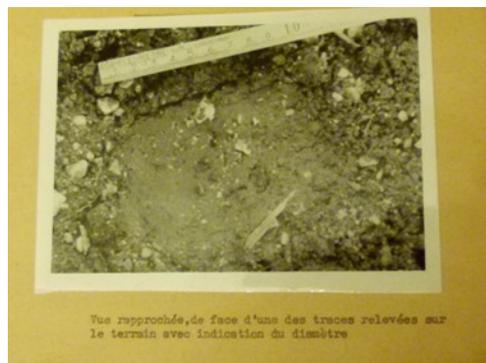


Figure 4.2.1.9.3 - In December 1973, in the North of France a flying object landed near a road according to a witness.

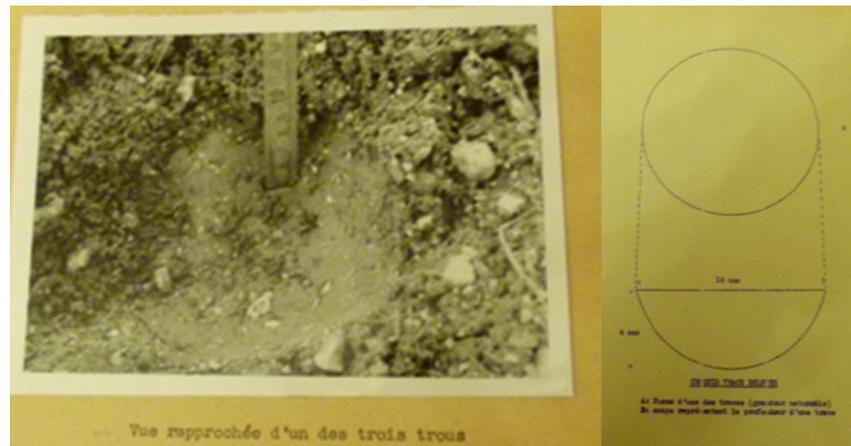


Figure 4.2.1.9.4- Three semi-spherical prints in the frozen ground were identified by the Gendarmerie, measuring 10 cm in diameter by 4 cm in depth.

4.2.1.10 Case of 1952: Lake Chauvet

The case of **Lake Chauvet** (see Figures 4.2.1.10.1 to 4.2.1.10.4) dates from 1952. A man observes a disc near Lake Chauvet and takes several photos. Reproductions of the published photos¹² are available but the negatives have been lost.

At the instigation of the Commission, the IPACO team (enlarged for the occasion) carried out in 2016 a large-scale investigation and analysis on the famous “cult” case of the 4 photographs of Lake Chauvet (1952), objects for a long time. numerous controversies between investigators (reconstruction of the previous case, see Figures 4.2.1.10.5 to 4.2.10.16).

This work, carried out with period equipment, was the subject of a long on-site reconstruction mission, using technical data on the vegetation and relatively complex calculations. It resulted in a definitive, fairly precise and well-supported explanation.

The conclusion of the report, available on the link below, demonstrates unambiguously that the photo taken is a montage. The photographed disc is actually a clay pigeon.

The complete analysis file (133 pages) can be viewed and downloaded at the following address:

www.ipaco.fr/RapportLacChauvet.pdf

Some illustrations of the case of Lake Chauvet:

12 Journal Le Méridional du 25/07/1952 (<http://uto.sigsno.org/ufologie.net/htm/sepraint1f.htm>)

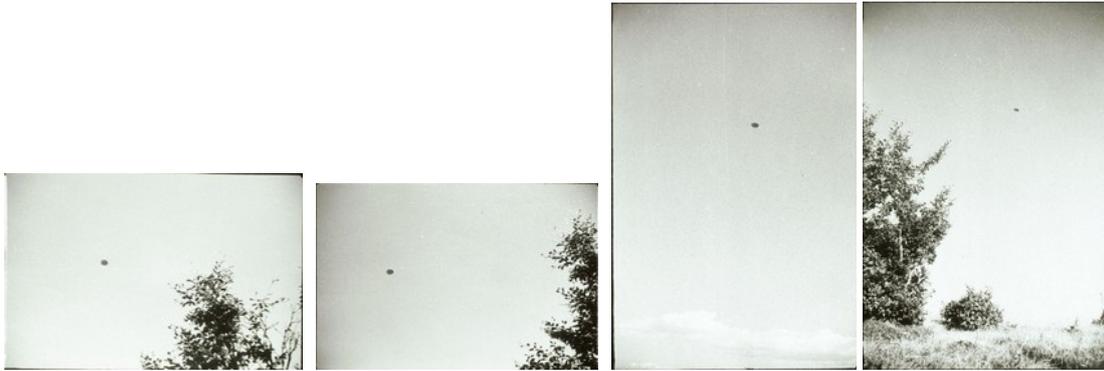
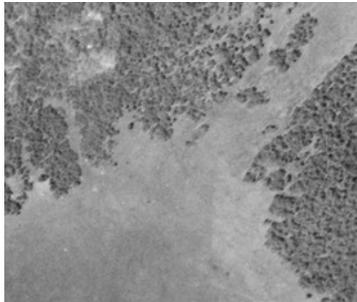
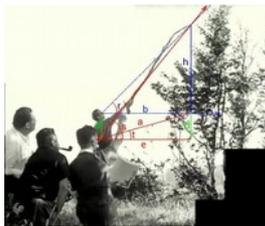


Photo 4.2.1.10.1

Photo 4.2.1.10.2

Photo 4.2.1.10.3

Photo 4.2.1.10.4



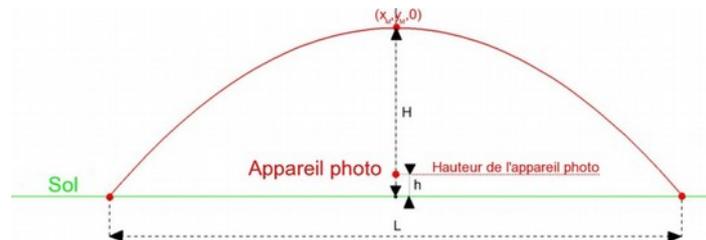
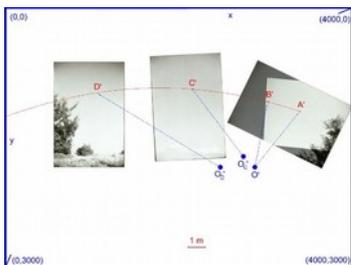
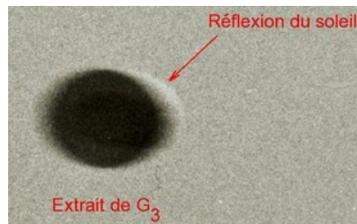
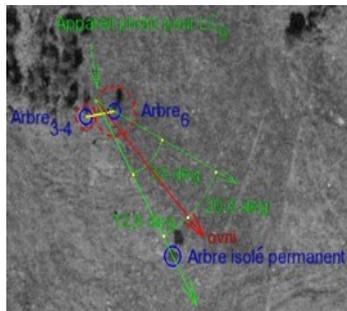
1955



1968



2009



Figures 4.2.1.10.5 à 4.2.1.10.16 - Reconstruction of the trajectory

4.2.2 UK case

We are starting a study on the observables observed in the British cases to compare them with French cases, based on the archives and report of the British MoD (see § 3.7).

4.2.2.1 Case Lakenheath

This case is one of the most astonishing known, referenced by the US Condon Commission as a totally unexplained PAN case, which was the subject of an IAIA article in 1971¹³, recorded and indexed in the CIA archives –RDP81R00560R000100010010 -0 authorized for publication in 2001 (see Annex A 4.2.2.1.1). It represents one of the most significant radar-visual cases in the history of ufology. Considering the high credibility of the information, the cohesion and the continuity of the accounts combined with a high degree of strangeness, this is certainly one of the most disturbing cases of all UFO incidents known today.

The Lakenheath-Bentwaters case arose on the night of August 13-14, 1956 at 9:30 p.m., in the south-east of England, between the UK NATO bases of Lakenheath and Bentwaters. It is characterized by highly redundant observations by USAF and RAF personnel (see Annex A 4.2.2.1.2) for more than 5 hours, of unidentified objects (ERN: Unidentified Radar Echoes) maneuvering at high speed, at night, near the two RAF bases:

- two observations with ground radars and visual observations on the ground and in flight (C47);
- two observations by ground radars, one observation by on-board radar and one visual observation in flight (Venom).



Figure 4.2.2.1.1 a (Venom plane) - b and c (radar station) - d (radar console - drawing showing the UFO pursuit maneuver of the Venom)

13 UFO Encounter II sample case selected by the UFO subgroup of the AIAA- G.D. Thayer (National Oceanic and Atmospheric Administration), *Astronautics & Aeronautics*, September 1971, pp.60-64
<http://rr0.org/time/1/9/7/1/09/ThayerAiaaLakenheath/index.html>

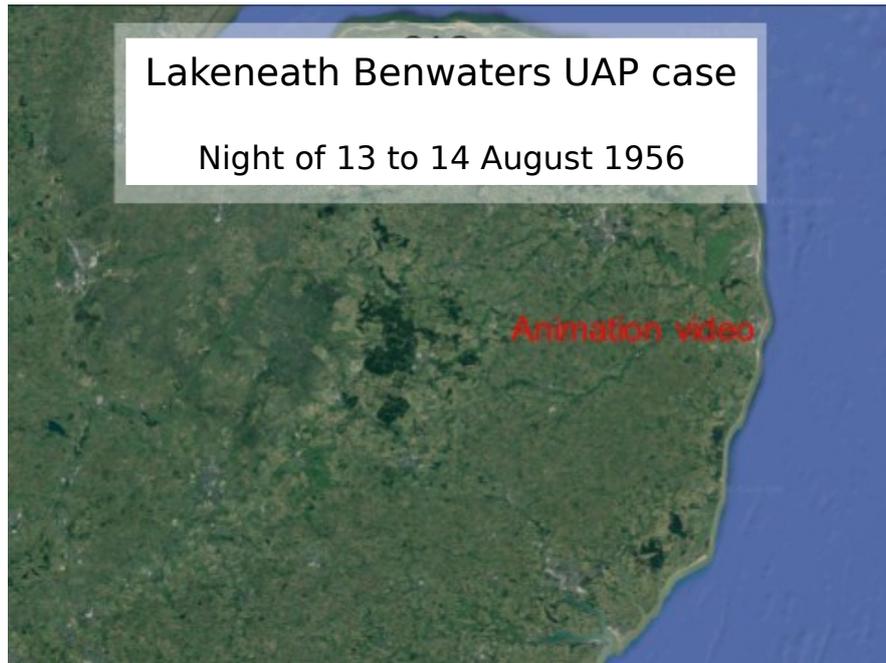


Figure 4.2.2.1.2 : vue de l'animation restituant la suite d'évènements à Lakenheath

1st episode in Lakenheath, from 9:30 p.m. Z

ERN N ° 1 at 9:30 p.m.Z:

An ERN (echo) the size of a normal aircraft appears on the Bentwaters radar screen at 25-30 miles E SE, in straight motion at 295 degrees, and disappears about 15 to 20 miles W NW. The radar operator estimates the speed of the object at 4000 mph which the investigator estimates to be greater than Mach 3. The transit time of 30 seconds and the distance traveled of 40-50 miles would rather give an estimate of 5000-6000 mph. On the other hand, the difference of 5-6 miles traveled by the object between two radar sweeps (2 second intervals) would rather give a speed of 9000-10800 mph. Despite the uncertainties about the speeds (not noted by the Condon report), speeds of several thousand mph are much higher than those of conventional planes and cannot be confused with those much higher than meteorites.

ERN N ° 2 from 9:35 p.m. Z to 9:55 p.m. Z:

From 12 to 15 apparently normal returns appear about 8 miles SW of Bentwaters, flying in a NE group at 80-125 mph, preceded by a triangular formation of three returns, the whole occupying an area of 6-7 miles, tapering off sharply in intensity 14 miles NE of Bentwaters. 40 miles NE of Bentwaters, the returns then merge into a single return the size of several B-36 returns. The return remains stationary for 10-15 minutes, then moves NE for 5-6 minutes, stops again 3-5 minutes and then finally exits the radar viewing range (50 miles) at 9:55 Z. The returns group speed estimated at 290-700 mph is again different from that estimated by the operator.

ERN N ° 3 - 10 p.m. Z:



Another return is observed about 30 miles east of Bentwaters and tracked 25 miles west of the station for 16 seconds. The operator's estimated speed is over 4000 mph, while the tracking time (16 seconds) and the distance traveled of around 55 miles would suggest a speed of around 16,000 mph!

ERN N ° 4 - 10:55 p.m. Z (2 visual observations and one radar observation)

According to the Condon report, Bentwaters radar observed at 10:55 Z an return 30 miles east of Bentwaters going west at 2000-4000 mph and passing almost over the base, then disappearing from the screen at 30 miles W. It was this last return that prompted a phone call from Bentwaters base to Lakenheath base for confirmation.

Bentwaters call, reports a visual ground observation of the passage at 4000 feet altitude, at fantastic speed, in brilliant light.

This visual observation from the control tower is confirmed by the pilot of a C-47 flying at 4000 feet, who saw the light pass from east to west under his plane.

Second episod in Lakenheath, from 00:10 Z to 3:30 Z

After Bentwaters called in, Lakenheath's supervisor ordered his controllers to scan radar screens equipped with the MTI (Moving Target Indicator) system to eliminate ground effect returns.

Visual observations on the ground:

- At indefinite times, USAF ground observers at RAF base Lakenheath saw a luminous object heading south-west stop then move east, two lights merging into one . These luminous objects move at high speed with stops and starts as well as sudden changes of direction, without transition.
- These visual observations are broadly consistent with the radar observations. The Lakenheath investigating officer reports that the two Lakenheath radars (GCA and RATCC) and ground observers made concurring observations regarding, in particular, the object's sudden starts and stops.

ERN N ° 5

One of the RATCC controllers noticed a stationary return 20-25 miles SW of Lakenheath, on the path of returns # 3 and 4. Despite the use of the MTI, no movement of the return was observed (which is unusual). if the target flies less than 40-50 knots). The supervisor calls the Lakenheath GCA who confirms the position of the stationary echo on his screen.

Then the return moves sharply in an N NE direction at an estimated speed of 400-600 mph, with no transition from rest.

From that moment, the supervisor alerted the USAF and, through them, the "RAF Fighter Command", responsible for the air defense of the United Kingdom.

The return then makes several changes of direction still in a straight line at 600 mph,



still without apparent acceleration or deceleration, over distances of 8 to 20 miles with stationary episodes of 3-6 minutes. This account, which agrees point by point with the detailed 1956 account of Project Bluebook, reinforces the strangeness of the behavior of this ERN, so far from any meteorological, astronomical or electronic explanation. Observation of these "stop and go" movements was carried out for 10 minutes before triggering the dispatch of interceptor planes to investigate.

ERN N ° 6 (one observation by ground radar, one observation by on-board radar, one visual observation by a pilot)

Coming from Waterbeach according to Project Bluebook and from London according to the supervisor, the interceptor plane, a Venom flying over Lakenheath is directed towards a target located 6 miles east according to Project Bluebook and 16 miles southwest of Lakenheath according to the supervisor (ERN N ° 5).

The pilot announces that he sees a bright white light and that he will do some research. 13 miles west of Lakenheath, he announced that he had lost track of the target on his on-board radar and the visual light.

McDonald¹⁴ wonders if the ground radar also lost track of the target simultaneously with the on-board radar and the visual observer. This is a question the Condon report fails to answer.

According to RATCC radar, the interceptor was aimed at a stationary target (presumably ERN # 5) located 16 miles SW of Lakenheath at an altitude of 15,000-20,000 feet. Half a mile from the target, the pilot announces over the radio that he has his guns "locked" on it, so on something solid. He would later tell a US Air Force investigator that the target's returns was the clearest he had ever seen on radar. From this point on, the reports of the Bluebook project and the supervisor are in agreement on almost all points.

Moments later, the pilot again lost his target. RATCC informs him that the object made a rapid circular motion to get behind him. The pilot, who has probably seen his target (there is no tail radar), confirms that the object is behind him and that he will try to escape it. But its maneuvers are ineffective and require assistance. The RATCC still sees a distinct return behind it (implying that the aircraft and object were at least 500 feet apart).

10 minutes later, unable to get rid of his target, the pilot announced that, running out of fuel, he was returning to base and asked the RATCC if the object was still following him on the screen.

According to the supervisor, the object followed the Venom only a short distance: at the SSW in London (or Waterbeach) it hovers (a fact which McDonald says does not appear in the Condon report).

A second Venom is then dispatched to the object's position but must return to base due

14 Lakenheath and Bentwaters RAF/USAF Radar/Visual Case, 1956, Dr. James E. McDonald, "Twenty-Two Years of Inadequate UFO Investigations", AAAS Symposium, 1969 (17 pages) <http://ufoevidence.org/documents/doc632.htm>



to engine trouble.

According to the supervisor, the object made a few brief movements and then exited north of the radar screen at 50-60 miles, at 600 mph (which is normal for an object below 5000 feet above sea level) .

ERN N ° 6, which is also the subject of a remarkable redundancy of radar and visual contacts:

- detection by two ground radars (GCA and RATCC) of Lakenheath;
- detection by an on-board radar of the De Havilland Venom aircraft, an interceptor dispatched to the scene and chased by the UFO;
- visual observation by the pilot of the interceptor aircraft.

4.2.2.2 The case of Rendelsham Benwaters

This case occurred on the night of December 27-28, 1980, then on the night of December 28-29, 1980, in Rendelsham Forest in the UK outside the RAF and US base. Woodbridge Air Force (Suffolk, UK).

It is related in an article by Patrick Gross¹⁵, an extract of which is cited below.

"After these events in the sky, military personnel from the Woodbridge base undertook a patrol to determine the cause of a strange light seen in the nearby forest. They said that the air seemed charged with electricity, and they saw an object they described triangular in shape of 2m50 in base and 1m80 in height. The object emitted a brilliant white light. There was a report mentioning that the top of the object carried a red light and the base was surrounded by a row of blue lights, which seemed to indicate that the object was posed on feet above the ground.

As the soldiers approached nearly a meter away, the craft began to maneuver between the trees, moving away from them. He passed a nearby farm where the cattle panicked, then sped through the air at an extraordinary speed. The investigation carried out the next day made it possible to find traces of feet in the ground at the place where the machine had landed. Measurements of the radioactivity gave positive results.

The craft was briefly sighted again an hour later, and the following evening was rich in sightings of aerial ballets of strange flying objects. "

This event and the investigation which followed are detailed in the British archives of the British MoD Department in document defe-24-1948¹⁶ (see Annex A 4.2.2.2), some extracts of which are reproduced below concerning the radiological traces found on site. It has also been featured in several books including "Encounter in Rendlesham Forest" by Nike Pope - the former coordinator of the Sec Bureau (AS) 2a on British UAP

¹⁵ <http://ufologie.patrickgross.org/htm/rendlesf.htm>

¹⁶ <http://documents.theblackvault.com/documents/ufos/UK/defe-24-1948.pdf>



- and "You can't tell the people" by Georgina Bruni.

An important aspect of this case concerns the traces of radioactivity that were found on the site during the investigation (see Figure 4.2.2.2.1). They are measured in Roentgen¹⁷ which makes it possible to characterize the radiation dose rates (in reality in mR per unit of time, therefore in mR / h which is reported in the official document DEFE-24-1948.

DI55a Attn Section 40

Unexplained Lights

Reference: DI55/106/15/1

1. Like DI55, DI52 do not know of any serious explanation for the phenomena described at reference.
2. Background radioactivity varies considerably due to a number of factors. The value of 0.1 milliroentgens (mr), I assume that this is per hour, seems significantly higher than the average background of about 0.015 mr. I would not expect the variation in this to be much more than a factor of two, although it might be greater for specific reasons.
3. If you wish to pursue this further I could make enquiries as to natural background levels in the area. The way the US report is written, however, suggests that 0.1 mr was greater than they expected.

Figure 4.2.2.2.1 : extract from the British archives file Defe-24-1948

This official document indicates 0.1 mR / h of radioactivity while that of the average soil corresponds to 0.015 mR / h, or 7 times less. Natural soil radioactivity is linked to the presence of radon (alpha emitter), uranium 238 (alpha emitter), thorium 232 (alpha emitter) and potassium 40 (beta emitter). The measuring instrument (geiger counter) used by the military concerns ionizing X and gamma radiation, and not natural emissions (alpha and beta). It is therefore not natural radioactivity.

It would have been useful to take measurements at regular time intervals to see if the radioactive anomaly was attenuating over time. It should be noted that the Base Commander, Lt Cl Charles I. Halt wrote a detailed report about this event. Some witnesses who approached the UAP reportedly suffered from the radiation effects afterwards. This was the case with John Burroughs who was compensated for finding a heart failure, abnormal according to medical experts, apparently resulting from the exposure.

4.2.2.3 Evening of 05/11/1990 (simultaneous British observations with the French case)

A PAN sighting (reported in correspondence with British pilots archived in MOD UK files¹⁸ - see appendix A 4.2.2.3.1 and A 4.2.2.3.2) was made over the Channel at around 6:00 p.m. (local time)) in particular by several British pilots of Tornado returning from

¹⁷ Roentgen is the unit used to measure the level of exposure to ionizing radiation like X and Gamma rays. 1 Roentgen is equivalent to the emission of $2,1 \times 10^9$ pairs of ions per 1 cm³ of air. It has to be associated to a duration for equivalent to a dose integrated along time.

¹⁸ <http://documents.theblackvault.com/documents/ufos/UK/defe-24-2041-1-1.pdf> pages 9 à 13

a mission in Great Britain towards the base of Laarbruch This one observed a luminous object in the shape of an airplane "4 to 6 white lights and one bluish at the rear of intensity variable "(see Figure 4.2.2.3.1). The object came to rest 440 yards in front of its plane flying at Mach 0.8 at an altitude of 27,000 feet, then accelerated and disappeared, while in flight under Dutch NATO control (area MC6). The object is not visible to NATO radar. The pilot said the object, the size of a C130, was unlike anything known, and could not be mistaken for a reentry of a Russian rocket or satellite.

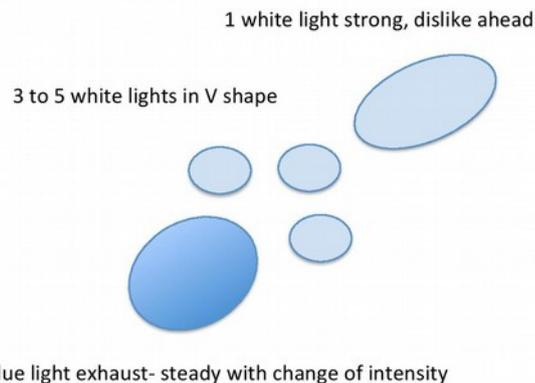


Figure 4.2.2.3.1 : diagram representing the lights perceived by British pilots

This observation made in a wider time slot therefore does not correspond to the observation of the start of the reentry phenomena. According to the pilot's words, it was also made by two other Tornados, themselves in the same area flying in the opposite direction from the Laarbruch base towards Great Britain. This "UAP" report will be made directly to MoD UK by the British pilot and seems to have also been reported to Dutch control.

4.2.2.4 Night of March 31, 1993 in Shrewsbury

The United Kingdom was flown over by a rocket reentry around 1 am following a North-West South-East axis but also by other aerial events also observed from different parts of the United Kingdom, all reported in the RAF reports¹⁹. The series of observations between 1 a.m. and 2 a.m. agree with the hypothesis of a re-entry. On the other hand, observations are reported by civilian and police personnel, between 7 p.m. and 1 a.m. of a large object (size of a 747), triangular, moving at low altitude and at slow speed, silent or emitting ultrasound, herds of animals exhibiting marked stressful behavior. Inconclusive radar traces are noted while observers describe intense air traffic at low altitude (helicopters and Tornado fighter planes). The investigation by the RAF Office is unsuccessful. The Air Secretary will question the US Embassy on the possible overflight of the United Kingdom by a stealth aircraft "Aurora" (hypothesis denied by the American authorities) which however corroborates the reality of the observations of the air traffic at low altitude. This case is considered one of the most astonishing in the British archives.

¹⁹ <http://documents.theblackvault.com/documents/ufos/UK/defe-24-2086.pdf>



4.2.2.5 04/23/2007 Channel Island UAP Jersey

This case does not come from the British archives. It was initially based on an investigation carried out by specialist journalists and experts on the basis of testimonies reported by pilots and primary and secondary radar recordings from Jersey and Guernsey air traffic control. The serious analysis resulted in a report "Channel Islands UAP" of April 23, 2007 by David Clark. The work carried out included an analysis of the primary radar data for which the French services of CNES and the Air Force had been requested. The French radars did not record anything a priori, while the Jersey area was not within the remit of SEPR, which was unable to intervene in the analysis process.

The interest of the SIGMA2 Commission was attracted by the concomitance of two visual and concordant observations of two cigar-shaped UAP (tapered, shiny, yellow with a black area) of large dimensions (Figure 4.2.2.5.1 and 4.2.2.5.2), from two airplanes following two different directions. Simultaneously, audio recordings relate the exchanges between one of the pilots and the ground control, as well as primary radar recordings showing two large radar returns (see Figure 4.2.2.5.3 to Figure 4.2.2.5.4). These recordings from the ATC Elvira control of Jersey were kindly provided to us by Mr. Rob Jeffs and are currently being analyzed. Contact could be established by SIGMA2 with the pilot as well as with the Jersey air traffic controller.

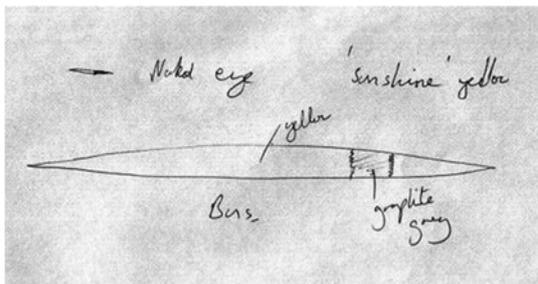


Figure 4.2.2.5.1 - Drawing of one of two cigar-shaped PANs rendered by pilot Paul Bowyer after sighting through binoculars. Estimated size: several hundred meters.

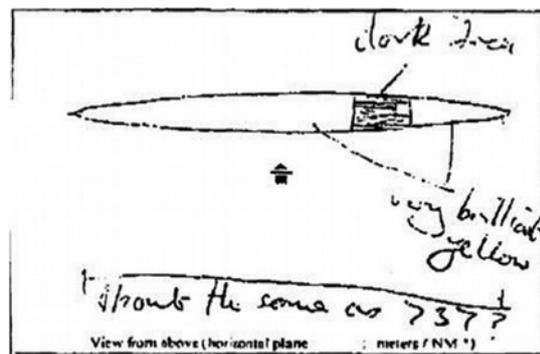


Figure 4.2.2.5.2 - Transcription by chief controller Paul Kelly of the description of the pilot during the radio exchanges

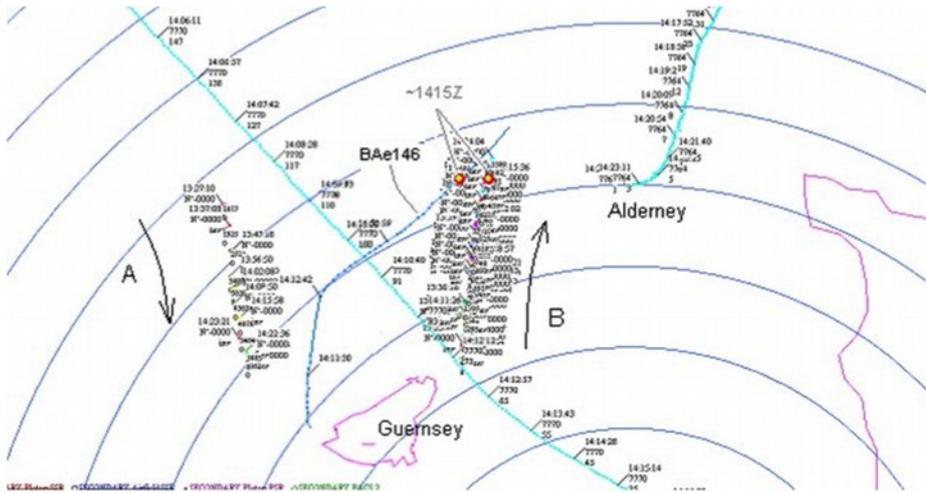


Figure 4.2.2.5.3 - Restoration of tracks and radar tracks including two slow tracks that can be linked to the observation of NAPS

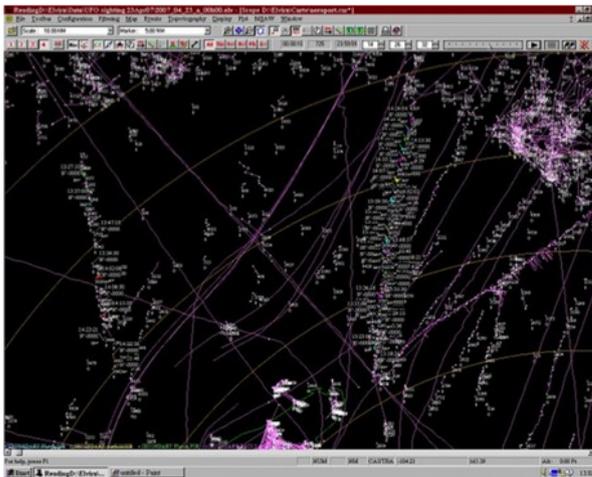


Figure 4.2.2.5.4: enlargement of the Elvira 2 radar situation (one of the two primary radars in Jersey) with the two large radar returns which could be the radar echoes of the PANs (study to be carried out)

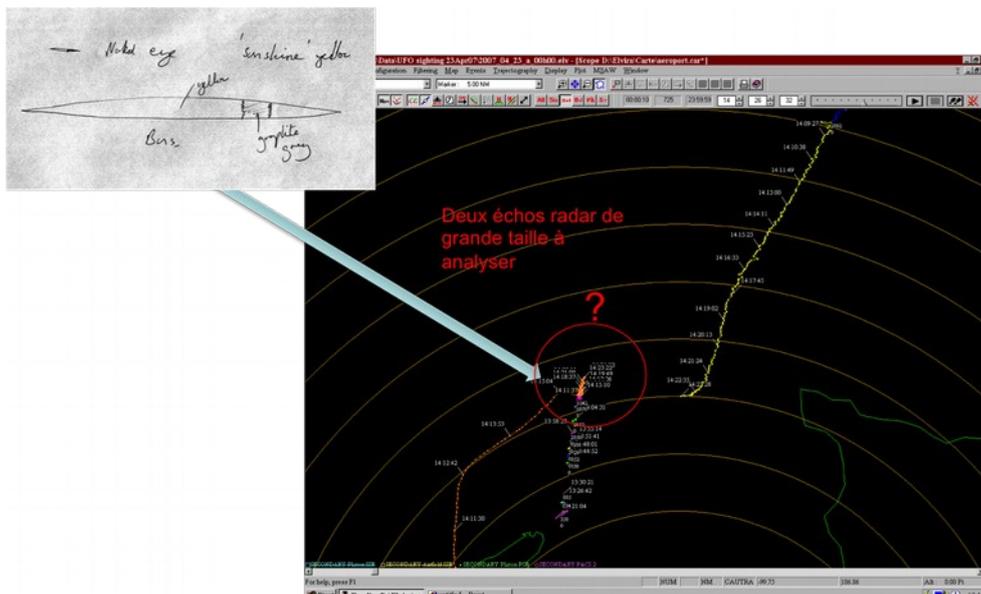


Figure 4.2.2.5.5- Enlargement of the Elvira 2 radar situation (one of the two Jersey primary radars) with the two large radar returns which could be the radar echoes of the UAP (study to be carried out)



4.2.3 US case: analysis of the Nimitz case (2004)

This paragraph is dedicated to recent American sightings, i.e. the Nimitz sighting from 2004.

However, older American cases are very numerous and have been archived in several waves since the 1940s, notably in the US Air Force's Blue Book Project file, deemed closed since 1969, but accessible via the Archives US Nationals (Fold3). Some old cases have caught our attention by their visual, electromagnetic characteristics or by the presence of particular aerodynamic or gravitational effects.

They are the subject of several Blue Book Project reports which describe overflights of American bases (Minot AFB, Malmstrom AFB,...) and encounters with military flights, by flashing light phenomena, unknown. Some cases studied have radar recordings, electromagnetic signals emitted at certain frequencies, and even interference with installations. These cases were described using the forms derived from the JANAP 146 instructions and Air Force Regulations in force in the USA at the time (1950s and 1960s) and equivalent procedures in Canada derived from the same JANAP instructions.

These old cases will be discussed in a paragraph entirely dedicated to the study of Electromagnetic Effects cases in § 4.2.5 where they will be compared to other similar cases reported in the British, Iranian, Russian and Ukrainian cases.

Before discussing the Nimitz case, we can cite three cases in the more recent period:

- **Mansfield - Ohio: 10/18/1973:** Near Mansfield in Ohio (USA), a US Army helicopter crosses a luminous metallic gray object in the shape of a cigar which approaches very quickly by emitting a greenish fluorescent light according to the CUFOS report²⁰. The observation is made simultaneously by the crew and people on the ground. The helicopter engaged in a rapid descent avoidance maneuver. While his controls are still in a rapid descent, the unknown phenomenon accompanies him by staying nearby and then rises, causing the helicopter which appears to be carried away in an upward motion. **The hypotheses of an upward aerodynamic flow or of a very possible neutralization of the gravity field have been mentioned.**
- **Chicago O'Hare Airport - 11/07/2006:** A circular object is observed by United Airlines personnel above Chicago O'Hare Airport (USA). It is animated by a rapid upward movement and leaves a circular imprint in the cloud layer known as the "Hole in Cloud" effect. This phenomenon is also studied by NARCAP in its report²¹.

²⁰ <http://www.ufoevidence.org/cases/case104.htm>

²¹ NARCAP report on « UAP and its safety implications at O'Hare international airport on November 7, 2006 ». (www.narcap.org.)

- **Case of Aguadilla Airport in Puerto Rico -2013:** Infrared and radar records were also submitted to us more recently by SCU. This case is analyzed in detail in § 4.2.4.

We focus below on the Nimitz case, one of the most recent and surprising.

4.2.3.1 Analysis and questions on the whole Nimitz case - Storyboard

Our analysis remains limited to the use of information present in the report of the SCU entitled (Scientific Coalition for Ufology) entitled “A Forensic Analysis of Navy Carrier Strike Group Eleven's Encounter with an Anomalous Aerial Vehicle” which was sent to us for opinion by the SCU and Robert Powell. We tried to reconstruct the course of events in the form of a storyboard without having technical and contextual data that would make it possible to restore the observations, visual, infrared and radar and cross-check them. This work is therefore on hold pending a report that the US Navy may wish to release at a later date. The illustrative boards associated with the storyboard were submitted to SCU who found no contradictions.

At the same time, we carried out an analysis of the IR videos (see § 4.2.3.2).

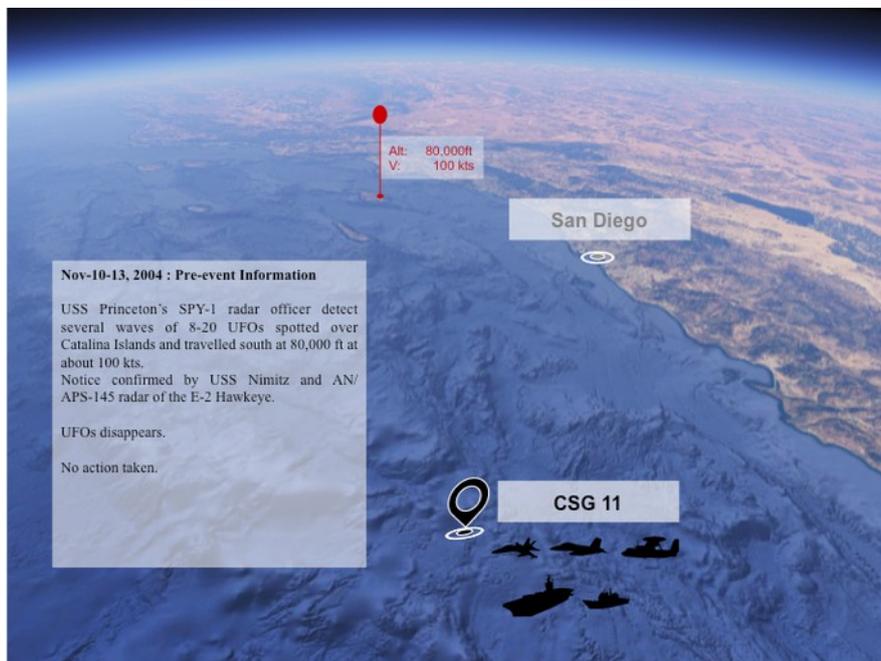


Figure 4.2.3.1.1 : UAP sighting in the days leading up to the November 14, 2004 exercise

The facts - For several days (November 10 to 13) waves of 8 to 20 UAP were observed on the SPY-1 radar of the USS “Princeton”, certainly, but also on the radars of the USS “Nimitz” and the “Hawkeye” E2.

Precisions - The UAP appear over the Catalina Islands, have a North-South trajectory at $V = 100$ kts and $Z = 80,000$ ft +. They sometimes instantly descend to 20,000 ft or 50 ft.



Comments - We are not talking about NORAD and land-based aerospace defense radars: have they detected something? In the end, no one is moved by these phenomena which appear regularly. Why ? What does 80,000 ft + mean? Does this mean that the radar (which one, SPY-1?) Is detecting above 80,000 ft but not able to pinpoint? What meaning should be given to “landings” at 20,000 ft and 28,000 ft? Are the UAP arranged in a particular formation? Repetitive? Do they all have the same behavior? Simultaneous? Are there typical behaviors? Are there remarkable schedules? What are the circumstances of radar contact ends? 100 kts: to our knowledge, no "plane" is able to maintain this speed at 80,000 ft. How long does the observation last? What happens to the UAP at the end of the observation? Are the detections by the radars of the “Nimitz” and of the E-2 spontaneous? Straightforward?

November 14, 2004, late morning: radar observation of 14 UAP.

The Facts - 14 UAP are seen on USS "Princeton" SPY-1. Also seen by the “Nimitz”. The E2 only detects the closest, focusing the beam in the direction of the UAP.

Details - The UAP are frontal, distributed regularly over 100 NM, at 80,000 ft +. At one time (unspecified), all UAP descend to different altitudes (between 0 and 28,000 ft) in “less than a second”.

Comments - The text of the SCU says that the witness “considers” to see appear again ... Why this oratorical precaution? What is the detection quality of the “Nimitz” and E-2 radars? UAP are only considered as a risk of collision in the course of the exercise: astonishing. 14 UAP spread over 100 NM are in principle at a distance of 7 to 8 NM from each other: if we intercept one of them (in this case the closest), we are really not far others ; however, no testimony from a controller or pilot evokes this proximity, which should be of interest to the rest of the operations.

Around 2:00 p.m. LT: first interception by an F18

The Facts - The Princeton Commander decides to intercept the nearest UAP. The Princeton guides an F / A-18C already in flight (catapulted at 11:10 LT).

Details - The UAP is about 60 NM from Nimitz, South / South-West sector

Comments - The controller questioned the pilot: ammunition on board? Answer no. Exact schedule, exact positions not specified.

14:10 LT: the first interception is stopped

The Facts - The interception was stopped to be resumed by 2 F / A-18Fs approaching UAP.

Comments - The pilot of the F / A-18C has radar contact on the 2 F / A-18Fs, but not on the UAP. He says he observed on the calm and transparent sea, when the interception



was stopped, a disturbed circular area 50 to 100 m in diameter, having the appearance of “white water” similar to that which a shipwreck could create.

14:10 LT: second interception by 2 F / A-18F

The Facts - The 2 F / A-18Fs were catapulted at 13:32 LT as part of the overall exercise and are on their way to their holding point (CAP). The “Princeton” (missile cruiser) provides guidance for the interception.

Comments - The controller questions the leader: ammunition on board? Answer no. Interception orders given by the “Princeton”: heading 270 °, altitude 20,000 ft, distance 60 NM. The AP-173 on-board radars are set to the 20 NM scale. The “Princeton” observes that the 14 other UAP descend to sea level (or is it at the time of engagement?) Note: cf. Wikipedia, the F / A-18F still have at this date the same radar as the F / A-18C (AN / APG73 with conventional scanning antenna).

Between 14:10 and 14:40 LT: the crews of the F18s observe a disturbance on the surface of the sea.



Figure 4.2.3.1.2 – visualization of the maneuvers of the 2nd patrol of F18 with visual contact on the "tic tac" (14/11/2004)

The facts - The F / A-18Fs reach the point of interception (combined plots) without having had any radar contact on the UAP. The pilots carried out a visual search and observed an oval-shaped “frothy and bubbling” area on the sea surface that appeared smoother and clearer towards the center. The leader thinks the phenomenon could be caused by "an object the size of a Boeing 737 floating 10 or 15 feet below the surface of the ocean", the winger thinks of a submarine. However, no submarine presence will be detected, with the exception of a fleeting echo picked up by an operator of the "Princeton".



Comments - The F / A-18Fs did not have radar contact on the UAP and did not observe any interference (apparently, no other type of interference than so-called “noise” interference was considered). The testimonies of the pilots confirm that of the pilot of the F / A-18C.

Between 14:10 and 14:40 LT: the F18 crews observe a UAP in the shape of a "Tic-Tac"

The facts - Then, the members of the two crews saw an object “in the shape of a Tic-Tac” (half-spheres connected by a short cylinder), at an estimated height of 50 ft above the surface of the ship. sea, directly above or around the disturbed area.

Comments - The leader estimates the size of the Tic-Tac: same order of magnitude as that of his plane. The Tic-Tac is animated with very sudden erratic movements (“ping-pong ball”). These movements do not affect the condition of the water surface.

Between 14:10 and 14:40 LT: one of the F18 maneuvers around the UAP

The facts - The leader decides to take a closer look; he “engages” the Tic-Tac.

Details - The leader descends to an altitude between 12,000 ft and 16,000 ft. The PAN “reacts”: by climbing, by orienting one of its ends towards the F / A-18F, and by holding a position diametrically opposed to that of the airplane on the circular trajectory that this one describes. The PAN remained 2,500 / 3,000 ft below the F / A-18-F, at a distance of 1 NM.

14:40 LT: UAP escapes

The facts - When the leader dives towards the altitude of the UAP, the latter approaches 0.5 NM then suddenly escapes to the South, in a slight climb, with a very strong acceleration, estimated speed greater than Mach 3.

Comments - If the direction of flight from the UAP (South) is well estimated, it is not the one that leads to the CAP (South-East, see figure 4.2.3.1.2). Was the movement tracked by radar? The phenomenon below the surface has apparently disappeared. What was the behavior of the other UAP during these events?

15:04 LT: situation after the departure of the UAP

The Facts - The “Princeton” indicates that the UAP has taken a position on the patrol CAP. The patrol joined the “Nimitz”.

Details - The patrol's CAP is located 40 to 60 miles southeast of the engagement position. The other UAP ascended, “in less than a second”, to 28,000 ft or 80,000 ft and continued their course southward at 100 kts.



Comments - How much time elapsed between the departure of the UAP and the finding of its presence on the CAP? Is it the same UAP? At what altitude? What does the UAP do next? Has he dissociated himself from the other UAP and does he behave in his own right?

16:20 LT: a third interception is started

The Facts - Catapulted third cycle F / A-18F “Super Hornet” patrol with ATFLIR with intent to report video.

After 4:20 pm LT - Third interception (continued)

The Facts - Under the control of the “Hawkeye”, only one aircraft was directed to the CAP where the UAP was seen on radar at 14:40 LT.

Details - Heading South.

Comments - Nothing is said about the monitoring of the UAP on the radar since 14:40 LT; apparently contact was lost, otherwise the “Princeton” would have probably taken control of the interception. So we can assume “we’ll see” where we last saw the UAP, that is to say 2 hours earlier.

After 16:20 LT - Third interception (continuation and end)

The Facts - The F / A-18F has radar contact and can record video footage where the UAP appears (IR image?)

Details - Radar contact would be about 33 NM south of the F18 position.

Comments - Contact is obtained in RWS (range while scan) mode, which gives an indication of distance. But hanging impossible in STT mode (single target track); no distance indication on the video. The testimonies are confused as to the possibility of jamming. Nothing is said about what the radars of the “Princeton”, the “Nimitz”, the “Hawkeye” see. What happened next ? Was the interception continued? Really little information ... Curiously, in this third interception, the radar contact is obtained by the F18 and not by the radars of the “Princeton”, the “Nimitz” or the “Hawkeye”. But is it the same UAP? Another kind of UAP? Is it conceivable that one of the 14:10 LT UAP remained in sight?

4.2.3.2 Analysis of infrared videos of the Nimitz case

We have 3 videos named respectively Flir 1, Gimbal and Go Fast. They are broadcast by “To The Stars Academy of Arts and Science”. These videos were acquired by Raytheon's POD AN / ASQ 228 commissioned in 2003 and installed on F18. **Only the first video is dated 2004 and given as associated with the Nimitz case**; the other two are presented as UAP sightings from US Navy planes, without further details.

4.2.3.2.1 Flir1 Video

The video lasts 1 min 14 s during which an object is observed in IR then in visible. The site and the bearing of the line of sight are very stable except for an increase in the bearing at the end of the video. In IR, the object seems to be a saturated point with no apparent structure, on the other hand in visible it clearly has an elongated shape.

The video, generally of poor quality, makes it difficult to identify the object. Note, however, that the object appears significantly larger in visible than in IR. Yet in both cases, the field of the sensors seems the same (NAR) according to the encrustation.

An image defect in the POD cannot be ruled out, knowing that we can read that the first PODs of this family installed on F115 had some debugging problems.



Figure 4.2.3.2.1.1 - Flir Image Example 1

4.2.3.2.2 Gimbal Video

This video lasts 35 seconds, it is neither located nor dated. It is of better quality than the previous one. On a sea of clouds, an oblong object is observed while the F18 is in a left turn. The site of the line of sight remains constant at -2° and the bearing varies from 54° left to 5° right.

Most surprisingly, the object changes tilt when the bearing is between -5 and $+5^\circ$, as if its position were related to the angle of the POD's head mirror. A defect in the intermediate focal plane of the optical system of the POD seems plausible to us. It may not be a coincidence that this video is called Gimbal (gimbal).



Figure 4.2.3.2.2.1 - Sample Gimbal Image

4.2.3.2.3 Go Fast Video

Certainly the most interesting video because the sharpest of the three. It lasts 30 s. The aircraft is 25,000 feet in level flight, then in the last part of the video in a left turn. The line of sight begins at -22° in elevation and 35° left in bearing at the start of the video, to regularly reach -34° in elevation and 55° left in bearing.

The object is a one-time hotspot moving rapidly over the seabed. The operator misses the track lock three times then successfully hangs and activates the automatic tracking.

The angular resolution is too low to identify UAP, but it can be said to be a small hot object. When the automatic tracking is engaged, a 4.0 RNG overlay appears. Considering this to be a distance measurement on the object, the object is 7.4 km from the plane while the flight altitude is 7.7 km. We would therefore have an object flying rapidly at an intermediate altitude. Under these conditions, a geometric analysis of the UAP is possible.



4.2.3.2.3.1 - Example of a Go Fast image

In conclusion, only the third video can provide relevant information; the first two are of too poor quality to hope to extract any information from them. It should be possible to supplement them from other sources.

4.2.4 Aguadilla case

4.2.4.1 Introduction

The “2013 Aguadilla Puerto Rico UAP” report was submitted to the 3AF / SIGMA2 commission in May 2015, along with its data (radar data and infrared video) by the scientific group called Scientific Coalition For UAP Studies (SCU). It can be viewed via the following link :

https://24d63f27-e686-40c4-adce-0870e805ceec.filesusr.com/ugd/299316_9a12b53f67554a008c32d48eff9be5cd.pdf

This report is the subject of a more detailed version including all the trajectory simulations carried out, annex available under reference Annex A 4.2.4 Likewise, references to the flight characteristics of certain objects are dealt with in dedicated paragraphs of the report. Thai lanterns are detailed in § 5.12.3.1, and UAV in § 5.12.3.5.

This report reports on the in-depth study of a case of UAP observed at the Rafael Hernandez airport site in Aguadilla, Puerto Rico, on April 25, 2013 at 9:20 p.m. (local time) from testimonies (control tower) , an IR video recording by a coastal surveillance aircraft and radar data from civil air traffic control.

The 2015 report of the SIGMA2 Technical Commission had given a first opinion, rejecting the hypothesis of an unknown object "UFO" presenting an unusual behavior including a phase of flight followed by a dive and an immersion in the sea (but nevertheless visible in infrared, which was not possible from our point of view, the water being opaque in infrared), before resurfacing according to the interpretation of the SCU. The SIGMA2 analysis favored a hypothesis of a low altitude trajectory above the earth followed by a grazing overflight of the sea in the final phase, which could generate misting phenomena that could explain the temporary disappearance of the infrared trace of the object above water. Since then, this analysis has been deepened on various trajectory hypotheses from a careful reconstruction of the lines of sight to be more exhaustive in the examination of alternative object hypotheses. Several alternatives exist without being able to be decided.

4.2.4.2 The observations

The DHC8 coastal surveillance aircraft (see Figure 4.2.4.2.1) was alerted by the control tower to the presence of unidentified radar returns near the airport to the North. The pilot of the aircraft sees a red light which he no longer sees soon after but before the IR recording is started (there is no simultaneous visual and infrared observation of the object). The aircraft makes two loops around the airport (see Figure 4.2.4.2.2) and records with its infrared camera (and a laser rangefinder) images of an object for about two minutes.



Figure 4.2.4.2.1: DHC8 surveillance aircraft

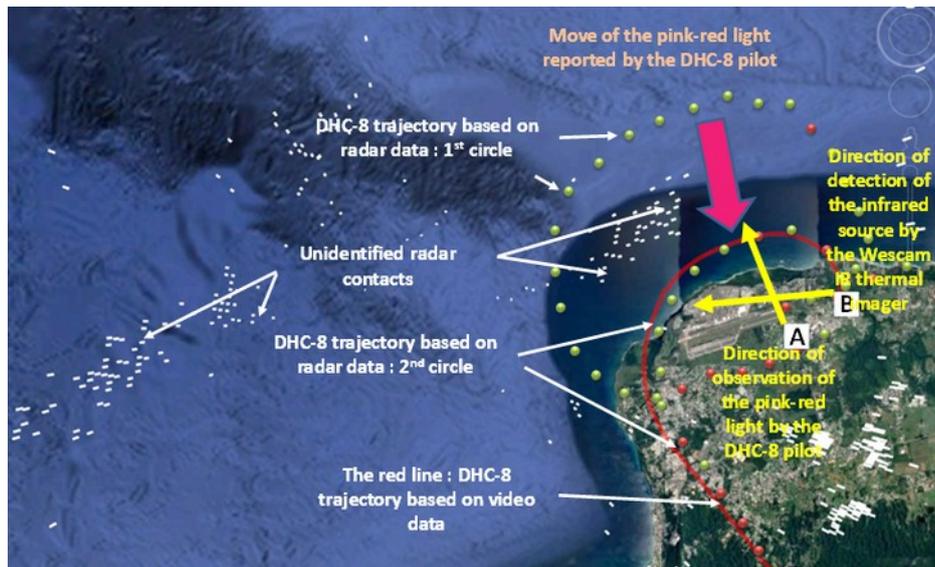


Figure 4.2.4.2.2 : map of the area with the trajectory of the plane - marking of main observation events (visual contact from the plane, IR, radar contacts)

4.2.4.3 Infrared observations

The IR video is of poor quality due to the image processing (saturation, contrast inversions) and does not allow precise use of the images, shapes or to find points of intersection in the image or on the map for estimate the distance and reconstruct the trajectory of the phenomenon in 3D. In addition, the laser rangefinder actually measures the distance between the aircraft and the point of impact (target position) of the laser on the ground, which makes it possible to restore the envelope of the camera and laser lines of sight on which the object is moving, but the position of the phenomenon and its altitude remain unknown.

The observed object appears to be emissive with an infrared signature presenting one or two apparent hot spots depending on the phase. The metric size (maximum 1.3 m), see Annex A 4.2.4 - Annex Object size) can be evaluated from the angular field data available in the technical manual of the Wescam MX-15Di, which make it possible to know the opening of the visual for a given magnification, therefore to measure the angular size of the UAP; the maximum diameter of the UAP can then be calculated by considering that it is at the same distance as the target.

Strange phenomena were observed on some sequences of the IR observation:

- **Contrast inversion** (see Figure 4.2.4.3.1) when flying over the water (linked to the gain in local image processing).



Figure 4.2.4.3.1 – IR image of the object with contrast inversion of the IR landscape background (local image processing effect). The object is to the right and at the base of the sighting cross

- **A temporary occultation or a strong attenuation of the thermal signature** of the phenomenon is observed first on a land background (see Figure 4.2.4.3.2) then on a sea background. Several interpretations are possible depending on the trajectories (see §.4.2. 4.5) and the flight altitudes considered. For a slow object moving around 600 ft (case of the trajectory of an object carried by the wind such as a Thai lantern) the occultation could be due to clouds at altitude, but these would also mask the background of the landscape, which is not the case. We also envision a grazing trajectory, possibly after a rapid descent. In this case, the temporary masking on the earth background could be caused either by trees or by local nebulosities and close to the ground.

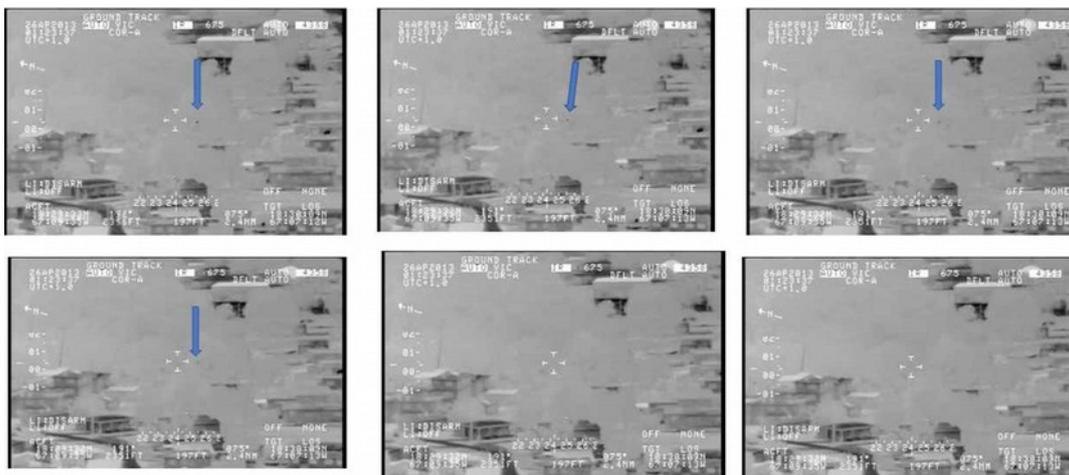


Figure 4.2.4.3.2 – Sequence of images showing the object's temporary concealment during the flight over the bottom of the earth

- **A grazing trajectory on the water with a surface effect?** In the last part of the video, the object hovers over the sea background, either flying high (500 or 600 ft) or near water. The SCU made the assumption of **a grazing trajectory on the water, with a dive "without splash"**, while showing a residual thermal trace, colder of the object supposed to be temporarily submerged and moving underwater (see Figure 4.2.4.3.3). We do not retain this hypothesis, which is not



physical (water is opaque to infrared, and should completely erase the thermal signature). Finally, if we retain the hypothesis of a level flight above the earth and then the water, it then seems possible to us that the object can "surf" at the level of the waves (we observe images with ricochets - see Figure 4.2.4.3.4), can also create a spray cloud and have its thermal signature temporarily obscured.



Figure 4.2.4.3.3 – One of the images seems to show the immersion of the object (according to the SCU), splat-free while leaving an attenuated thermal trace



Figure 4.2.4.3.4 – The analysis of the images on the seabed seems to show ricochets, as if the object was flying very low, surfing on certain waves while raising spray which could explain the temporary and partial occultation of its thermal signature

The phenomenon becomes visible again after passing over the sea background (overflight, grazing flight or immersion according to some).

- **In addition, a phenomenon of doubling or replication of the object is observed.** This phenomenon appears first when flying over the land (see Figures 4.2.4.3.5 a and b - two visible hot spots) then more clearly at the end, when flying over a sea background (see Figures 4.2.4.3. 6 a and b) after what appears to be a ricochet. The object then seems to split or replicate in two similar thermal spots.



Figure 4.2.4.3.5 – doubling of the image of the object on an earth background

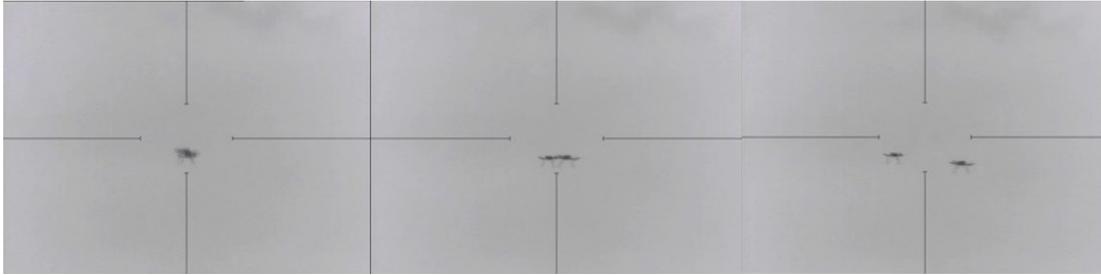


Figure 4.2.4.3.6 – doubling of the image of the object on the sea background

Several hypotheses can be put forward, involving the type of trajectory and the nature of the object; none can be taken with certainty:

- Spurious reflection in the lens? This explanation seems unlikely, as the parasitic image is normally attenuated. She isn't.
- Is this a physical separation of two hot spots, either by breaking the object into two parts after a shock, or by actually observing two separate but close objects. This could be the case with a twin Thai lantern, in the case of the final doubling, but difficult to explain during the first separation on the earth background. In the case of the grazing trajectory of a micro-drone on the bottom of land or on the sea, one could also consider either a separation by an impact in the water causing a rupture, or the close flight of two evolving micro-UAV. at a short relative distance. Their images would sometimes be confused (not resolved by the camera), sometimes separated temporarily (on land, then on water) when they move away (see Figure 4.2.4.3.7).
- This is a reflection phenomenon in water (in the case of final doubling) or a mirage-type phenomenon (see the study in Appendix A 4.2.4- Mirage doubling appendix). Is this possible in two different places, on land and then at sea, in infrared? Like the occultations, this deserves additional analyzes.

The mystery remains unsolved. We do not have a certain explanation for this phenomenon. Analysis is continuing.

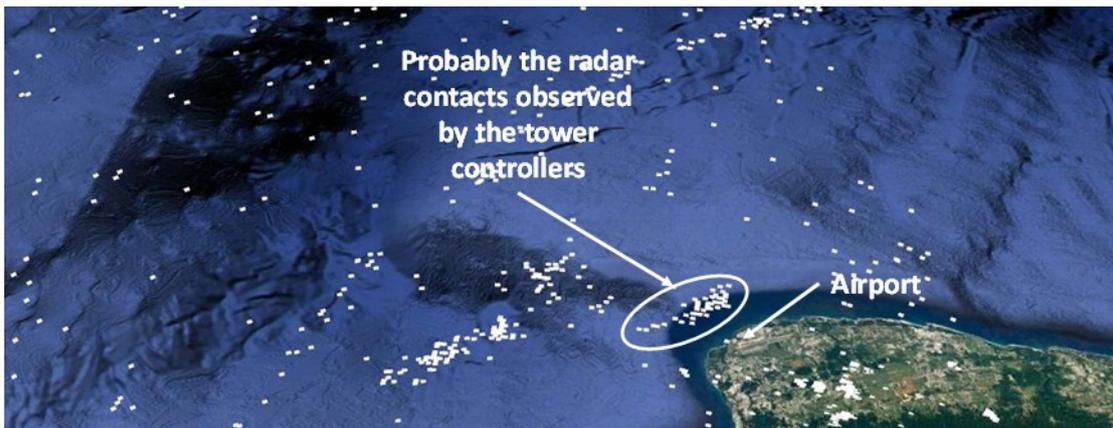


**Figure 4.2.4.3.7 – observation of drones in close formation by a visible camera
(a) merged - (b) start of separation - (c) resolved image - two drones**

4.2.4.4 Radar observations

We also attempted to cross-check the IR observations and the radar data from the civilian radar at Pico del Este 91.5 NM from the airport (see Figures 4.2.4.4.1 and 4.2.4.4.2) to obtain the position of the object. The radar data shows a series of plots moving from east to west, mainly corresponding to nebulosities. The initial positions of the returns may justify the alert given by the control tower.

On the other hand, the cross-checking of the radar data and of the aircraft attests to the authenticity of the observation and of the video, the evolution of which corresponds to the radar trace of the aircraft.



**Figure 4.2.4.4.1 – Primary radar contacts from 20:58 to 21:26 LT
(the radar returns are the little white dots)**



Figure 4.2.4.4.2 – Primary radar contacts from 20:58 to 21:26 LT (the radar returns are the little white dots)

4.2.4.5 The hypotheses of the trajectory and kinematics of the object

In the absence of cross-checking of the observations on the altitude and the distance of the object, we reconstituted the envelope of the lines of sight (see Figure 4.2.4.5.1) of the airplane at the “target” (point d impact of the laser beam on the ground).



Figure 4.2.4.5.1 – The projection of the trajectory of the UAP is in the yellow zone

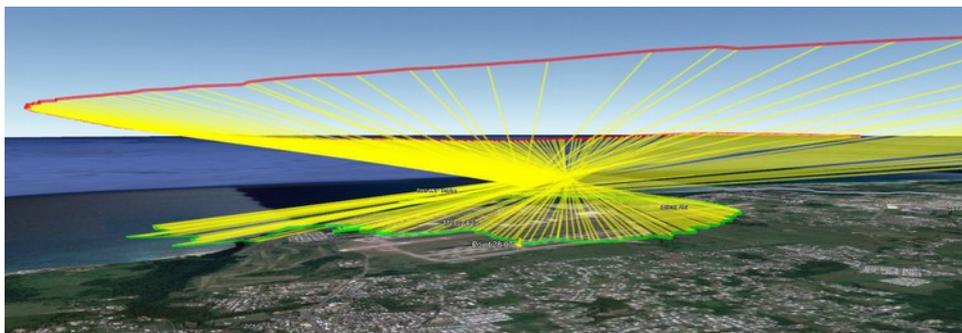


Figure 4.2.4.5.2 – The projection of the trajectory of the UAP is in the yellow zone

Then we built models of the supposed trajectory of the object by relying on the lines of sight and by taking various assumptions of starting altitude and rate of change of altitude (see Figures 4.2.4.5.2 to 4.2.4.5.6).

- Case of a ground following trajectory at about 100 ft altitude, ending above water. The object is not visible to radar. This trajectory could be that of a micro-UAV with electric propulsion or high speed by micro-reactors (the restored speed reaches nearly 300 km / h at the start of this trajectory).

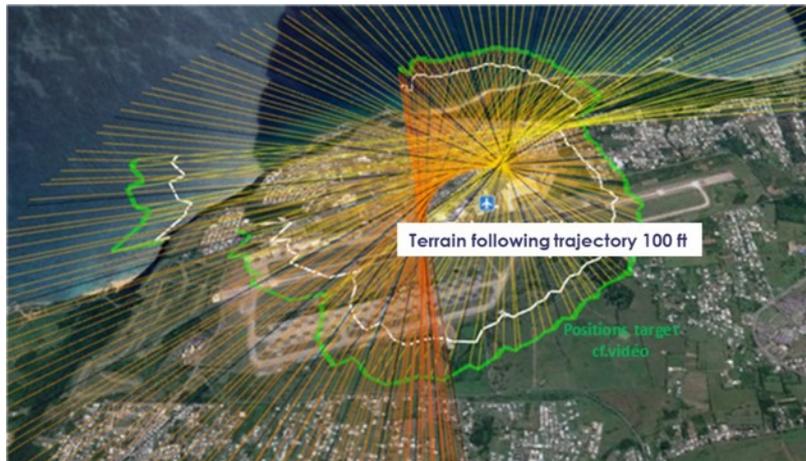


Figure 4.2.4.5.3 – In white: the UAP trajectory in ground following at 100 ft

- Case of a flight at medium altitude (between 1000 and 600 ft) with a low rate of descent (-2 ft / s); the trajectory is contained in the zone of intersection of the lines of sight; it is quasi-rectilinear and the distance traveled is small. This trajectory case may correspond to a kinematics of a Thai lantern pushed by the wind (the descending trajectory would be due to a vertical component of the displacement of the air mass).



Figure 4.2.4.5.4 – UAP trajectory for descent from 1000 ft / -2 ft / s

- Case of a high altitude trajectory where the object accompanies the aircraft on a concentric and close trajectory. The object could be an airplane, a medium altitude UAV, or a helicopter. It would likely be visible on radar, like the airplane; and clearly visible by its IR signature, even acoustically. This does not seem to be the case.

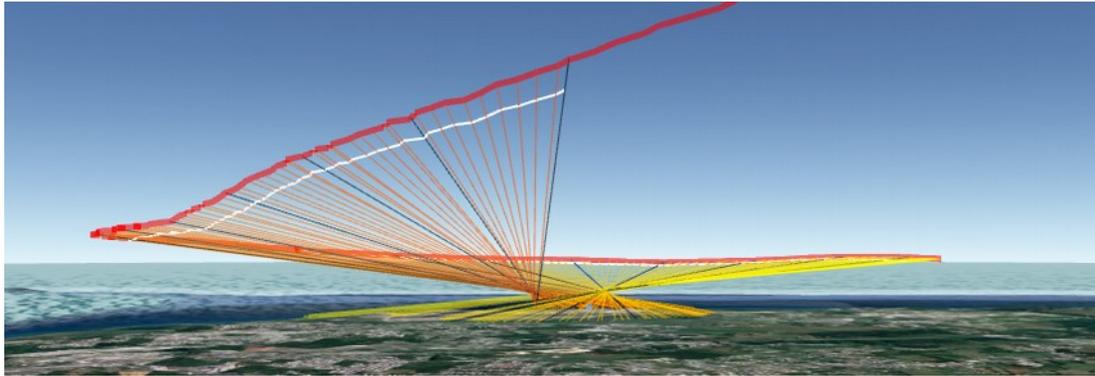


Figure 4.2.4.5.5 – UAP trajectory (in white) at 100 ft below the DHC-8 (in red)

- Composite trajectory case with a rapid rate of descent (constant or changing) and low level level flight



Figure 4.2.4.5.6 – Profile at high descent rate at the start of the trajectory

This trajectory allows a rapid rate of descent to reach a level of flight at low altitude to the right of the cliff, with stabilization then at very low altitude at sea level. The object could be of the micro-UAV type with electric propulsion or by micro-reactors.

4.2.4.6 Conclusions

| | Representative example | Ceiling (mètres) | Speed range (km/h) | Mode of propulsion | RCS (m ²) | Size span/length (m) | Infrared emissive parts | Observed temp. (°C) |
|--------------|------------------------|------------------|--------------------|--------------------|-----------------------|----------------------|-------------------------|---------------------|
| Thai lantern | Not applicable | 600 | Not applicable | Not applicable | ? | Ø=0,5 | Heater | 60 |
| Micro drone* | DJI Phantom4 | 6000 | 0/72 | 4 electric engines | <0,01 | <0,7 | Engines +Battery | 35/ 37 |
| Miri drone | TTA America M 6A Pro | 1.500 | 0/36 | 6 electric engines | <0,1 | Ø=1,6 | Engines +Battery | ? |

* Radio range up to 8 km

“Traditional” air mobiles



| | Representative example | Ceiling (mètres) | Speed range (km/h) | Speed range (km/h) | RCS (m²) | Size span/length (m) | Infrared emissive parts | Observed temp. (°C) | Exhaust temp. (°) |
|------------|------------------------|------------------|--------------------|--------------------|----------|----------------------|-------------------------|---------------------|-------------------|
| Mini drone | Racer X | ? | 0/290 | 4 electric engines | ? | ? | Engines + Battery | ? | Not applicable |
| Mini drone | JetQuad ABS | 10 000 | 0/480 | 4 microturbos | ? | 1,2 | Comb. chamber & exhaust | ? | 200/300 |
| Mini drone | JetQuad AB6 | 10 000 | 0/400 | 4 microturbos | ? | 1,2 | Comb. chamber & exhaust | ? | 200/300 |

Fast mini and micro-drones: Racer X and Jet Squad

| Flight profiles | Flying objects compatible with metric size and speed range | Consistency with radar data | Consistency with wind data | Consistency with object temporary disappearances on vidéo recording | Consistency with the hypothesis of the impact on the sea | Consistency with testimonies | Overall plausibility |
|--|--|-----------------------------|----------------------------|---|--|------------------------------|----------------------|
| UAP accompanies DHC-8 (Z - 100 feet) | Fast mini or microdrones | + | Not applicable | 0 | 0 | 0 | 0 |
| Terrain following (H = 100 feet) | Fast mini or microdrones | Undetermined | Not applicable | ++ | ++ | + | + |
| Constant altitude flight | Mini or micro drones | ++ | Not applicable | + | 0 | + | + |
| | Fast mini or microdrones | ++ | Not applicable | + | 0 | + | + |
| Staight trajectory at steady speed profile (Z1=1 000 feet, VZ=-2 feet/s) | Thai lantern | Undetermined (SER is small) | ++ | ++ | 0 | + | ++ |
| | Mini or micro drones ("conventional" or fast) | ++ | Not applicable | 0 | 0 | + | + |
| Constant vertical speed trajectory impacting the sea at the apparent dive point on video | Fast mini et microdrones | ++ | Not applicable | ++ | +++ | + | ++ |
| Variable vertical speed trajectory impacting the sea at the apparent dive point on video | Fast mini or microdrones | ++ | Not applicable | ++ | +++ | + | ++ |

Summary table of plausibility

From a kinematic point of view **three hypotheses** emerge even if we have no certainty as to the type of object, and no robust explanation for the final doubling.

One corresponds to a local trajectory in the vicinity of the airport in slow descent (2 ft / s) between 1000 and 600 ft, compatible with that of a balloon or a Thai lantern, or even a micro-drone , drifting at low speed while being carried by the wind. But this hypothesis, which would have the merit of corresponding to a simple scenario and to a classic kinematics, is not consistent with the radiometric data (hot spot, occultation during flight over the background of an urban area and then on the sea background).

The other hypothesis could correspond to a flight in ground following at 100 ft, at least in the second part of the trajectory; which could explain certain phenomena observed (hot spot, temporary occultation of the signature in flight grazing above the sea). It could be a micro-drone with very high speed capabilities (nearly 300 km / h) as there are a few prototypes.

Finally, the hypothesis of a trajectory with a variable rate of descent at first, then ending

in low flight, could be compatible with a high-performance micro-UAV.

There is nothing to confirm a case of extraordinary UAP, even if we are faced with uncertainties about the restitution of trajectories and therefore of the type of flying object, or even facing questions about certain IR phenomena (occultations, duplication).

The three hypotheses cited each have advantages and disadvantages. They are physically possible and remain in the domain of "normal" or "plausible".

The Thai lantern-type slow descent trajectory is plausible as during wedding ceremonies from the Montana Beach villa in Puerto Rico (Figure 4.2.4.6.1).

The other trajectories, of the ground following or plunging rapid descent type (V_z constant) or "composite" of the micro-UAV type may correspond to an illicit flight over the airport and the descent zones by a micro-UAV, as in many cases reported on airports in the period 2013-2017.



Figure 4.2.4.6.1: Thai lantern villa Montana - Thai lantern in visible and infrared



Figure 4.2.4.6.2: micro-UAV with electric propulsion



Figure 4.2.4.6.3: micro-UAV powered by micro-reactors



4.2.5 Case with Electromagnetic Effects (EME)

This paragraph takes up the elements mentioned in previous paragraphs, in particular the American cases, but with particular attention to the electromagnetic effects induced on materials and equipment or on the natural environment, including humans. These effects are physically characterized by the interaction of radiation, particularly microwave type, according to mechanisms described in § 5.9. Some effects on electronic equipment are similar to the effects of directed energy weapons which can induce electric fields on electronics and temporary malfunctions (see § 5.10). Finally, the analysis carried out on the physiological effects linked to close contact with certain UAP (see § 5.11), also shows a strong similarity with microwaves, to be compared also with the effects on the natural environment (traces on the ground, § 5.8). We will try to make a synthesis based on a comparison between these different effects in § 5.14. This will not have the force of law experimentally or in terms of correlation between cases, for lack of sufficient statistics, but the similarities raise many questions.

We successively evoke numerous testimonies concerning the electrical or electromagnetic disturbances that appeared during encounters with UAP, some very significant because having the common characteristic of having been the subject of numerous and consistent physical measurements, particularly in terms of frequencies. It is probable that the work carried out by the USA within the framework of the AATIP program related in the same way to certain observations made on the American air bases near the Canadian border, the AATIP program including, according to a presentation by Mr. Hal Puthof at the University of Berkeley²², a “Nothern Tier” component linked to these cases.

We list in a non-exhaustive way US, Russian, aeronautical (inventoried by the US NARCAP), Iranian and French (traces on the ground) cases, which have been the subject of reports and records.

4.2.5.1 US EME case

4.2.5.1.1 US RB-47 case

This case, which dates from 1957, is very interesting because it is very well documented. A US Air Force RB-47 aircraft was tracked for 1300 km and over an hour of flight by a "large bright light" that emitted waves in the radio domain.

On July 17, 1957 at 4 a.m., a USAF Boeing Stratojet RB-47 reconnaissance aircraft (with 6 experienced officers on board and equipped with eavesdropping devices to locate and identify radars) carried out a mission to training over the Gulf of Mexico, including electronic countermeasure exercises with on-board ELINT (signal listening / recording) systems.

On his way back to the central and southern United States, he detects an unidentified object circling around him as he flies at 35,000 feet, at a speed of 258 miles / h (Mach 0.75) ! First eye contact takes place at 4:10 am with an intense bluish-white light that

²² https://m.youtube.com/watch?feature=share&v=-199qc_6090



oscillates at high speed in front of the device, then disappears.

This case is evoked by James Mc Donald within the framework of scientific meetings AAS in 1969²³. There it evokes the gaps in the interpretation of the observations of UFO by the US radars and EM means between 1947 and 1969. The case is also evoked in the US Air Force Condon Report²⁴.

What is extremely interesting, in this incident, is that on several occasions, we observed the appearance and disappearance of the "object" simultaneously on all the observation channels (ground radar, on-board ELINT system, visual since the edge).

Another troubling point is that the object's maneuvers were clearly beyond the capability of any aircraft.

For more than an hour, the luminous object circled around the RB-47, emitting in the radio domain at a frequency of 2800 MHz (2 microsecond pulse, 600 Hz repetition period). These are very surprising characteristics for the time, especially for synthesizing a radar pulse of 2 microseconds duration at 3 GHz. The characteristics are recalled in appendices A 4.2.5.1.1.1 / A 4.2.5.1.1.2 / A 4.2.5.1.1.3 which notably include a blog listing the 3 GHz emissions emitted by UAP, subject mentioned by Hal Puthof referring to documents dating back to 1971. This operating frequency is standard for ground observation radars (S band). In this case, confusion with a ground radar is impossible, because there is proof that the transmitter was indeed the object moving around the RB-47.

4.2.5.1.2 Malmstrom case: US Canada border - Montana airspace: 03/26/1959

The Blue Book Project File (see Appendix A 4.2.5.1.2) relates the case of a B52²⁵ in flight at 32,000 feet which visually observes a UFO following it in the rear sector at approximately 9 km, then on its radar scope and finally on the ELINT ESM system, for an hour. Recordings of electromagnetic signals are obtained oscillating on two frequencies between 1 GHz and 9 GHz, one frequency of which is 9.135 GHz (scanning in 1 s) and the other estimated at 2.5 GHz. The object is chased by an F89 put on alert from Malmstrom base, but disappears shortly after the arrival of the fighter in the area while the crew of the F89 notes that the object reacts by making a sudden turn to 80 ° while starting a rapid climb.

Observation from the B52 confirms a radar return of the object much larger than that of the F89 while noting a sudden and unusual escape maneuver for a fighter. The F89 cannot keep up with the object's rate of climb. Long-range ground firing radars were able to visualize the various planes in the area, including the F 89, B52 and a tanker, but the object remained invisible from these radars.

The remarkable fact again concerns the observation of a transmission frequency by a

23 http://puhep1.princeton.edu/~mcdonald/JEMcDonald/mcdonald_aaas_69.pdf

24 Final report of the Scientific study of Unidentified Flying Objects - Condon E.pdf P.57/665

25 The National Archives (<http://www.archives.gov>) - NARA T1206. Records and case files relating to investigations of sightings of unidentified flying objects (UFOs). <https://www.fold3.com/image/9079675>



UAP close to 3 GHz as in the case of RB47.

4.2.5.1.3 Carpio Grano case: August 24, 1966

This case from the Blue Book file²⁶ (see Appendix A 4.2.5.1.3 Project_Blue_Book_19471969. Campio Grano) relates the observation of three UFOs visually and by radar over an area of missile silos at the Campio Grano base. One of them arises. They generate interferences of the parasitic type with the radio transmissions of the base. The parasites appeared when the UFO flew over the silo and disappeared when it climbed (radar tracking up to 100 Kft). Similarly, the response team dispatched to the silo site where the object landed observed radio interference 10 miles from the site.

This is an EME type case interfering with radio broadcasts.

4.2.5.1.4 Malmstrom case: March 16 to 23, 1967

Malmstrom Base reports UFO overflights of 10 Echo and Oscar launch pad silos. The control electronics of the 7 missile launch centers reportedly failed during a day (see Annex A 4.2.5.1.4) while one of the UFOs landed. These events are noted in an April 3, 1967 Blue Book Case report²⁷ from the Malmstrom Base UFO investigation antenna to Wright Patterson's central UFO investigation office. An extract of the conclusions is given below (see Figure 4.2.5.1.4.1). He evokes the answer to questions arising in July 1967:

- Events in this period based on overflight by UFOs,
- The absence of malfunctions of the launch facilities (not proven),
- The absence of known classified military experiences or of confidentiality rules imposed on base personnel regarding the disclosure of this information.
- UFO landing (March 24, 1967) reported by base and Sheriff's Office not proven.

The attached document relates a de-classification of Strategic Air Command documents following a FOIA request. It attests to electronic malfunctions that contradict the 1967 report.

Colonel Salas (1st Lieutenant at the time of the event), present on the scene and operator in the control center of the silos, for his part confirmed under oath, during the press club in Washington in 2010²⁸, a malfunction of the electronic control systems during these events. If this is correct, it is about direct EME effects on the control electronics of missile silos. The parallel can be drawn with other similar events that have been reported, including those at the USOVO base in Russia reported below.

26 The National Archives (<http://www.archives.gov>) -NARA T1206. Records and case files relating to investigations of sightings of unidentified flying objects (UFOs)- <https://www.fold3.com/image/8286831>

27 The National Archives (<http://www.archives.gov>) -NARA T1206. Records and case files relating to investigations of sightings of unidentified flying objects (UFOs)- <https://www.fold3.com/image/7471846>

28 Captain USAF Salas, testimony at Press Club, Washington DC May 2001, book Faded Giants 2005

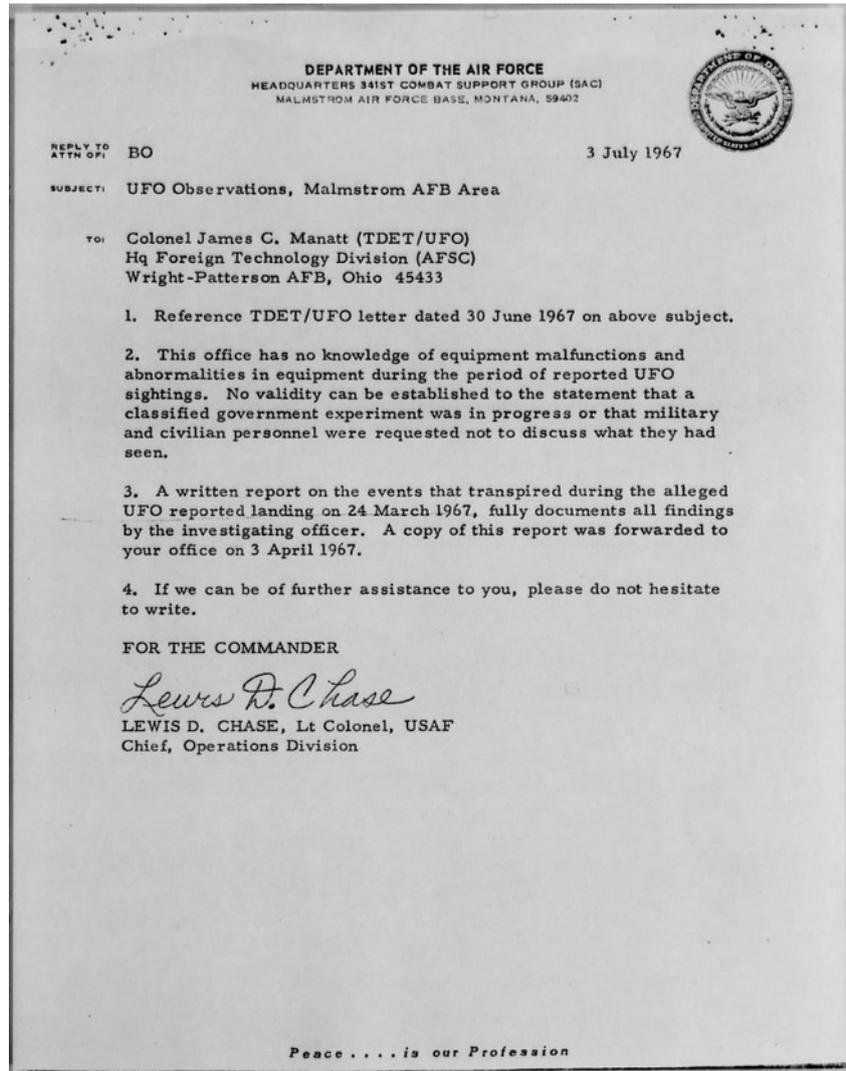


Figure 4.2.5.1.4.1 – extract from the Blue Book 27 report dated April 3, 1967 from the UFO survey antenna at Malmstrom base

4.2.5.1.5 Minot case: October 24, 1968

This case is listed in the Blue Book project²⁹ and in the Airpanc file (case 732 of the AIRPANC file) - see appendix A 4.2.5.1.5.

A B52 is 39 miles from the base of Minot equipped with silos of IBCM missiles. A UFO was reported rapidly approaching the B52 at 3000 mph, which it was following at a short distance (1 mile). UHF radio transmissions are interrupted until the departure of the UFO. The radar echo (equivalent in size to that of a KC135 tanker) is recorded on the scope of the aircraft (see Figure 4.2.5.1.5).

29 Project Blue Book, 1947-1969- NARA T1206. Records and case files relating to investigations of sightings of unidentified flying objects (UFOs) -<https://www.fold3.com/image/6981875>

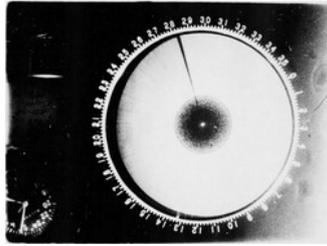


Figure 4.2.5.1.5.1 : radar scope

UFO is heading to the vicinity of the Minot base. It is followed by ground radars. It is observed at an altitude of 1000 ft, in the form of an orange red light, larger than an airplane, and from the ground by maintenance teams, also from the B52 which arrived in the area (altitude 2000 ft) which sees the object near the ground hovering. The B52 again observed a disturbance in UHF radio transmissions while flying over the UFO. The Oscar silo will be found with the door open.

This EME case is characterized by radio disturbances near the UFO, the presence of a radar echo of size equivalent to that of a KC135, as well as effects on the door opening and alarm equipment. silo.

4.2.5.2 Russian EME case

4.2.5.2.1 The Kapustin Yar 1971 case

Russian work on the UFO research program conducted by the Academy of Sciences and also by the Ministry of Defense is discussed in § 3.6.

A secret laboratory dedicated to the study of UAP was installed at Kapustin Yar, the Russian cosmodrome. Its existence was not revealed until June 14, 1983 by the New York Times article by Theodore Shabad. This site was reportedly the subject of events related to the outbreak of UAP.

An important incident occurred in June 1971; the teams of this laboratory observed a black object, shaped like a cigar, which flew 800 m above the clouds. It was about 25m in length and 3m in diameter; it seemed to have no engine, ailerons, or wings.

Various incidents probably motivated the signing of the Russo-American agreement of 1971³⁰ (see Annex A 2.2 Agreement) intended to prevent the risks of accidental launching. Several cases can be compared to the effects of EM weapons on electronics described in § 5.9 and 5.10, such as high power microwave weapons.

It should be noted that a similar risk had been mentioned on the occasion of the appearance of sprites (see § 5.12), a phenomenon of stormy origin manifested by an electric discharge in the ionosphere, of which the electromagnetic and visible signature, very energetic, could be confused with that of a nuclear explosion. One of the known cases is that of Petrozavodsk³¹, which occurred on September 20, 1977, mistaken for a

30 <http://www.state.gov/t/isn/4692.htm>

31 <http://www.ufoexperts.net/petrozavodskufo.html>

UFO (see Appendix A 4.2.5.2.1 Petrozavodsk). It can look like a sprite or effects similar to nuclear radiation (X, gamma) as can be found in certain natural phenomena (see § 5.12.2.2 Elves Sprites Blue jet and § 5.12.2.3.3 Interactions with the environment).

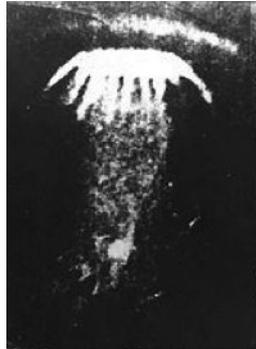


Figure 4.2.5.2.1.1 - Photo of the Petrozavodsk phenomenon

This had prompted the launch of military research into these phenomena, with the aim of defining discriminating signatures. This problem is another type of risk associated with the detection of nuclear launches and explosions from alert satellites.

The link between various EM interference phenomena subsequent to the appearance of UFOs, and the detection of radiation of nuclear or natural origin (Sprites), through the detection of missile launches, to the military surveillance of space, may explain the grouping under the generic program name SETKA MO, at the time these subjects were merged. This was in 1971-72. This is consistent with the alert / verification of events related to launches, explosions etc ... which have been the subject of reciprocal information between Russians and Americans as previously mentioned.

4.2.5.2.2 : Case of the Usovo base in Ukraine: October 4, 1982

According to the statements of Colonel Sokolov (member of the Russian military investigation teams), an overflight of a circular UFO (apparent size 700 m), silent, took place October 4, 1982³² (see Appendix A 2.5.2.2.1 Case USOVO Ukraine from SETKA and Annex A 2.5.2.2.2 soviet nukes and UFOs), above the Usovo ballistic missile base near Byolokovoriche in Ukraine. Major Kataman, who is in the command unit, observed the missile command codes being out of order for 14 seconds. At the same time, several soldiers from the base, including Lt Platunov, observed outside a disc-shaped UFO with an apparent diameter of 700 m.

This incident corresponds to an EME-type phenomenon that selectively affected the control electronics of the silos. According to Robert Hasting book (Pp 448-49 UFOs and Nukes (2nd Edition)), radio operator, Vladimir Matveyev, stated that radio communications were also blocked as the control panel of missiles were out of control during 14s.

³² <http://www.openminds.tv/soviet-nukes-and-ufos/2002>

4.2.5.2.3 : EME Borisoglebsk Incident: April 1984

According to the KGB UFO File book, the Borisoglebsk³³ crash occurred in April 1984 near the Povorino base.

A MIG-21 has a visual on a black cloud³⁴ and detects a UFO on its radar (see footnote 13). The MIG then encounters successive failures of its electronics and of the reactor. His crew ejected. A similar incident occurs a year later in the presence of a UFO. According to the same book (KGB UFO File), so-called ZEFIR EM weapon-type equipment was subsequently developed by one of the TsNIPP radio research institutes³⁵. This company is part of the Russian research centers. Specializing in miniaturized electronics and owned by the Rostex State Complex. According to the book, she is credited with having developed the Krazukha-4³⁶ electronic warfare system (see Figure 4.2.5.2.3), of the microwave EM weapon type (see § 5.10 and 5.11) to jam radars but also missile guidance systems³⁷... The report on the Borisoglebsk case therefore speaks of facts linked to EME effects on MIG-21 aircraft, affecting the on-board electronics and the thruster.



Figure 4.2.5.2.3.1 - Krazuckha-20 and Krazukha-4S (report reference FOI-R4625-SE)

4.2.5.2.4 The Kapustin Yar case: August 28, 1991

Another incident was reported to Kapustin Yar³⁸ on August 28, 1991 at 4:40 p.m. (see Appendix A 4.2.5.2.4 KGB UFO File), an event reported in the KGB Files book (p.252 and 253). That day, an unidentified machine was detected by ground radars. It was flying at an altitude of 6,600 m, at a speed of 960 km / h.

33 Le dossier OVNI du KGB- P.122

34 <https://archive.md/HZxdv#selection-419.153-419.172>

35 <https://warwick.ac.uk/fac/soc/economics/staff/mharrison/vpk/history/part2/tsnii.pdf>

36 Voir le rapport Russian Electronic Warfare- Jonas Kjellen- FOI-R-4625-SE P.52

37 <https://avia-pro.fr/news/rossiyskie-kompleksy-reb-otrabotali-raketnyy-udar-po-izrailyu-vyvedya-iz-stroya-zrk-zheleznyy>

38 <https://books.google.fr/books?id=oCp7DwAAQBAJ&pg=PA247&lpg=PA247&dq=Kapustin+28+août+1991&source=bl&ots=20FQBdZLTf&sig=ACfU3U01OFC23Ygq1HlGEz0kXmz7EfatFw&hl=fr&sa=X&ved=2ahUKEwjy5ZG96K3vAhUMExoKHQT7DJ8Q6AEwCh0ECAkQAw#v=onepage&q=Kapustin%2028%20août%201991&f=false>



When the aircraft failed to respond to IFF interrogations from the base, two MIG 29 fighters were dispatched, soon followed by two more as reinforcements.

The pilots of the first two MIG 29s quickly arrive in sight of the "object". They describe it as metallic, resembling a metallic cylinder, but much larger. The pilots' estimates, supported by analyzes of **the radar echoes, indicate a length of 600m and a diameter of 110m.**

The pilots are ordered to fire; they are about 500m from the object initiating maneuvers for warning shots parallel to the object. **The electrical and electronic systems of two planes were broken and the weapons blocked as well as the jet engines.**

Radars tracked the object, which moved away at a breakneck speed of 6,800 km / h.

The phenomenon reported this time resembles a case of EME acting on the on-board electronics of MIGs, like an EM weapon. This case is comparable to that of Tehran described below.

4.2.5.2.5 Alma Ata case: 11/19/1991

According to the archives disclosed by the CIA on the cases of Russian UFOs (USA Crest site - see the archival census Annex A 2.3 CIA notes - document 0005517792)³⁹, the Tass agency reports an event that occurred concerning a patrol of soldiers and soldiers. police officers, having followed an object emitting flames and red rays which had landed on a mountain at a place called Kok Tyube. On approaching, their vehicle was reportedly stopped 200 m from the object, breaking down, after being traversed by beams of red light. They would then have manifested amnesic disorders, not finding their way. Their conversations were recorded, which attests to the sincerity of the testimonies according to Tass. This case is described in detail in the appendix (A § 4.2.5.2.5).

This is a case of double EME effect, on the one hand on the vehicle's electrical ignition equipment (failure), on the other hand from a physiological point of view on their memory. These last elements should be compared with §5.12 on the physiological effects of microwaves (5.12.7 Effects on the central nervous system, concentration disturbances, 5.12.11.1 The French cases with cerebral effects).

4.2.5.3 EME cases identified by NARCAP US

NARCAP, the American Association for Investigating UAP, has published reports on 600 aviation cases⁴⁰ studied by Richard Haines (NARCAP US) and Dominique Weinstein (also a member of the GEIPAN college of experts).

39 https://www.cia.gov/library/readingroom/docs/DOC_0005517792.pdf

40 https://www.narcap.de/dokumente/aircat_DWeinstein_300cases_9-09.pdf



64 cases concern the EME effects observed on aircraft are studied in the report entitled NARCAP TR-3 Study of 64 EME cases 2001⁴¹ published in 2001 (see Annex A 4.2.5.3).

The objective of the study was to demonstrate the value of studying these phenomena from an aviation safety point of view, in particular for civil aviation, in order to avoid untimely maneuvers.

Technical and statistical analyzes were carried out on the EME cases encountered by establishing the conditions of the encounter according to parameters (altitude, distance, type of civil or military aircraft, conditions of presentation of the UAP) and on the effects undergone by the on-board equipment (navigation instruments, controls, radio, etc.). The facts were reported by pilots.

For example, the effects of distance are significant with respect to those identified suggesting the presence of an EM field thus produced by the UAP up to distances of 5000 ft.

The EM effects observed on electronic equipment concern:

- navigation equipment: 12 military cases (31 /%) with disturbance of the magnetic compass is affected, 3 cases for the gyro compass. The effects occurred at a very short distance (about 10 ft) which is consistent with our analysis of magnetic field disturbances which are a priori detectable only at a short distance (see § 5.5)
- electrical navigation equipment: effects at very short range (approximately 100 ft)
- radio equipment: 16 cases (39%)
- propulsion systems (effects observed at distances greater than 900 ft)
- electrical equipment, effects observed at long distance

Details are given in the following table

41 https://static1.squarespace.com/static/5cf80ff422b5a90001351e31/t/5d02eb044a252700010bd9de/1560472330113/narcap_TR-3_2001.pdf



| N° | Date | UAP position | E-M symptom |
|----|------------|-------------------|---|
| 03 | 00/02/44 | beside | Radio system and ADF complete failure |
| 08 | 24/07/49 | beside / below | Engine began to malfunction |
| 11 | 10/02/51 | behind / in front | Magnetic compass rocking back and forth / ADF needle jumping |
| 12 | 00/04/51 | beside / above | Magnetic compass spinning wildly / engine began to run rough |
| 13 | 18/09/51 | beside | ADF went out a few mn / radar jamming and went out |
| 15 | 02/02/55 | in front | Radio interferences |
| 16 | 24/03/55 | circled | All instruments stopped working and engine sputtered |
| 18 | 16/01/1957 | beside | Compass pointed directly toward UAP |
| 19 | 31/05/57 | in front | Radio total failure |
| 23 | 13/08/59 | circled | Magnetic compass rotating continuously (360° swing) |
| 26 | 20/04/64 | above / beside | Radio dead / engine stopped and altitude maintained / radar stopped working |
| 28 | 03/02/67 | above / behind | Magnetic compass oscillated 15° left then 20° right / lights reduced / radio went out |
| 29 | 09/06/67 | below / above | radio ceased to function and emitted interferences |
| 63 | 18/06/68 | | VHF interferences |
| 31 | 22/08/68 | in front | communications failed, statics |
| 32 | 24/10/68 | beside / below | Radio became unoperative |
| 34 | 02/02/73 | beside | ADF needles rotating aimlessly / magnetic compass screwed up / VOR lock on UAP |
| 35 | 16/07/73 | beside | Radio failed |
| 36 | 18/10/73 | above | Magnetic compass rotating slowly radio UHF and VHF frequencies was dead |
| 38 | 28/11/74 | beside | Magnetic compass rotated counter-clockwise |
| 39 | 13/08/76 | beside | Magnetic compass spinning rapidly in clockwise direction |
| 40 | 19/09/76 | in front | Inertial navigation system fluctuated / radio communications lost |
| 41 | 12/03/77 | beside | Magnetic compass offset from normal direction / Autopilot failed to operate normally |
| 42 | 17/06/77 | beside | Gyro-compass rotated wildly |
| 43 | 26/10/77 | in front | Radio static |
| 44 | 18/11/77 | above | Two transponders stopped working the first one did not return to normal |
| 45 | 26/05/79 | beside | ADF & magnetic compass spinning / radio blocked by static / engine running rough |
| 46 | 10/09/79 | behind / below | Radio interferences |
| 48 | 08/04/81 | beside | DME went out / radio failed / transponder went out |
| 49 | 18/06/82 | in front/ beside | Gyro-compass gave awrong direction 30° on right / radio jamming |
| 50 | 24/10/82 | behind / beside | Altimeter malfunctioned |
| 51 | 23/09/84 | behind | magnetic compass oscillated between 0.5 and 270 degrees. |
| 53 | 17/11/86 | beside / in front | Radio interferences |

4.2.5.4 Iranian EME cases

4.2.5.4.1 Tehran case: September 19, 1976

Two F4 Phantoms are sent successively to intercept a UFO on September 19, 1976. This case is recorded in a report from the DIA (Defense Intelligence Agency - see Annex A 4.2.5.4.1 reported UFO Sighting IRAN, translated in the Annex A 4.2.5.4.2- AIRPANC document from NARCAP which also references the source of a classified US DIA report (Sources: US government documents (confidential DIA report⁴² declassified on August 31, 1977) / Uninvited guests, Richard Hall, 1988: The UFO cover up, L. Fawcett and B. Greenwood, 1984 / NARCAP Technical Report n ° 3, "A preliminary Study of 64 pilot sighting reports involving alleged Electro-Magnetic effects on aircraft systems." By Dr Richard F. Haines and Dominique F. Weinstein)).

42 <https://www.dia.mil/FOIA/FOIA-Electronic-Reading-Room/FOIA-Reading-Room-Iran/FileId/122011/>

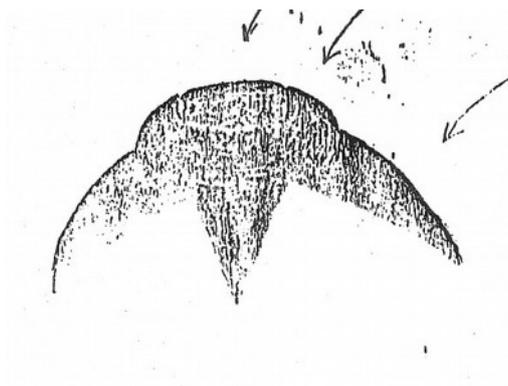


Figure 4.2.5.4.1.1- Case 1055: September 19, 1976, Iran

The F4 crew saw the glowing object at 70 NM, shaped like a star (see above).

The F4 approaches the object at 25 NM and loses its UHF radio and intercom communications. He interrupts his interception maneuver, changes course and regains use of his equipment.

A second F4 is vectored onto the object and locks its radar at 27 NM on an echo comparable to that of an air-to-air refueling Boeing 737, the object appearing very bright emitting very fast multicolored flashes like a strobe. The object moves away and keeps a distance of 25 NM from the fighter. The fighter pursues the 1st object while a second shiny object detaches from the first and approaches the F4 at high speed, in frontal presentation. The pilot tries to fire an AIM9 missile but the control panel fails as does the UHF radio.

The 2nd object maneuvers in the wake of F4 then rejoins the 1st object with which it merges. The F4 regains its radio and intercom capabilities, as well as the weapon system control panel. A third object appears as it exits the first object, descending at high speed and appearing to crash into the ground on which it lands gently; radiating light over a radius of 2 to 3 km.

The F4 made a few circular passes at 15,000 ft above the UFO thus posed, noting interference with the UHF radio and the intercom, as well as instrumental drifts of 30 to 50 °, each time it passed in the 150 angular bearing. of Merhabad and this for about 15 s. An approaching airliner in the same area suffered similar disturbances on his UHF.

We are faced with a case of EME characterized by the failures which affected the means of communication, navigation and electronics of the F4 weapon system when it attempted to fire its missile. These phenomena were repetitive, recorded twice on two F4 fighters (Coms, Nav, armament) as well as on an airliner (radio).



4.2.5.4.2 Iranian EME case F14 vs. UFO: 2013

Journalist Babak Taghvaei reports⁴³ in Combat Aircraft Magazine that Iranian F14s attempted to intercept "UAV" believed to belong to the CIA and flying over Iranian nuclear facilities. These flying objects would be capable of hovering as at cruising speeds of Mach 10, of emitting bluish radiation and of implementing countermeasures with EME effects, disrupting the navigation and control electronics of the aircraft weapon systems.

We also note in this case a disturbance of the on-board electronics, but without noting any interference to the radars or communications.

4.2.5.5 Canadian case reported by UCS: August 28, 2013

The SCU group (Scientific Coalition for UFO) which cooperates with the SIGMA2 commission sent it an astonishing testimony (see Appendices A 4.2.5.5.1 and A 4.2.5.5.2), that of three brown bear hunters and images equipped with video means, having made a close encounter with a UFO. One of them, head of an engineering company working for the Department of Defense in the United States, forwarded his testimony to SCU⁴⁴, asking to remain anonymous, along with an analysis of the video signal from the camera⁴⁵.

They observed the craft flying silently at low speed and at low altitude, following a zigzag path (10 s cycle), turning on itself (1 min cycle) while emitting lights (16 to 17 different colors) synchronously. They then stopped their vehicle and attempted to use their Sony Cyber Shot camera in video mode to film the craft which was approximately 500 ft (300 ft altitude, 400 ft estimated distance) at the start of the sighting. The camera refused to work despite several attempts, each time starting for a short period of a second or two before stopping again.

A description of the device is made (see Figure 4.2.5.5.1); the object was surrounded by a bluish light about 12 to 16 inches thick reminiscent of a plasma induced by a very high voltage, leaving behind a kind of conical trail of 150 ft, of blue / white color accompanied white / yellow sparks. Likewise, one of the witnesses saw his Motorola cell phone reset after being on standby.

On another attempt to film the object which is a few miles away, the witness manages to turn on his camera, but the screen remains black. Wanting to turn on his phone again, he remains off but he finds it very hot.

Two more objects are observed before the three disappear at high speed. Several remarks can be made about these EME effects occurring at a distance varying from 500 to 1800 ft from the craft:

43 <https://warisboring.com/f-14s-versus-ufos-in-iran/>

44 Rapport du cas Ontario : <https://drive.google.com/file/d/1tFUKAABpBKfjZsIHysy86NBcHsibVF-/view?usp=sharing>

45 Analyse oscilloscope du signal de la caméra : <https://drive.google.com/file/d/1HsGbis7xaBoJeuUfiC5NKVmsgakEt0e6/view?usp=sharing>



- No disturbance was observed on the truck located at a minimum distance of 500 ft. The truck was stopped, then the engine was shut off approximately 4 minutes after the start of the close-up observation.
- The witness perceives an electric field which he considers to be an intense high frequency alternating field without any effect felt at a minimum distance of 500 ft (he notes that his hair is not on stand-up).
- On the contrary, the camera does not work normally, and the phone remains off, fully discharged after having had its battery overheated. The on-board radio (range 20 miles) also does not work. After the meeting, once recharged, the phone will work normally again.



Figures 4.2.5.5.1 a: artist's view of the object observed according to one of the witnesses
Figure 4.2.5.5.1b presence of a bluish luminosity similar to that of a plasma- (SCU courtesy)

Very short recordings were nevertheless made with the camera allowing the signal to be analyzed over 1.5s (machine at 600 ft), 13s (machine at 450 ft in front of the vehicle,) 2'17s (machine at 1500 ft).

These recordings reveal the impossibility of detecting a video signal in the field of the camera. On the other hand, they show interference cycles occurring at a regular period of 462 ms (which the witness attributes to the propulsion system for having observed light flashes during the interaction of the plasma with the air with a rate estimated at 0.5 s). These cycles combine bursts of 11 pulses of alternating current (see Figure 4.2.5.5.2) with a micro modulation-like waveform. In addition, the DC component also shows micro modulation.

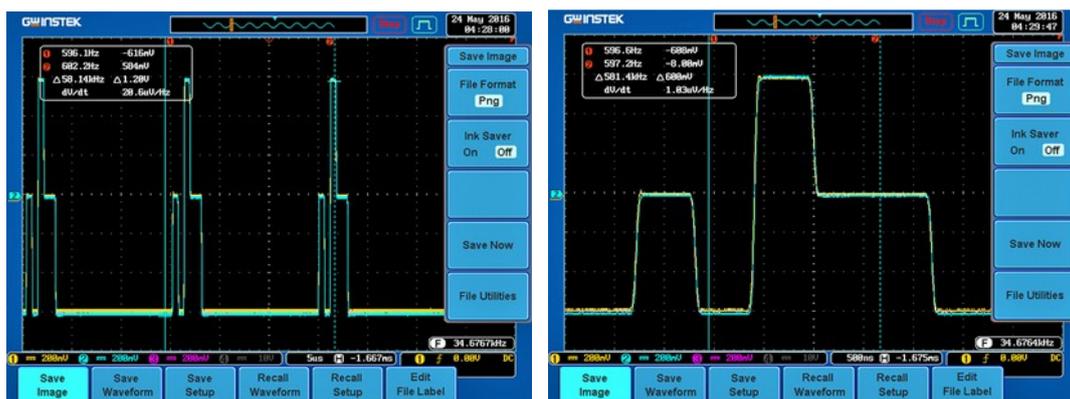


Figure 4.2.5.5.2 : interference signal (SCU courtesy)

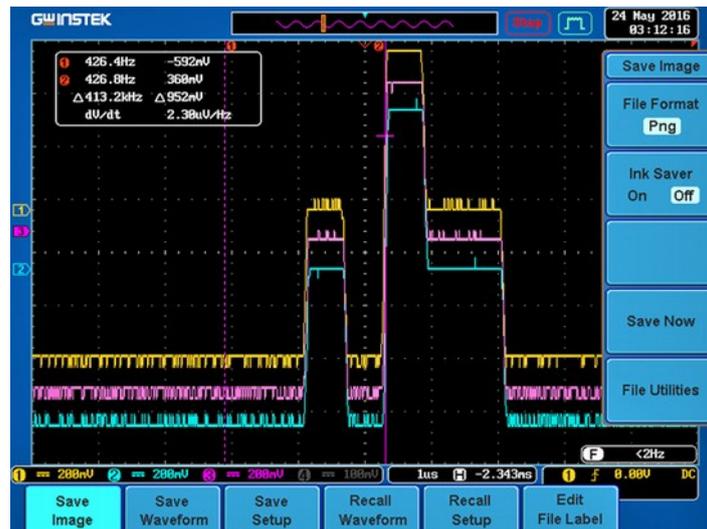


Figure 4.2.5.5.3 : modulation of the interference signal (SCU courtesy)

The witness wondered about the cause of these signals which may be due to interference caused by the propulsion system and the surrounding plasma which appears to be pulsating (light pulsation observed). It could also be intentionally generated to neutralize the camera recording, but this assumption did not appear to be accepted by the witness.

In conclusion, this case seems to show an EME effect linked to an interference between the EM environment and the luminescent one of the UAP, akin to a pulsed plasma possibly related to the propulsion (according to the witness). Likewise, these effects have generated a malfunction in the control electronics of the camera, sensitive photo cell circuits and the telephone, the battery of which has heated abnormally to the point of being empty. Such malfunctions are discussed in § 5.9 and 5.10.

The study of the signals recorded in this specific case should be carried out by comparing the precise characteristics of the electronics and their susceptibility to microwave radiation.

4.2.5.6 EME case in the presence of traces on the ground of PAN

Some cases of ANP on the ground are characterized by an EME effect on the environment and on witnesses.

Thus the case of Trans en Provence which occurred on 01/08/1981 is characterized by mechanical traces left on the ground but also on the vegetation. After biochemical analysis, a 33% reduction in chlorophyll and pigment levels was observed, regardless of the age of the leaves collected. If part of the chemical analyzes is subject to caution due to poor conservation of certain plant samples, however, there is a concordance between samples taken at different distances from the site of the prints, suggesting the decreasing influence of an EM field. This alteration of plants could therefore be explained by the effect of a very energetic, microwave-type electromagnetic field: it is



an EME effect. Similar effects were reported in the case of Valensole, where the vegetation of trees (apricot trees) close to the traces of UAP left on the ground, was dried in a particular orientation.

Close encounters between UAP and human witnesses induce effects which are described in § 5.11. Similar EME effects emerge, diagnosed by microwave-type radiation to varying degrees. In particular, microwaves emitted above 3 GHz induce thermal effects penetrating into tissues more than 10 mm thick (see § 5.11.4). They can also affect memory as described in the case of Alma Ata (see § 4.2.5.2.4) and explained in the chapter dedicated to physiological effects (see § 5.11). In the case of Valensole the controls suffered a number of effects (temporary but conscious paralysis, sleep disturbance).

We therefore observe many EME effects caused by microwave radiation over a more or less long time affecting human cellular tissues (thermal, cardiovascular effects,) or plants.

Similarly, the study of the olfactory effects (see § 5.11.10.8) induced by microwave radiation would have been observed during the recordings of traces of UAP, either by interaction between nitrogen molecules excited by MW interacting with pollutants in the air, or due to the chemical transformation of compounds in the soil. The Delphos sighting case (Kansas, 102/11/1971) revealed traces of carboxylic acids (R-COOH) in the soil believed to have been formed under the influence of microwaves.

Finally, we have the EME case with radioactive traces which occurred on December 28, 1980 in the forest of Rendelsham near the base of Benwaters (Suffolk, United Kingdom). This case is described in § 4.2.2.2 and concerns the landing of an unknown machine following the observation of a luminous phenomenon. Traces of radioactivity 7 times greater than normal atmosphere were recorded with a Geiger counter, measuring dose rates of X and gamma radiation. It seems that some military personnel who have approached the UAP closely have suffered after-effects. One of them was compensated for an unusual serious heart condition.

Ionizing radiation has been observed more rarely than the effects of microwaves often described with induced effects on vegetation or on electronics.

4.2.6 Cougar case analysis

4.2.6.1 Introduction

Among the cooperation initiated by 3AF / SIGMA2, that with the Chilean CEFAA (entity dependent on the Chilean DGAC for the study of UAP, similar to the French CNES / GEIPAN) began in 2013, followed by a meeting in October 2014 in Paris . On November 11, 2014, a Cougar helicopter (see Figure 4.2.6.1.1) from the Chilean navy observed a UAP: this is the “Cougar” case which was sent by CEFAA in July 2015 to CNES / GEIPAN,

to the IPACO⁴⁶ team and at 3AF / SIGMA2, accompanied by infrared and visible video. No radar data was available at the time, but it was stated that the helicopter could have been observed by radar, except for any other object nearby. The CEFAA concluded that the phenomenon seemed "invisible" to the radar. SIGMA2 submitted a detailed report in French and English on the Cougar case in March 2017, available on the 3AF site (section SIGMA2)⁴⁷.



FLYCOOL AT ENGLISH-WIKIPEDIA
A Chilean Navy AS 532SC Cougar helicopter in Mejillones, Chile.

Figure 4.2.6.1.1 – chilean cougar helicopter

4.2.6.2 First analysis of the case in 2015

The analysis of the video by the IPACO team provided in September and then in November 2015 concluded with the observation of an infrared source made of two hot spots (see Figure 4.2.6.2.1), the angular spacing of which decreased linearly. with time. This suggested a distant infrared source at constant speed on a course almost parallel to that of the helicopter. The (CEFAA's) assumption of a distance of less than 55 km led to the conclusion that a medium-haul carrier whose inter-reactor distance (around 11 m) was consistent with the angular separation of the two hot spots thus measured.



Figure 4.2.6.2.1 – visualization of hot spots - extract of IPACO report

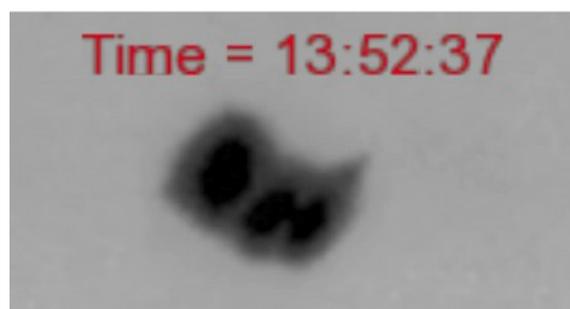


Figure 4.2.6.2.2- visualization of the 3 hot spots - extract of the IPACO report

46 IPACO : IPACO est un logiciel de traitement d'image mis au point par le Dr François Louange avec Antoine Cousyn et Geoffrey Quick pour étudier les images de PAN et déceler les éventuels montages.

Le Dr Louange fait partie du réseau d'experts du GEIPAN depuis les débuts, il a conduit l'audit du SEPRA, et il participe également aux travaux de SIGMA2. Rapport d'analyse IPACO : <http://www.ipaco.fr/RapportChileanNavyCEFAA.pdf>

47 <https://www.3af.fr/news/analyse-du-cas-pan-video-ir-gougar-cefaa-mars-2017-travail-collectif-1485>

A third hot spot (see Figure 4.2.6.2.2) was seen occasionally, supposed to be an APU (auxiliary energy generator motor) or a solar reflection on the cell. A plume (see Figure 4.2.6.2.3) was also observed twice. The observed object being supposed to fly at the altitude of the Cougar (4500 ft), the hypothesis of a contrail was rejected (too low altitude) in favor of a liquid drain, forming a priori a reflective trail. It also solar radiation.

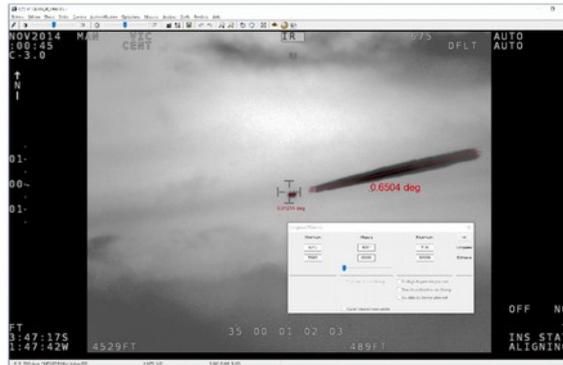


Figure 4.2.6.2.3 – plume visualization - IPACO report extract

A very brief analysis was made by a few experts from 3AF / SIGMA2 and sent to CEFAA in September 2015. Overall in agreement with IPACO's conclusions, it underlined the existence of two intense hot spots corresponding to nozzle exits. These very hot points created effects of saturation of the processing of the camera, resulting in a phenomenon of "blurring or fuzziness", which can be confused with the blur due to a plasma effect, as has been mentioned by the Chilean experts thereafter. The plume could be the effect of a solar reflection on a liquid spray or a contrail. The lack of radar data was regretted to better estimate the distances and to confirm the "radar invisibility" of the object.

However, as the Huffington Post article of January 5, 2017⁴⁸ underlines, the CEFAA experts maintained their questions regarding the analysis made by IPACO (absence of radar echo, formation of contrail impossible to the altitude of the helicopter, liquid spraying / emptying prohibited) and confirmed their own conclusion on the extraordinary nature of the case: a UFO.

4.2.6.3 An in-depth radar and optronics analysis of the case in 2017

Following the article in the Huffington Post, the CEFAA, at the request of SIGMA2, provided new and very useful data, which enabled progress to be made by combining radar and infrared observation data:

1°) the missing radar data made it possible to reconstruct the trajectories of the air traffic (see Figure 4.2.6.3.1), around the Cougar.

48 http://www.huffingtonpost.com/entry/groundbreaking-ufo-video-just-released-from-chilean_us_586d37bce4b014e7c72ee56b

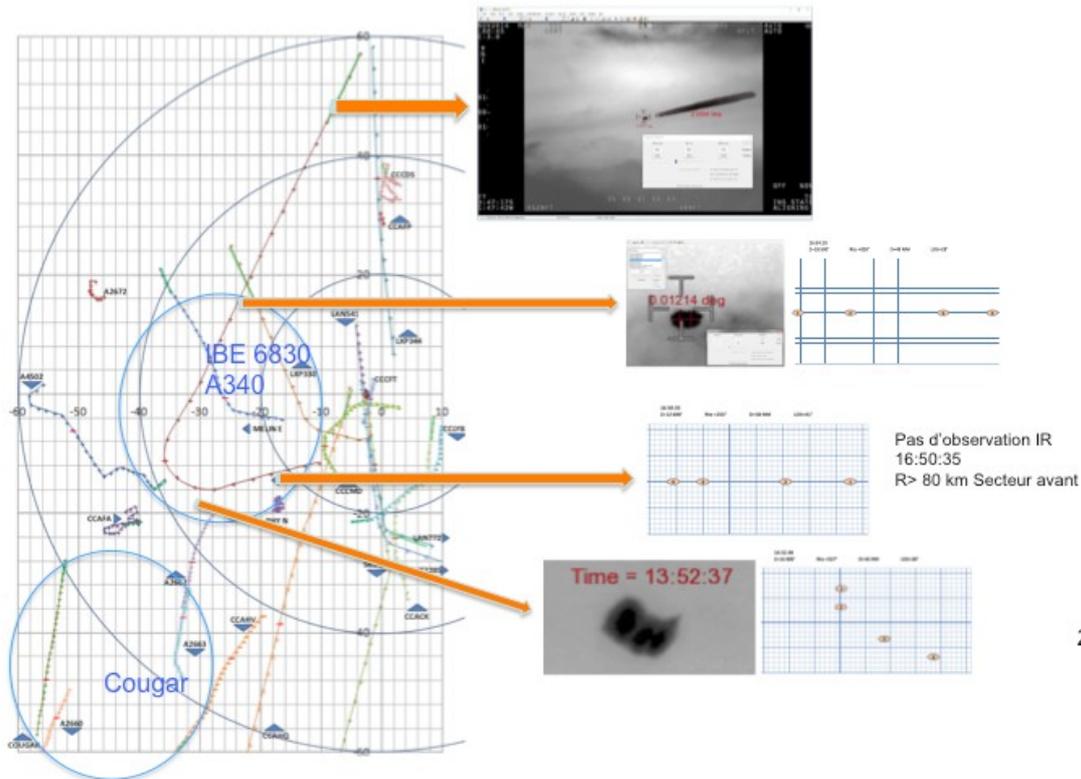


Figure 4.2.6.2.3.1 – civil air traffic control air situation around the Cougar - Santiago area

2) the two hot spots observed by the infrared camera can correspond to the thermal emission of the jet engine nozzles brought to high temperature, seen in the rear sector by the camera. It can also be that of two pairs of nozzles of a large four-jet engine, each pair of nozzles remaining combined in the same pixel of the camera.

3) by lifting the maximum visibility distance constraint (55 km) assumed by the CEFAA, which is not applicable in infrared⁴⁹, we found several possible candidates among the radar tracks. In particular, flight IBE 6830 (Airbus A340 in climb procedure after takeoff from Santiago), which follows a trajectory compatible with the angular evolution in azimuth and in elevation in the field of the camera. The relative observation geometry between the helicopter and the aircraft (see Figure 5) is consistent even in the phase of the aircraft turning at approximately 77 km (minimum observation distance) at 16:52:38 . The plane then begins a turn with a slight inclination and the relative geometry shows that the plane first presents itself from the front (weak radiation), then unmask the hot spots (nozzles), which will then be observed in its rear sector (start of infrared observation, intense radiation).

⁴⁹ The limit of visibility in the visible spectrum is not transposable to the IR spectrum. The range limit in IR is only due to the energy transfer range equation which induces the IR signature of the object (intense in the case of heavy carrier), atmospheric transmission, range and camera sensitivity.



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Figure 4.2.6.3.2- Reconstructed trajectories of the Cougar and of flight IBE 6830 (Airbus A340) - specific observation points and associated images - geometry of hot spots in the image plane

4 °) we have studied this particular phase and reconstructed the relative kinematics of the helicopter and the plane. We also studied the angle of view of the plane⁵⁰ seen from the helicopter as well as the relative positions of the nozzles in the image plane of the camera (plane orthogonal to the line of sight). At 16:52:38, the two left reactors can be seen as a single hot spot in the camera's resolution cell, while the two right reactors can be separated into two separate smaller hot spots. So that explains the three hot spots identified by the IPACO team. They will only be separated during this short phase. Previously, the aircraft was further away (inbound) and seen from the front. It then moved away in the climb phase, then observed from behind, revealing two hot spots, the left and right engine groups.

5 °) the trail observed later is a priori a condensation trail. Indeed, the analysis of the trajectory of the IBE 6830, shows a phase of ascent. The aircraft, observed under a slightly positive elevation (2.75 °) by the helicopter, was at a higher altitude when the plumes were emitted (between 26.8 and 27.4 kft then between 28.6 and 29.1 kft) and at a distance of around 180 km. The dating of the plumes has been compared to meteorological analyzes and coincides with the crossing of cold layers indicated by the emagram⁵¹. The contrail is made of solidified water droplets, which strongly reflect solar radiation, the apparent temperature of which is very high (5900 ° K). This explains why the level of radiation from the plume in the images is comparable to that

⁵⁰ The aspect angle is the angle of the line of sight with respect to the longitudinal axis of the observed object.

⁵¹ We are awaiting confirmation from aeronautical meteorological specialists to confirm the conditions for the formation of condensation trails but the overlap between the trajectory, the hot spots and the crossing of the altitude bands where cold air zones are present leaves little room to doubt.



of the hot spots of the plane (engine exhausts). In addition, the special position of the sun promotes near-grazing radiation relative to the axis of the plume, which further amplifies the phenomenon of reflection of solar radiation.

On the other hand, the orientation of the plume relative to the aircraft speed is consistent with the composition of the aircraft speeds and the wind which results in an offset of the contrail.

4.2.6.4 Conclusion

In conclusion, the object was seen on radar, but the infrared sighting distance was greater than the supposed limit of 55 km. The different observables are compatible with each other. From our point of view, the PAN is none other than an Airbus A340. The Cougar's camera can detect hot nozzles in the rear sector and condensation trails.

This analysis therefore does not reveal a case of extraordinary UAP. On the other hand, it is very instructive to demonstrate that an analysis based solely on a visual or optical observation by a witness or by a camera, can lead to erroneous conclusions due to the lack of objective data which is replaced by the interpretation of witnesses, especially for estimating distances. The combination of observables from different techniques, in particular radar and optics, is particularly useful thanks to their complementarity: the radar situation makes it possible to resolve ambiguities on distances and speeds, to refine the position of aircraft and to identify the radar signatures (for primary radars) or an unknown phenomenon.

The visible or infrared image, without distance information, nevertheless makes it possible to describe the shape, the radiated energy and the map of the hot spots.

5 Observed phenomena - physical effects

5.1 Imaging in the visible

5.1.1 Observation and photos in the visible

Photographs of UAP or their traces can be found on the Internet, there are photo databases such as the Spanish FOTOCAT database but there does not seem to be any French photo database apart from the rare photos present in the GEIPAN database or from archives; they are old, most of the testimonies only being accompanied by drawings reproducing the observations (case of flight AF 3532, case of Amarante, etc.). Some others are accessible, such as the photos of Lake Chauvet (see § 4.2.1) whose special effects have been demonstrated by IPACO. The same is true of old American documentary databases, where drawings are numerous, but reliable photos are rare. Finally, the archives of the British MOD, already cited, offer some too rare examples of photos (see Figure 5.1.1.1 and Figure 5.1.1.2). What reliable physical information can we extract from such a diverse collection? The observations recently reported by the US Navy mention IR videos (subject discussed elsewhere) but also photos that would have been taken by US Navy pilots with smartphones recently (2019); we are awaiting the publication of the report of the UAP Task Force US to find out what is the degree of authenticity and the conclusions of the US experts.

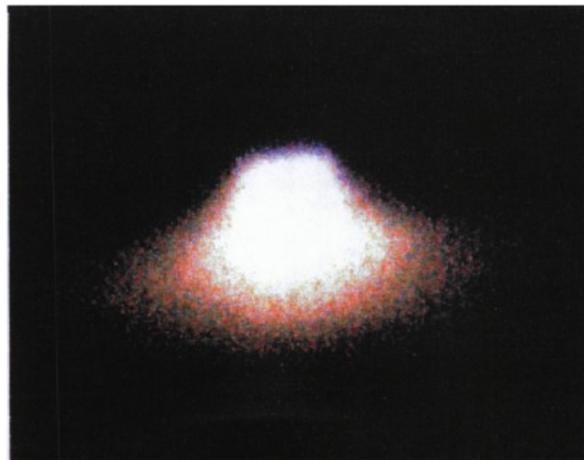


Figure 5.1.1.1- photo of a disc shape, taken from MOD UK report¹

¹ *Unidentified Aerial Phenomena in the UK Air Defense region* N°55/2/00 UAP Vol.2 p.151-162 & Figure 14 p.11-14, Condign project

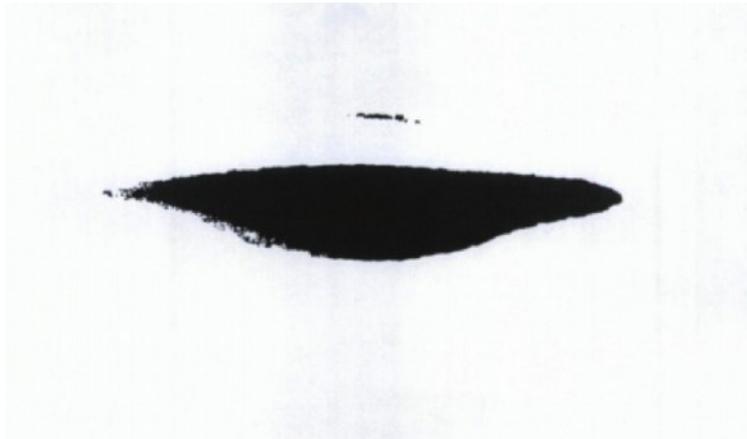


Figure 5.1.1.2 - Photo of a silver disc shape (20-30ft in diameter) 1993, extract from the MOD UK report

In addition, beyond special effects, some photos can reflect very real phenomena not understood by the author of the photo such as the Blurfos which cause fairly frequent erroneous interpretations, the flights of birds or insects being assimilated to UAP.

The term “blurfo” (see Figure 5.1.1.3) was formed from “blurry” and ufo to characterize a pseudo-UAP resulting from poor focus or movement of an object during of the shot. This object is often an insect (see the theory of "rods" and flagellum animalcules on Wikipedia).

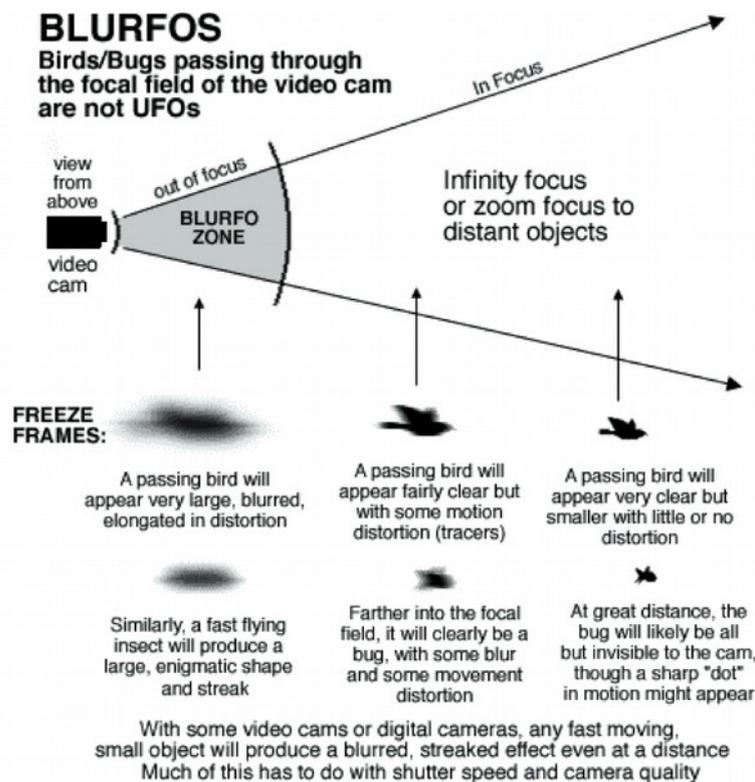


Figure 5.1.1.3 "Blurfos" are blurry, defocused images of a moving insect or bird taken by chance by a camera lens and mistakenly taken to be a "UFO"²

2 *Blurfos are not UFOs* by James Neff



5.1.2 Digital photos and analysis software

Photos in the broad sense (film or digital, films, videos) are particularly sensitive documents in the field of UAP. Indeed, they offer the public a concrete representation of unidentified phenomena, which gives them the value of "absolute proof".

Moreover, it is in this area that one encounters the most deception, a document of this type sometimes representing a market value. Between these special effects and the many types of misunderstandings or unintentional false maneuvers, investigators have always been confronted with a large number of dubious or unusable clichés.

The facts of the problem have changed dramatically over the past two decades, with the massive emergence of digital cameras and camcorders, which have very quickly spread to the general public, especially with the massive spread of smartphones.

At the same time, the possibilities for special effects within everyone's reach have become endless, thanks to the availability on the market and the ease of use of numerous software for retouching, distorting and synthesizing digital images. Some mobile devices offer editing tools for superimposing images, artificially aging a snapshot, producing motion effects, or even embedding fake UFOs! Technical developments have quickly extended the scope of these changes to the field of video.

These upheavals had two major direct consequences for the study of UAP:

- The probability that a fortuitous witness has a camera in working order at the time of the facts, extremely low in the past explaining the virtual absence of exploitable documents, has increased considerably nowadays with the explosion. smartphones.
- The ease of computer manipulation of digital images has made even more true than ever the principle that **a photo can in no way constitute proof of anything on its own.**

Based on decades of experience as an expert on this subject with CNES / GEIPAN, François Louange, over the past ten years, with the financial support of CNES, has developed a methodology embodied by the authentication and photo / video analysis IPACO software.. This software, which has no equivalent, is constantly evolving, and it can effectively help the analyst to authenticate documents and then analyze them.

The site www.ipaco.fr, managed by 3 specialists of the "IPACO team", presents in detail the state of the art in the field of authentication and extraction of objective information from a photo or video on which an apparently unidentified object or phenomenon appears, such as from analysis files produced internally or at the request of CNES / GEIPAN. The IPACO team is of course working with them as well as with the Sigma 2 Commission.

One of the examples of IPACO operations on cases handled by GEIPAN is in particular

the case of Lake Chauvet (see § 4.2.1) already mentioned or the Golfech case.

The case of Golfech in 2010, taken from the GEIPAN database, refers to drawings representing the object observed by one of the two witnesses, while a video deemed taken with the smartphone of the second witness, was analyzed in the GEIPAN survey³ (see Figure 5.1.2.1) and does not allow a clear conclusion either on the presence of the object in the image, or on its nature.



Figure 5.1.2.1 - Golfech case photo taken from video taken by the second witness with a smartphone

5.1.3 Plasma radiation in the visible

The visible image of an object is generally generated by the reflection of sunlight (or lunar) on the object itself (or even that of the atmosphere, for example the blue of the sky on the sea).

However, high temperature bodies emit continuous black body radiation, the frequency spectrum of which corresponds in part to visible radiation. This is the case of the sun (Black Body Temperature 5900 ° K which radiates in the UV (0.1 to 0.45 microns), the visible spectrum (0.45 to 0.75 microns) but also in the infrared beyond 0.75 microns). This explains the reflection of sunlight on terrestrial objects or the atmosphere and its meteors in this part of the spectrum. It is also the same in the infrared spectrum. This is a continuous black body spectrum.

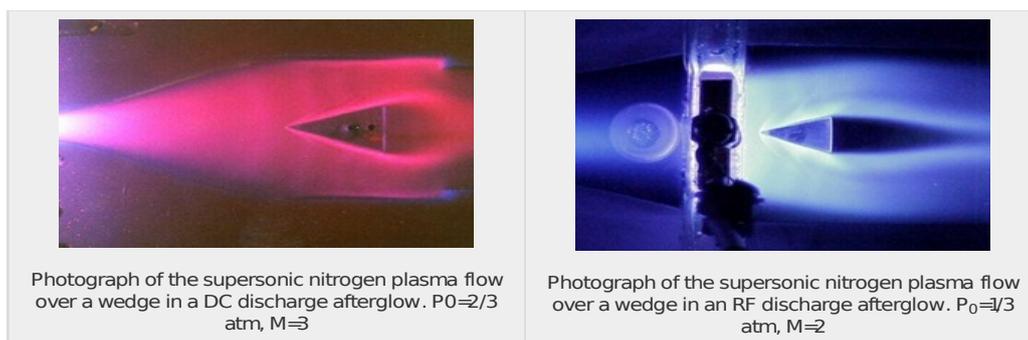
However, gaseous elements can be energy carriers or even brought to very high temperature. These are, for example, combustion gases at the nozzle outlet, gas plasmas linked to the intense heating of the air flow during atmospheric re-entry or else generated by a deposit of energy of electromagnetic origin (deposition by an energy generator, MHD process, breakdown of the atmosphere in the event of a lightning strike, etc.).

In this case, the plasma or ionized gas comprises electrons animated by a high temperature which induces radiation in the infrared, the visible or even the ultraviolet,

³ cas GEIPAN GOLFECH_82_06.10.2010_T2-Cgei_Cm_V_O_T2video_V061010_20.17.3gp

identified by emission lines (or a color) characteristic of this gas. (it is a frequency spectrum, a sort of characteristic signature of the gas). For example, ionized nitrogen emits in violet blue ($0.39 \mu\text{m}$), ionized oxygen radiating in green ($0.557 \mu\text{m}$), and red ($0.630 \mu\text{m}$).

It is not our purpose to go into more detail on the theories on body or plasma emissions. However, we cite an article⁴ which describes experiments on plasmas induced by supersonic aerodynamic impact zones (Mach 2, Mach3). The nitrogen plasma generated (see Figure 5.1.3.1) therefore exhibits radiation ranging from blue (at Mach 2) to purple (at Mach3). These tests allow studying the influence of plasma and ionization contributing to the control of impact zones, in connection with MHD techniques, drag reduction control, etc. (see article and commentary on the figure).



Reports of anomalous shock wave behavior in weakly ionized plasmas have recently stimulated considerable interest due to possible implications for supersonic flow control. These may include drag reduction, varying lift-to-drag ratio, MHD energy extraction, and MHD boundary layer control. This phenomenon has been extensively studied for the last 15 years, mostly in Russia at the A.F. Ioffé Physicotechnical Institute in St. Petersburg and the Radio Technical Institute in Moscow. More recently, similar experiments have been conducted at the U.S. Air Force Laboratories - Wright Patterson and the Arnold Engineering Development Center. The results demonstrate the following effects:

- acceleration, weakening, and splitting of shock waves launched into glow discharge plasmas with ionization fraction of 100 ppb - 1ppm
- weakening of a bow shock formed ahead of a projectile moving through a discharge plasma at a supersonic velocity (shock stand-off distance increase)
- dramatic wave drag reduction on the projectile (up to 50%)

Figure 5.1.3.1 – photos of shock layer nitrogen plasmas with MHD control

This type of radiation could evoke the bluish emissions reported by the Tornados pilots having observed a machine flying 500 yards in front of their aircraft (Mach 0.8; 8000 m) during the reentry of November 5, 1990 (see § 4.2.2). Or would it be the atmospheric reentry observed closely this time, then accelerating in an astonishing observation geometry. This second hypothesis seems doubtful, in the specific case of the sighting by the Tornados, whereas it is quite probable for the observation made by a large number of witnesses located at a great distance from the re-entry path (see § 4.2.1).

⁴ <https://netl.engineering.osu.edu/shock-wave-control-plasmas>

The same is true of the more recent report of sightings allegedly made by Iranian F14 pilots who attempted to intercept drones (supposedly American⁵), an event reported in a Spooked article: Iranian Pilots' UFO Encounter May Have Been With an American Mach 10 Drone by David Ax Follow @daxe on Twitter L. These drones would have had the following characteristics:

- an unusual kinematics (Mach10),
- an emission of **blue** radiation (again)
- a neutralization effect of the fighter control electronics (see § 5.9 and 5.10 relating to EME effects).

What is it about ? Could it be an emission from a plasma emitted by an aircraft using low-energy MHD-type technology? Nitrogen thus ionized by a device contributing to stealth and aerodynamic flow would radiate in the blue (Figure 5.1.2 b)?

5.2 Infrared imaging and signature

This document does not claim to be exhaustive on the subject of IRS, it just sums up a few generalities on objects that we are likely to encounter.

The IR Signature (IRS) mainly reflects the heating of all or part of an object. It is therefore indicative of an activity index.

Figure 5.2 below illustrates this fact by showing the blackbody radiation law as a function of wavelength for different temperatures.

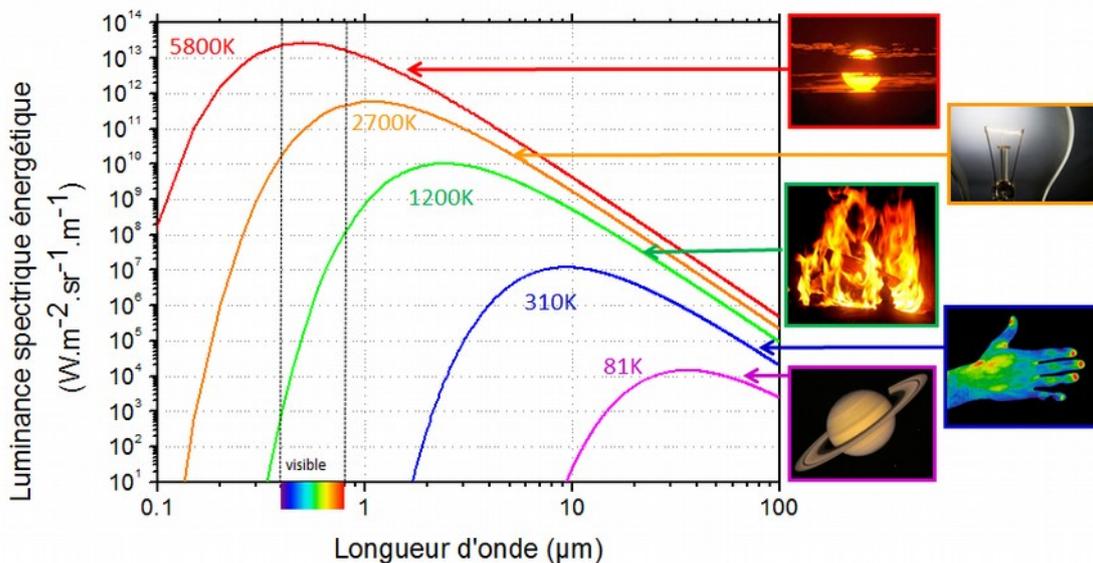


Figure 5.2.1 : IR spectrum radiated by different types of objects (different temperatures)

5 <https://nationalinterest.org/blog/buzz/spooked>

It is important to note that the more the temperature increases, the more the emission peak moves towards the visible range, but also and above all, the more the signal increases in the infrared range.

5.2.1 IR signature of drones

There are mainly 2 types of propulsion: electric propulsion and micro-turbo. They will be characterized by totally different IR signatures.

In electric propulsion, there is a fairly uniform heating of the drone which leads to an IR signature of the black body or gray body type. The typical values provided by the reference article are between 30 and 50 ° C depending on the models, the flight time, the initial conditions, etc. These values are very similar in band 2 and in band 3, which confirms the gray body appearance.



Figure 5.2.1.1 : thermal image of micro drone in band 2 (gray body type emission)



Figure 5.2.1.2 : thermal image of micro drone in band 3 (gray body type emission)

In the case of micro-turbo propulsion, the main contributor to IRS will be the plume made up of combustion products, that is to say mainly hot gases (CO_2 , H_2O , CO , etc.).

The figure below gives an example of a SIR of a jet expressed in cm^{-1} . The 2 peaks correspond to the emission of hot CO_2 around $4.3\mu\text{m}$, the main contributor to the IRS.

Example of turbo jet plume spectrum

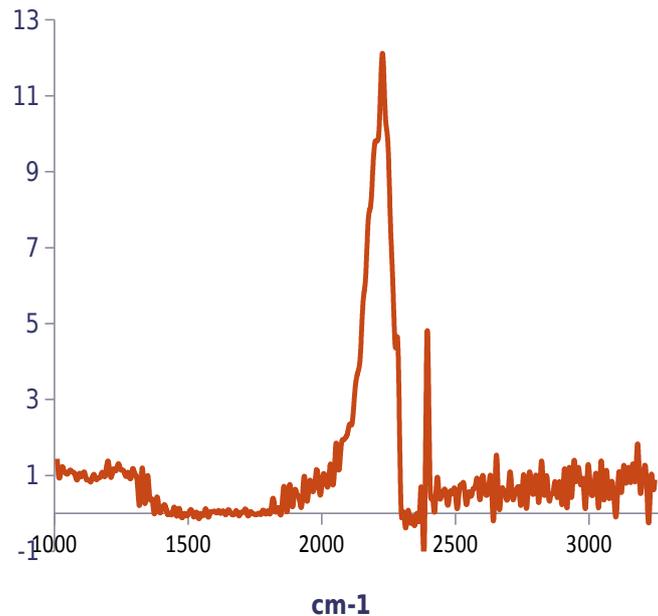


Figure 5.2.1.3 – Example of liquid jet spectrum

It is difficult in this case to speak of apparent temperature or gray body and the IRS is totally different in band 2 and in band 3 where the gases do not emit.

In band 2, the airframe whose temperature will be between 30 and 50 ° C (apart from the nozzle) will have a low contribution in front of the jet whose apparent temperature in band 2 will typically be 200 to 300 ° C.

In band 3 on the other hand, the plume will be hardly visible, the cell will be the main contributor except when the nozzle is visible (temperature above 100 ° C).

In both cases (band 2 and band 3), the aspect angle⁶ of the UAV will have a significant effect on the IRS.

A similar effect is observed on the IRS of an airplane propelled by a turbo-jet engine where the hot zones of the air inlet or nozzle are clearly visible in band 2 in a resolute manner at short distance (see Figure 5.2.1.3) or in a less resolute way at long distance. The signature is strongly directional, intense in the forward sector (air inlet - see Figure 5.2.1.3) and very intense in the rear sector (emission from the nozzle outlet visible at a great distance - see Figure 5.2.1.4).

⁶ The aspect angle of an object is the angle between the Line Of Sight and the longitudinal axis of the object



Figure 5.2.1.4 : 2-band air inlet airframe image

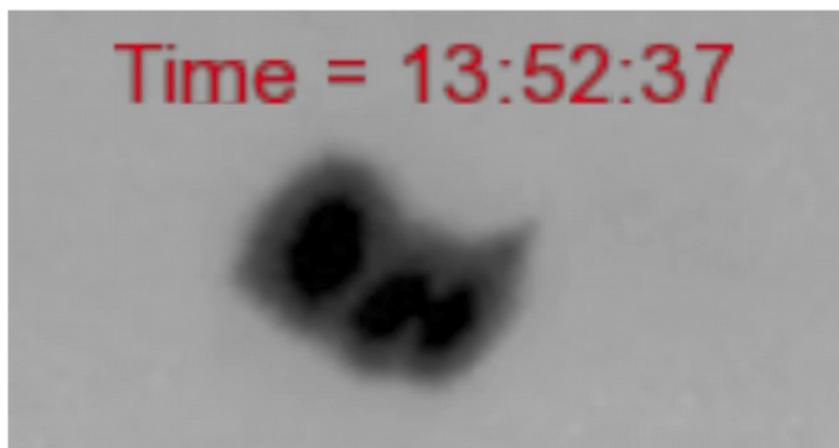


Figure 5.2.1.5 : image of band airframe 2- high temperature nozzle outlet rear ¾ sector views - low resolution - long distance

5.2.2 Thai lantern



Figure 5.2.2.1 : Thai lantern - image in the visible spectrum

Typical size is less than 1m. We performed IRS measurements on 2 types of lanterns of comparable sizes. The measurements are taken outside, but by retaining the lantern by a wire so as not to drop it in the Paris region. The measurements are carried out with a band 3 thermal camera and a thermo point which provides a poor quality image but a very good apparent temperature measurement. Some examples of the images obtained are given below.

A fairly high measured temperature (between 50 and 60 ° C) is observed, confirmed by contact measurements. As the lantern is "captive", these measurements correspond to a maximum. However, these values must be achieved for the lantern to fly. The ambient temperature was 4 ° C.

The combustion of the fireplace lasts about 5 minutes and the temperature rise takes between 30 and 60 seconds. On the other hand, the thermal inertia is very low (a few seconds) and the IR signature drops very quickly as soon as the flame goes out or a gust of wind covers the lantern.

In summary, the lantern's IR signature is significant as long as the flame is burning, but collapses very quickly.

At night, the visible signature is important; that's what these lanterns are all about.



Figure 5.2.2.2 : Thai lantern - Example of an IR band 3 image



Figure 5.2.2.3: thai lantern

Thermo point image: the temperature displayed at the top (52.8 ° C) corresponds to the center of the image, the 3 measuring points at the periphery give an idea of the dispersion.

5.2.3 Missiles or rockets

For these objects, the signature is reduced almost exclusively to the propellant exhausts plume.

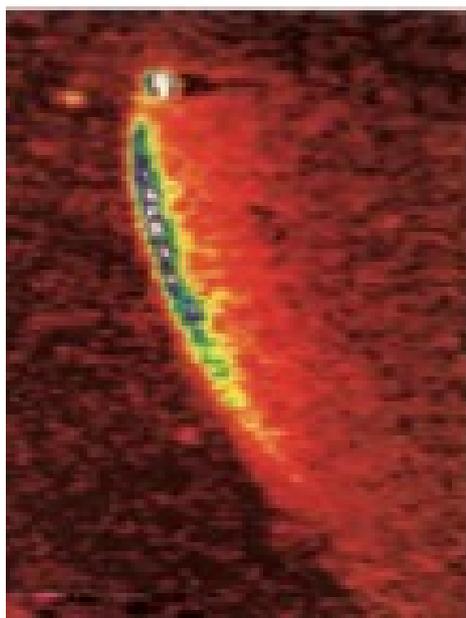


Figure 5.2.3.1 : exhaust plume signature in band 2
high altitude - asymmetric impact zone (angle of attack)



A missile test off the California coast sparked frenzy on social media and spooked residents Saturday who believed they had just seen a UFO. (Photo courtesy: Twitter)

**Figure 5.2.3.2 : exhaust plume signature in visible spectrum
high altitude - symmetrical impact zone (zero angle of attack)**

The extension of the plume will strongly depend on the flight altitude: at low altitude (less than 20-30km), the plume will have a pencil shape, but at higher altitude (much lower pressure), we observe a burst of the plume which widens strongly (see Figure 5.2.3.1 above in IR and 5.2.3.2 in visible).

There are mainly 2 types of propellants: liquid or solid aluminized.

In the case of the liquid propellant (scud, vulcan engines, etc.) the signature is that of the hot gases as represented above.

In the case of a solid propellant, the alumina particles heated to a very high temperature give the plume a black body type behavior.

There are a few non-aluminized solid thrusters for tactical missiles (small anti-tank type missiles) and in this case, we have a hot gas type signature. There are also many variations in the composition of the propellants which will result in the presence or absence of certain chemical species in the plume; however, the main contributor is hot CO₂.

To conclude, we stress the importance of the complementarity of sensors (infrared, radar, visible, near infrared, active, etc.) in order to understand a situation. The 2 images below illustrate this complementarity. On the first, we have a Fouga Magister airplane daisy on the ground observed by IR-radar and visible; on the second, we have a visible-near IR and IR face image. In both cases, we see that the image information is significantly different from one spectral domain to another, and that each provides a type of information, whether on the object or on the environment.

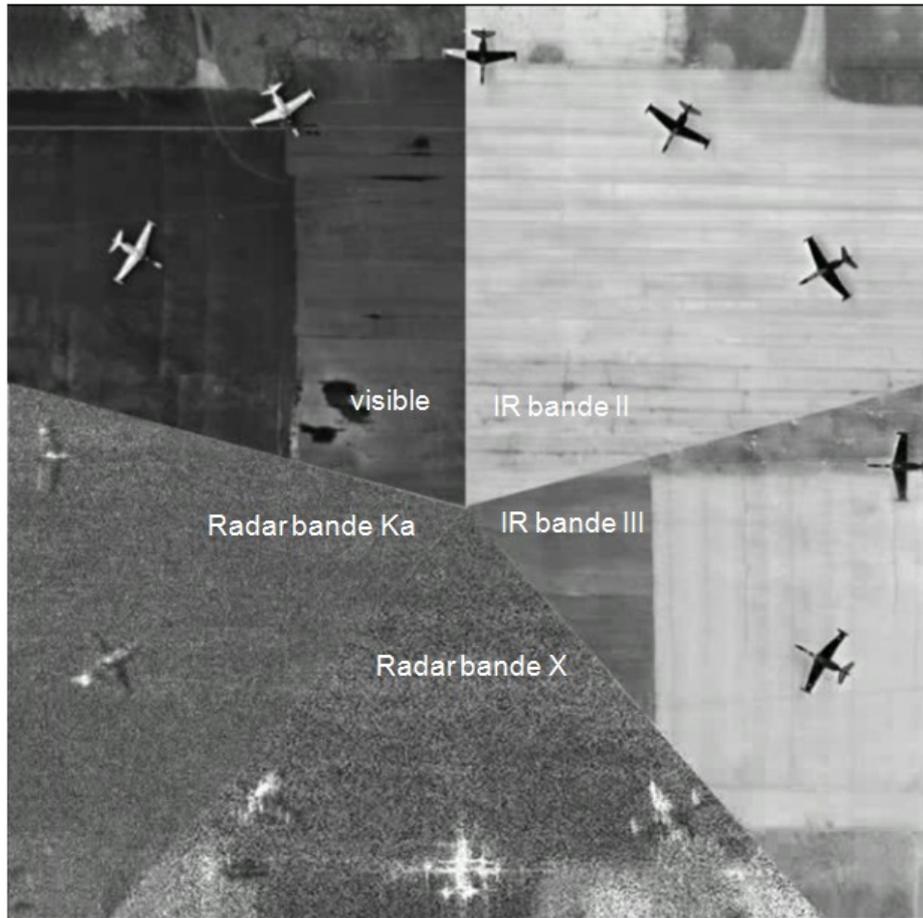


Figure 5.2.3.3 - Marguerite from the Fouga Magister plane on the ground observed by IR-radar and visible



Figure 5.2.3.4 - Visible-near IR and IR face image



5.3 Ultraviolet imaging

No objective information is available in this frequency range, although ultraviolet radiation is mentioned in the Belgian work of COBEPS.

5.4 Radar and plasma detection

5.4.1 Radar detection

Radar detection is a definite plus in that it conventionally indicates the presence of an object in the atmosphere by measuring its position (including distance) and speed, and especially when it is associated with visual observation. However, there are many issues that prevent this means from being fully reliable for SIGMA 2 research. These issues are reviewed. The radar-visual correlation is not always conclusive. This is in particular the case of flight AF3635 of 1994, for which the radar and visual observations were synchronous but shifted in space, without an explanation being able to be offered.

The majority of cases reported are old. Useful information is almost non-existent in most countries. The American data are old, those of military origin became confidential in 1954 (JANAP 146C regulations) and declassified with regard to the Blue Book Project archives, including some rare radar data such as the photos of the B52 radar scope in the 1968 Minot AFB case.

The case most often cited for the radar observation is that of the observation carried out by an RB47 (US Air Force Electronic Intelligence aircraft) on July 17, 1947: the onboard radars recorded animated phenomena of a high speed, moving away and approaching the plane, with variable RCS (echoes oscillating from strong to weak) and a pulse frequency attributed by some to plasmas around 3 GHz. Likewise, observations were made in 1959 by a B52 followed by a UAP, which recorded with its recorders emission frequencies around 3 GHz and 9 GHz.

Radar detection also inherently presents a number of difficulties:

- There may be aberrations resulting from an abnormal path of electromagnetic waves due to unusual characteristics of the atmosphere (temperature inversion, inhomogeneous concentration of water vapor). Some theories have been proposed such as "ducting" which leads to the detection of real and very distant objects on the ground, apparently at high altitudes, giving the illusion of high trajectories. It would be useful to make a scientific update on electromagnetic aberrations and to determine if the radar detections of UAP take them into account.
- Radar detectability is also difficult for stationary or moving phenomena at low speed in ground clutter.
- Similarly, radar tracking becomes difficult when an object is animated by an aberrant kinematics with respect to the classical flight mechanics, with

strong accelerations applied (sometimes close to 100 G) which do not correspond to any behavioral model for a conventional aircraft, the structure of which would moreover not withstand the mechanical or thermal stresses induced.

- The behavior of these “non-standard” phenomena then makes detection and tracking inoperative, when the speeds are much higher than the speed filters (speed limit generally Mach 3 for air defense radars), the object then either is rejected by the filtering, or is subject to spatial and temporal positioning errors (Doppler migration effects, unsuitable distance box). In addition, the kinematic models used for forecasting positions can be faulty. It is then difficult to position the radar beams in the right direction to renew the measurements, because the phenomenon in this case escapes the tracking logic.

The radar detectability of UAP is therefore unreliable. That advanced aircraft (see Figure 5.4.1) and certain stealth aircraft could have been developed within the framework of military or intelligence programs and could have given rise to UAP observations cannot be excluded since this was the case for the Lockheed U2. On the other hand, any generalization is prohibited and the existence of the supposed TR3B, SR75 and Aurora is a matter of speculation. Devices such as UAV or hypersonic missiles can make it possible to establish classes of objects observable by radar, defined by a speed, altitude, radar signature performance template, etc. (see §5.12.3.4 and 5.12 .3.5) in order to distinguish them from UAP whose kinematic, electromagnetic and infrared characteristics may be different.



Figure 5.4.1.1- Photos of advanced aircraft

In the future, it would be desirable to have a non-directive, omnidirectional radar observation that does not require any pointing, in order to facilitate tracking (subject dealt with in §6. *Observation*).

5.4.2 Plasmas

Phenomena of atmospheric spheres or balls of plasma are sometimes observed visually and by radar (NARCAP Sphere Project report below or Hessdalen spheres below).

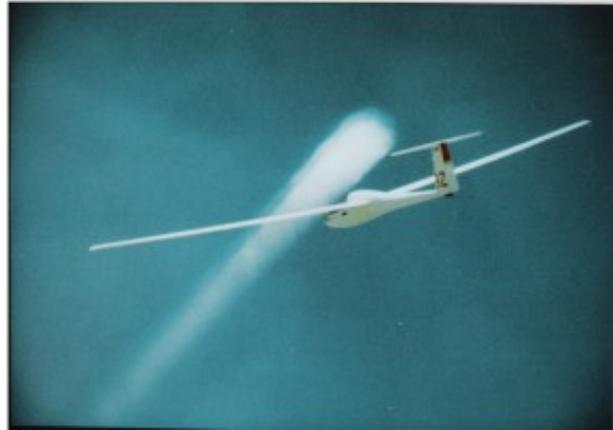


Figure 5.4.2.1- Image of a ball of light flying at high speed near a glider

To address these questions, we will rely on the report drawn up in December 2000, by the MoD UK report, “Defense Intelligence Analysis Staff” (DIS) of the United Kingdom, and partially declassified since.

In this report, the operational and physical aspects are closely linked, and this seems to us to be a good process; this is why we will adopt the same approach. At the end of the paragraph we will quickly give our vision concerning the physics concerned.

The declassification of the report concerned certain chapters; others remained classified. It seems that the latter are dedicated to potential military applications of observed phenomena. One of these chapters is clearly titled “radar performance; potential military applications”.

Overall, the executive summary explains that, based on the data available within the DIS department, and which include all the testimonies over a period of thirty years, it clearly appears that the phenomena described do not “seem to be explicable in the framework of a known technology or phenomena”.

These data will therefore be used for two purposes. The first is whether these phenomena are likely to present a danger to the security of the United Kingdom : the answer is no, even if caution recommendations are made to pilots. The second is to know if we could learn lessons likely to improve the performance of the weapons of the United Kingdom (Anglo-Saxon pragmatism) or Russian, the report describing the studies of UAP and plasmas made by Russia for military purposes, decoy in particular.

Overall, the answer is, according to this report, that one is often faced with atmospheric phenomena or related to bodies re-entering the atmosphere (or meteorites), and in no



case to something from a foreign power or "Extraterrestrial", although extraordinary cinematic performances are mentioned as well as the ability to land. What is it all about ?

The findings, interesting for military technologies, refer to what they call floating "charged masses" (say plasmas). Their abilities to mix, separate, float, rise, dive and accelerate are not understood. The plasmas and magnetic fields that have often been observed are one of the big surprises of this study.

One of the final recommendations of this study is that we must continue to study phenomena of this kind with a view to military applications in the field of decoy and active stealth, in particular with regard to radar reflectivity.

From the physical point of view, a plasma becomes a Radio Frequency reflector (and therefore detectable by radar) for any incident electromagnetic wave whose frequency is lower than a specific cutoff frequency (called plasma frequency or plasma pulsation) proportional to the square root of its electronic density (degree of ionization).

It will be characterized by its radio signature (RCS, linked to the electronic density and the frequency of the radar) and by its speed, measured by the radar (Doppler measurements, filtering of position / distance measurements to estimate the trajectory).

It is therefore clear that the control of this type of plasma can make it possible in space to reveal "zones" whose radar cross section will be "controllable", allowing decoying (electromagnetic or IR homing seekers⁷ for example in the case of LIPF Laser Induced Plasma For IR homing counter-measures system⁸) or "masking" by active stealth making it impossible to identify as it is generally seen by radar processors. These subjects are also mentioned as a research theme in the American AATIP program⁹ which has since been revealed. Of course, the generation of plasmas can be of natural origin (plasmas of atmospheric reentry of meteoroids), or induced by aerochemical mechanisms linked to devices interacting with the atmospheric environment.

The fact remains that the extraordinary mobility (acceleration) of these objects, very often mentioned in testimonies, remains absolutely inexplicable to this day.

The rapid displacement of UAP is difficult to explain by a macroscopic collisional plasma of natural origin moving in dense air (normal temperature and pressure conditions) at hypersonic speed. Such a plasma would have a high energy density ($> 5 \times 10^7 \text{ J} / \text{m}^3$ for a speed of $104 \text{ m} / \text{s}$) stably confined over very long distances (100 km in the case of UAP). No natural mechanism leading to such conditions has yet been identified. This model is also unable to describe the observed accelerations and decelerations, in intensity and direction (90 °, sudden reversal).

7 <https://www.forbes.com/sites/davidhambling/2020/05/11/us-navy-laser-creates-plasma-ufos/>

8 <https://patentimages.storage.googleapis.com/ad/27/1c/baede7d8638bd6/US20200041236A1.pdf>

9 see DIA letter on AATIP <https://fas.org/irp/dia/aatip-list.pdf> depicting the AATIP themes of research including invisibility cloak AATIP



In the cases of the appearance of luminous phenomena (and reflector on the radar) moving in the air and attributed to plasmas, we can distinguish 3 cases; plasmas resulting from combustion, plasmas of aerodynamic "compression" and plasmas of electrical origin.

- **Combustion plasmas**

These plasmas result from exothermic chemical reactions between a fuel (kerosene, hydrogen, wood, etc.) and an oxidizer (oxygen in the air here). Typically, in the case of a flame, these plasmas are weakly ionized. Their movements are defined by those of the surrounding neutral air (advection) and by their own diffusion (function of the gradient of their density and temperature). These two mechanisms are collisional: the atomic collisions induce, step by step, the transfers of momentum, a process which cannot therefore exceed the local speed of sound (<1 km / s for a typical flame) .

If these combustion plasmas are ejected at supersonic speed by a turbojet / ramjet / scramjet, they generate zones of compression by colliding the flow of ambient air and the radiation induced as in the following case.



Figure 5.4.2.2- Schematic diagram of a combustion plasma

- **Compression plasmas**

These are the ones that accompany a hypersonic reentry body (like meteoroids). The retracting body constantly creates intense aerodynamic friction, with high pressure, which causes a shock wave (mach disk, see Figure 5.4.2.3). In the shock frame of reference (see Figure 5.4.2.4) a considerable part of the kinetic energy of the atoms of the incident cold air is transformed into thermal energy under the action of viscous forces: a subsonic hot compression zone (layer of shock) is formed between the shock and the reentry body. When the temperature is sufficient, this layer is ionized, luminous and opaque at radio frequencies. Seen from a radar, the newly created plasma is animated by an "apparent phase velocity" which is that of the reentry body; however the plasma does not "follow the reentry body" and will drift with its local atomic speed as a trail or wake (meteorite wake) off the lead plasma.



Figure 5.4.2.3- Schematic diagram of a compression plasma

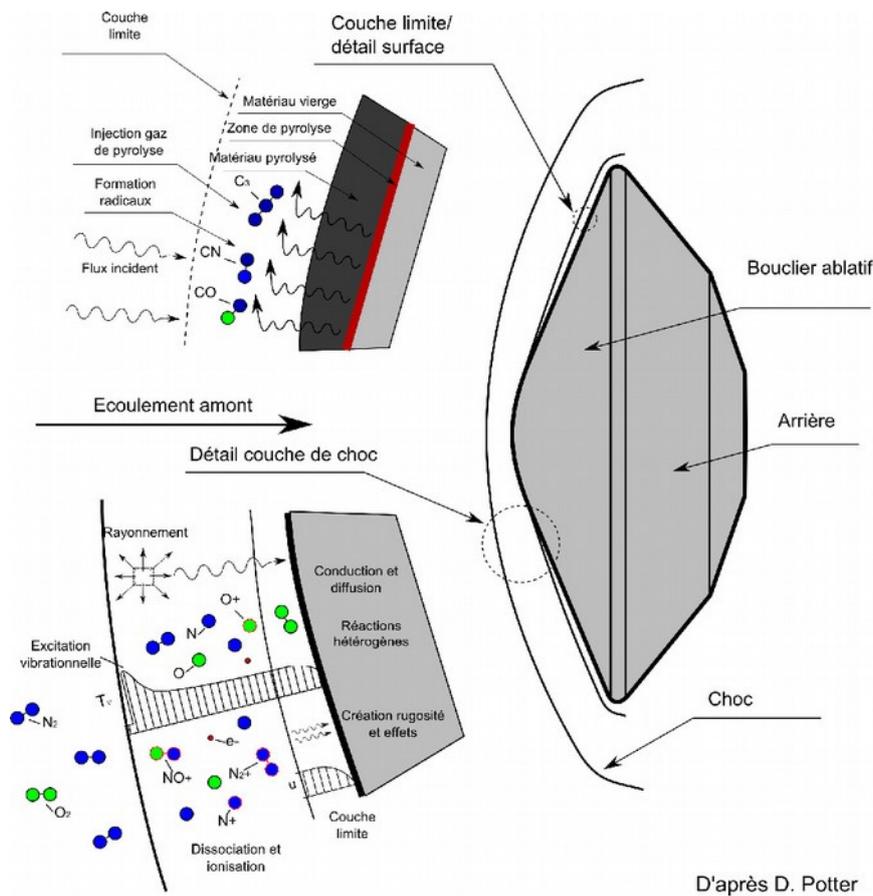


Figure 5.4.2.4: Hypersonic flow interaction with heat shield
(License: Creative Commons Attribution-Share Alike 4.0 International)

- **Natural plasmas generated by an electric field**

Plasmas of natural origin, generated by an electric field, are more complicated because an electric force is added to the only mechanical force that propels the previous two types, where the effects of space electric charges are negligible. If in a point in space there is a solitary electron and an electric field sufficient for the acceleration of this electron between two atomic collisions is such that the energy of the electron becomes greater than the ionization energy of the collided atom, the latter will lose other electrons (2, then 4,...), generating an electron avalanche phenomenon and an ion carcass.

These electrons leave in the electric motor field (drift or drive by the field), but are quickly braked electrostatically by the ionic mass of opposite charge, which it moves at the atomic speed (that of sound). We can then have, if the space charge fields are superimposed on the motor electric field, the appearance of an arc (after heating the atoms of the channel to thermodynamic equilibrium), and then a lightning flashes. But in any case, the electrostatic return forces mean that it is the ions (ionized atoms) which give the speed of movement.

The speed will remain limited around that of sound.

Could these plasmas be related to the "buoying plasmas" floating plasmas mentioned in the British MoD report but also be related to the Hessdalen spheres?



Figure 5.4.2.5 - Schematic diagram of an electric plasma

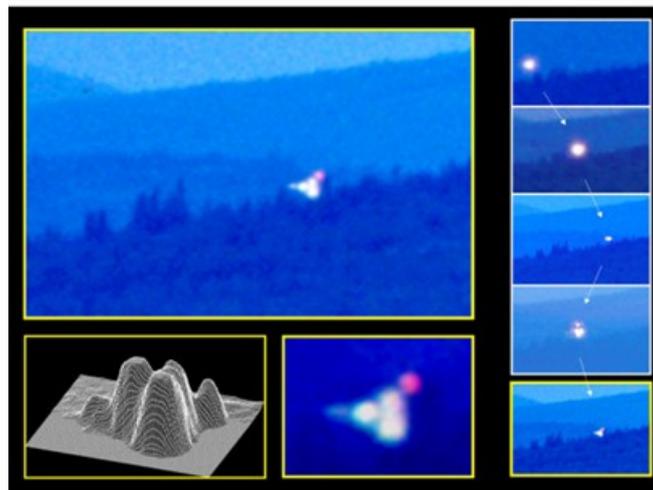


Figure 5.4.2.6 - Analysis of the spheres of the Hessdalen valley¹⁰

- **Plasmas of artificial origin (electromagnetic, laser source or related)**

Femtosecond laser-type energy sources make it possible to remotely deposit quantities of energy that create a local plasma that can generate a light signature (visible, IR) but

¹⁰ Massimo Teodorani lead an analysis on aggregates of plasma balls at Hessdalen. Extracted and allowed by NARCAP (from NARCAP TR-14, 2010) www.narcap.org



also an electron density, making it possible to create a radar signature at a distance. The laser spot can be moved quickly. The plasma will not physically move, but the warm-up area can be moved very easily, like a spot on a spotlight, and give the illusion of very high speeds, a hard stop, a change of direction.

However, it is necessary to be able to generate the beam and the deposit of energy at a distance (see Kerr effect¹¹ of formation of plasma filaments), and to ensure that the beam is not visible when crossing the atmosphere. It is a priori irrelevant in 1957 during the observations of Lakenheath (or of the Carousel of Washington), even during the observations of the Nimitz case in 2004. The American developments of the LEPF technology show another scale of phenomena of artificial plasmas intended for the IR-radar decoy techniques (within a radius of the order of a few hundred m to one km).

Research on high energy plasma projectiles has been carried out in the military field. In the early 90s, the USAF, inspired by experiments carried out at the Lawrence Livermore National Laboratory, launched the MARAUDER project and developed a coaxial railgun capable of propelling self-contained plasma toroids of 1-2mg at more than 1000 km / s (kinetic energy ~ 1MJ). These plasmas are formed by the vaporization of metal targets subjected to very strong pulsed currents (tens of MA) in rise times of several microseconds. The trajectory of these projectiles is linear and their dynamics are difficult to compare with that of UAP. Research continued at the Philips Laboratory where the concept was optimized until the end of the 90s. The fate of the project is not known.

Consequently, in the current state of our knowledge, the supersonic speeds of luminous objects observed by radar can only be linked to the drive effect of a hypersonic carrier vehicle, the ejection of combustion gases, the formation of a luminous ionized shock zone, or the artificial creation of a plasma spot detached by a source of directed energy located at a distance. The natural generation and propagation of a plasma is possible but remains a priori limited to sonic speed.

In the case of a hypersonic plasma, it should be noted that the movement of the supersonic or hypersonic carrier vehicle should induce a shock wave with an acoustic effect (see § 5.7), which does not seem to be the case for UAP.

In any case, we cannot attribute to these plasmas, natural or artificial, these unusual kinematics thus observed, of the type zero speed then sudden acceleration to 1000 km / h, change of direction at right angles, or even reversal.

5.5 Detection of magnetic anomalies linked to PAN

5.5.1 Introduction

Magnetic detection of UAP was considered particularly in Canada in the 1950s. This

¹¹ https://drive.google.com/drive/folders/1iRTln1zH_2-0bksDdwvJ-V8KH9ZG4WSp



consists of measuring variations in the Earth's magnetic field linked to the presence of UAP.

Subsequently, other work was carried out, inventoried by the SIGMA2 Commission, an overview of which is given below.

This summary is based on notes from Dr Kuentzmann who had conducted some documentary research before visiting the national magnetic observatory of Chambon-la-Forêt in May 2016 to learn about disturbances in the Earth's magnetic field observed in the presence of different vehicles.

These notes are reserved in Appendix A 5.5.1 Magnetic anomalies related to UAP and Appendix A 5.5.2 CR of 05/05/2016 visit to the national magnetic observatory.

The analysis was based on a limited number of documentary sources in the absence of available measures:

[1] "Basic Patterns in UFO Observations", Claude Poher and Jacques Vallée, AIAA Paper 75-42, AIAA 13th Aerospace Sciences Meeting, Pasadena, January 20-22, 1975.

Apart from this paper, we can rely on three other references:

[2] "Strong Magnetic Field Detected Following a Sighting of an Unidentified Flying Object", Bruce Maccabee, Journal of Scientific Exploration, Vol 8, n ° 3, pp 347- 365, 1994.

This reference has already been discussed between the editor and the commission for the chapter on the physiological effects of UAP.

[3] "Pulsed electromagnetic propulsion (PEP)", Christophe Meessen, internet.

This document remains somewhat poor to conduct a scientific analysis. The analysis was however attempted in paragraph 5.5.3.

[4] "A Preliminary Study of Fifty Seven Pilot Sighting Reports Involving Alleged Electro-Magnetic Effects on Aircraft Systems)", NARCAP Technical Report NARCAP TR-03, 2001,

Richard F. Haines Chief Scientist Los Altos, California - Dominique F. Weinstein International Technical Specialist - Paris, France

5.5.2 Physics reminders

The magnetic field is a vector field expressed by forces acting on moving electric charges or by effects affecting certain materials. The magnetic field and the electric field are the two components of the electromagnetic field; the two fields are coupled by Maxwell's equations, which so far have not been questioned.

The most commonly used units for the magnetic field (more exactly for the induction flux density) are:

- the Tesla (T), dimension $MT^{-2}I^{-1}$,
- Gauss (G), $1G = 10^{-4} T$,
- the Gamma (γ), $1\gamma = 10^{-9} T$.



The Earth's magnetic field is around 47,000 γ in central France. The measurement accuracy of each component would be according to the IGP of 6 γ , that is to say high. The principles implemented in the measurement techniques can be found on the internet.

5.5.3 Brief analysis of the main references

5.5.3.1 Basic Patterns in UFO Observations

The analysis conducted by Claude Poher and Jacques Vallée is based on French (Chambon La Forêt) and American observations. It intervened after the closure of the Blue Book project; therefore the term UFO is frequently used. Without taking sides on the conclusions presented, due to lack of access to the raw data used, attention can be drawn to the following points:

- the duration of the phenomenon for which the maximum number of observations exists is between 5 and 15 minutes;
- the distances are between 20 m and 3 km, or even more. Unfortunately it is not indicated how these distances are obtained; moreover a particular classification system is used (types I to III);
- an attempt to correlate observations with magnetic measurements is proposed. The magnetic measurements carried out at Chambon-la-Forêt are mentioned: an accuracy of 1 γ on the three components is indicated (this seems optimistic) as well as a bandwidth of a few Hertz, not to mention a statistic established over a fairly short period. (see Annex A 5.5.1). This correlation was later questioned by author Claude Poher¹².

So the assumption that a UAP could create a measurable "peak-to-peak" disturbance 10 γ at 40 km from the source is to be taken with caution. Indeed, this local disturbance would then be generated by a very intense magnetic field at the level of the source, representing a higher magnetic pressure of several orders of magnitude than that of the terrestrial magnetic field. Our analyzes have not been completed and we are reserving additional studies for the future. Canadian work dating back to the 1950s on the magnetic detection of UAP does not appear to have been continued. Probably for the reasons mentioned, ie that the local disturbances generated are too weak to be measured at a distance of only a few km to tens of km from the UAP. In addition, the EME effect cases studied by NARCAP¹³ highlight the detection of magnetic field disturbances (by the compass of planes) at very short distance from the UAP. This would tend to show limited and measurable effects only a very short distance from the source.

12 According to "Lettre ouverte à P. Viéroudy" LDLN n°155,1976 ; P.Viéroudy wrote in his article « Vague d'OVNIs et psi collectif », Revue de parapsychologie n°6, 1978 : « Poher believed also having demonstrated some correlation between the monthly UFO observation number in France in 1954 and the variations of the Earth magnetic field measured at Chambon-la-Forêt. This correlation is an illusion and was by the way refuted by his author himself later »).

13 https://static1.squarespace.com/static/5cf80ff422b5a90001351e31/t/5d02eb044a252700010bd9de/1560472330113/narcap_TR-3_2001.pdf

According to the CR of visit to the Chambon -la-Forêt observatory where the question of UFO detection was not directly raised, the only measurements making it possible to highlight changes in the magnetic field are linked to the electric propulsion of the trains and micro-variations linked to the passage of trucks at a distance of 100 m from the magnetometer sensors.

5.5.3.2 Strong Magnetic Field Detected Following a Sighting of an Unidentified Flying Object

This is the alleged UFO landing that occurred on September 11, 1992 in Florida. The ground would have been temporarily magnetized. A measurement was performed by a commercial apparatus from Schoensted Instrument Corp. described as a gradiometer, that is, it gives an estimate of the magnetic field gradient, as do metal detectors in the ground.

What is surprising is that there was no analysis of the soil to determine if it was likely to magnetize.

5.5.3.3 Pulsed electromagnetic propulsion

The graph below is from a recording allegedly made in July 1978 by the Ray Stanford team.

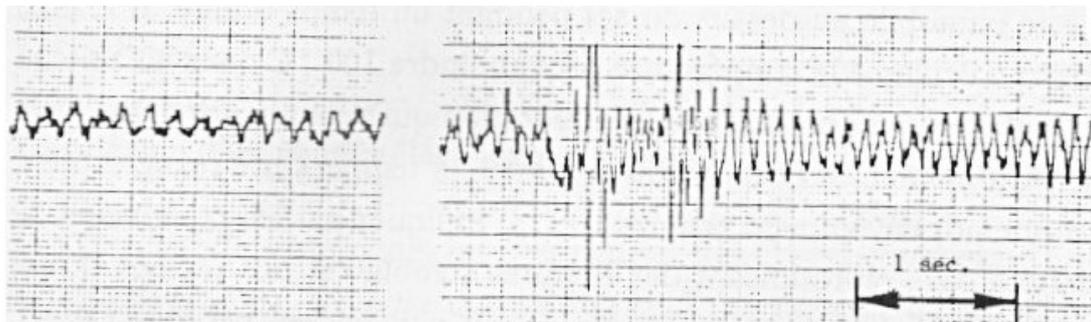


Figure 5.5.3.3.1 - Recording allegedly made in July 1978 by Ray Stanford's team

The instrument used is not known. In addition there is no indication of a scale on the ordinate. Two questions arise: on the one hand, little is known about the response of the instrument to a transient disturbance of the magnetic field and, on the other hand, the irregularity of the oscillations needs to be interpreted.

5.5.4 Conclusions

There are no indisputable observations linking UAP or UFO to variations in the magnetic field at long distances (a few km to tens of km), other than a few rare and vague speculations.

Aircraft compass interference is more common at very short distances (see the NARCAP document), but there is no measurement associated with the magnetic field.



The existence of interference with electrical networks or electrical or electronic equipment is analyzed in the paragraphs devoted to EME cases and associated physics.

In particular, the pulsed effects of EM fields emitted by UAP are cited in the case of RB47 but also in a case submitted by the SCU (interference with electronic devices) during a close encounter in Ontario (see § 4.2.5).

5.6 Atmospheric or fluid interaction

The interactions between UAP and atmosphere that have been observed are few. The most frequently reported cases are Chicago O'Hare in 2006¹⁴ and Mansfield on October 18, 1973¹⁵. These two events gave rise to untested analyzes and theories.

However, the absence of aerodynamic interaction phenomena is frequently observed and deserves to be studied in depth.

5.7 High Altitude Acoustic Effects

5.7.1 Introduction

Acoustics applied to the high altitude domain have been the subject of studies since the beginning of the 20th century and especially after 1945, when rockets reached the stratosphere and the speed of air¹⁶craft became transonic and then supersonic.

Originally, as part of the studies on what was then called the ballistic wave, one wondered about the fact that the sound of bolides (meteorites) returning to the atmosphere was never audible. During the First World War, one mainly sought to locate heavy artillery pieces by sound, from the detonations at the start of the shot (blast wave) rather than from the acoustic phenomena caused by the projectiles (ballistic wave and aerodynamic noise).

After the Second World War, it is above all the noise of the jet¹⁷ and the sonic boom of

14 « Hole in Cloud », according to NARCAP report, a hole in the cloud could be induced by a local heating and vaporization of water droplets

15 An army helicopter was submitted to a fast ascent rate, having its control full down, after crossing a UAP

16 Charbonnier P., Esclangon E., Etude cinématique du champ acoustique d'un projectile. L'acoustique des canons et des projectiles, Mémorial de l'Artillerie Française, Tome IV, 3^e fascicule de 1925

17 Varnier J., Experimental study and simulation of rocket engine free jet noise, AIAA Journal, Vol. 39, N° 10, pp. 1851-1859, octobre 2001



launchers¹⁸ and aircraft¹⁹ that have attracted attention, on the one hand for the evaluation of acoustic fallout on the ground²⁰, on the other hand for purposes. detection and localization.

The acoustics of in-flight missiles and atmospheric reentry²¹ are among the hot topics in this field.

5.7.2 Jet noise

Jet noise is a sound source of considerable intensity, the vibratory consequences of which led to the failure of a large number of launches during the initial phase of the conquest of space. When the gases are ejected at a highly supersonic speed, the peripheral vortices in contact with the ambient air create shocks which explain the strong acoustic directivity of the phenomenon: everyone knows that the noise of a jet plane only becomes perceptible when the airplane moves away from the observer and reaches its maximum when seen from the rear three-quarters.

Although intense and complex, this noise is subject, at great distance, to the same laws as noise from so-called harmonic sound sources, in particular refraction by atmospheric layers (sensitivity to meteorological conditions which can prevent it from reaching the ground) and the Doppler effect (variation of frequencies and sound levels induced by the movement of the source).

In the calculations aiming to simulate the noise of a launcher received on the ground, it is also necessary to take into account the atmospheric absorption which attenuates the high frequencies more quickly than the low ones, and, in the infrasound domain ($f < 20$ Hz), natural background noise resulting mainly from wind and waves.

5.7.3 Sonic bang

Contrary to popular spherical wave modeling, the sonic boom is a shock phenomenon created by the impact of a material body in the air that has nothing to do with classical acoustic emission. The best image of the sonic boom is that of the wake created by the bow of a ship, with the difference that the shock wake is here formed of two cones extending respectively from the nose and the base of the mobile. The first cone corresponds to an overpressure, the second to a depression, all of which produce a detonation sound in the ear, or a click on a lower scale (firearm projectile). In Figure 5.7.3.1, the shock wake of the bullet corresponds to the light area between the two darker shock fronts. Aerodynamic turbulence and spherical wave fronts located inside

18 Varnier J., Le Pape M-C, Sourgen F., On the ballistic wave from projectiles and vehicles of simple geometry, AIAA Journal, Vol. 56, N° 7, pp. 2725-2742, juillet 2018

19 Le Pichon A., Garcés M., Blanc E., Barthélémy M., Drob D.P., Acoustic propagation and atmosphere characteristics derived from infrasonic waves generated by the Concorde, J. Acoust. Soc. Am., Vol. 111, n° 1 (Part 2), pp. 629-641, janvier 2002

20 Ménexiadis G., Varnier J., *Long-range propagation of sonic boom from the Concorde airliner : analyses and simulation*, Journal of Aircraft, Vol. 45, n° 5, pp. 1612-1618, septembre-octobre 2008

21 Henneton M., Gainville O., Coulouvrat F., *Numerical simulation of sonic boom from hypersonic meteoroids*, AIAA Journal, Vol. 53, N° 9, pp. 2760-2770, juillet 2015

the so-called turbulent wake correspond to the acoustic zone which produces a sound that is sometimes audible (hissing), but much less intense than the initial click.

The double bang that is sometimes perceived in the case of an aircraft results from the reflection of this shock wave on the ground or the sea, and therefore from two identical pressure signals successively striking the ear of the observer. In figure 5.7.3.2 left, this is a sonic boom of the Concorde aircraft recorded at a distance of 20 km, with its characteristic N profile (the time runs from left to right, the passage time of the shock wave is between 0.1 and 0.2 s).

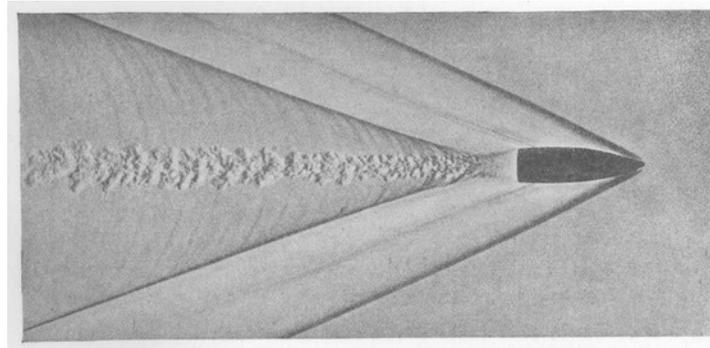


Figure 5.7.3.1 - Wake of a rifle bullet (photo 1917, Germany)

Unlike most acoustic spectra presenting a set of lines (fundamental frequencies and their harmonics), the spectrum of the sonic boom is presented as a continuous curve in arches whose decrease as a function of the frequency is curiously identical to that of the natural background noise. This decrease is symbolized by the red envelope curve in figure 5.7.3.2 right. A sonic boom is therefore easily identifiable by its frequency spectrum at distances that can reach several tens or even hundreds of kilometers, while the signal itself is spread over time by the same atmospheric phenomenon which transforms the flash of lightning into roar of thunder.

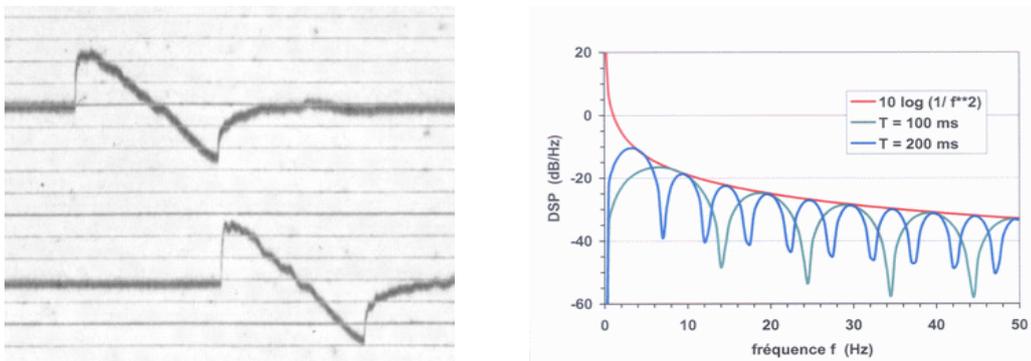


Figure 5.7.3.2 - Pressure temporal signals and acoustic spectra of sonic booms

5.7.4 Sound of a supersonic plane

The conical shape of the shock front explains why the spatial decrease in its intensity



(energy per unit area) is slower than that of a spherical wave: in fact the surface of the cone increases as the square of the distance to its axis when that of the sphere increases as the cube of the distance to the center. Either way, studies on the subject show that the magnitude of the sonic boom intensity is roughly ten times that of supersonic jet noise. Of course, the jet noise can only develop inside the turbulent wake, preceded by the shock wake, the normal speed of which is close to the speed of ambient sound: when a jet plane passes, the perception of the sonic boom therefore always precedes that of the noise of the reactors, just as the slamming of the ballistic wave of a projectile always precedes its aerodynamic noise.

Finally, the intensity of the sonic boom can be amplified in a ratio of 3 to 5 by the phenomenon of focusing which occurs in certain regions of the surrounding space when the airplane is accelerating or maneuvering (turning or rounding of the trajectory).

Note that the sonic boom of the Concorde, an aircraft which flew at Mach 2 at an altitude of 17,000 m, was commonly audible at a distance of close to 100 km (for example at Saint-Malo when it was descending on the approach to Guernsey). The noise of the reactors, however, was not perceptible.

5.7.5 Sonic bang in upper atmosphere

In the upper atmosphere, the air becomes scarce to the point that the average free path of molecules can become of the same order of magnitude as the useful dimension of the mobile (its diameter or its span). The medium therefore becomes granular and the mechanics of continuous mediums no longer apply. For a launcher or a missile, this becomes true for an altitude which varies according to its size and its lift, but which is in any case greater than 30 km.

Fluid mechanics calculations were however carried out by ONERA at an altitude of around 50 km for the Apollo command module in atmospheric reentry. As seen in figure 5.7.5.3 left, the classic pressure profile of the supersonic wake is replaced, at different distances from the moving body which flies at more than 5000 m / s (Mach 16), by an intense pressure front followed by 'a lower amplitude depression and an asymptotic return to ambient pressure. This form persists to some extent in the recordings made on US Navy ships below the track, apart from the doubling of the pressure fronts due to the reflection of the sonic boom off the sea surface. In Figure 5.7.5.3 right, the signal recording is in red, the double sonic boom simulation is in blue.

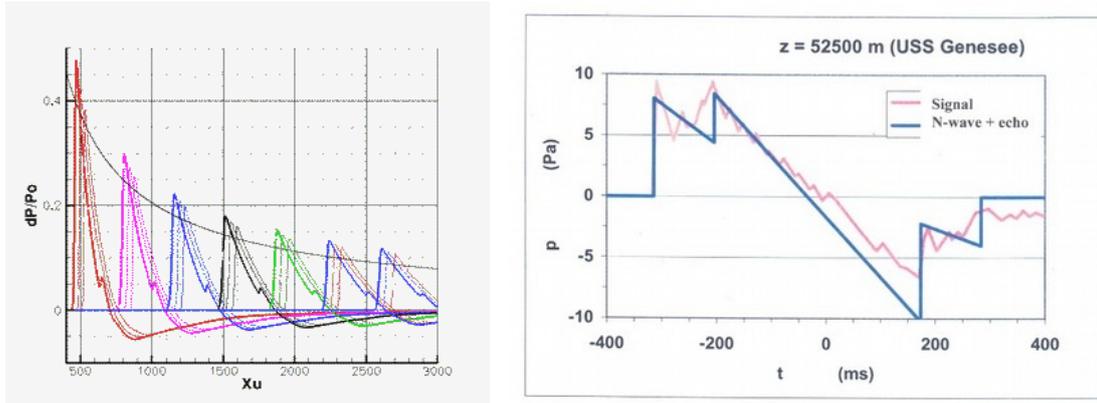


Figure 5.7.5.1 - Sonic boom profiles calculated at 52 km altitude and signal received at sea level

Note that the Chinese hypersonic glider's cruising altitude is around 60 km but its speed is lower, varying between Mach 10 at the end of the propelled phase and Mach 4 at the final. We speak of hypersonic speed when the corresponding Mach number is greater than 5.

5.7.6 Case of a powered vehicle

When the mobile is propelled by a rocket motor or a stato-reactor, its aerodynamics change noticeably at high altitude. In fact, due to the very low ambient atmospheric pressure, the divergence of the gases at the nozzle outlet increases dramatically and the apparent dimension of the jet becomes much greater than the characteristic dimension of the mobile.

As a result, the aerodynamic disturbance associated with the impact of the solid body in the atmosphere is in fact absorbed by the much larger disturbance formed by the jet itself. Indeed, the speed of the mobile being in general greater than the speed of ejection, the front of the jet becomes supersonic in the same direction as the carrier vehicle itself constitutes the main impact front, as can be seen on Figure 5.7.6.4.

Note that what is commonly called a shock cone or Mach cone always has a more or less rounded shape, at least near the mobile. This is due to the gradual slowing down of the local normal speed of the forehead which gradually tends towards the speed of ambient sound. The impact front then tends towards a cone whose opening α is defined by the law $\cos \alpha = 1 / M$, M being the Mach number of the vehicle.

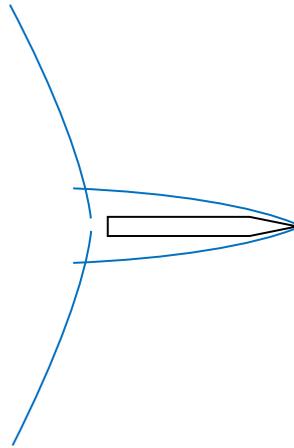


Figure 5.7.6.1 - Absorption of the shock cone of the mobile by the front of the jet

5.7.7 Case of a pulso-reactor vehicle

The pulso-reactor is comparable to an internal combustion engine which would have no mechanical part apart from the cylinder itself. The ignition cycle is self-sustaining at a given speed, at a frequency that cannot be changed. The pulse-reactor was originally the subject of a French patent and a German patent, but only the Germans went on to execute it with the V1 missile, of which there was a piloted version. Operating on a 45 Hertz cycle at a speed of 700 km / h, the engine emitted a characteristic high noise at this frequency.

The pulsejet of a supersonic vehicle should have a much higher operating frequency, the acoustic effects of which would be absorbed and would disappear very quickly in the upper atmosphere, the air molecules being too far apart to transmit high frequency disturbances. There remains the front of the jet, which we can assume would be a little less regular than that of a classic rocket engine or jet engine. But given the smoothing phenomenon which characterizes the propagation of a shock front in the atmosphere, this being due in particular to heat dissipation, it seems extremely unlikely that the signature of a pulse-reactor can be differentiated by its shape. or its intensity compared to that of more conventional thrusters.

5.7.8 Infrasonds and UAP

As indicated in the introduction (§ 5.7.1), we wondered at the beginning of the XXth Century on the absence of noise during the falls of bolides (meteoroids), linked to the fact that the physics of continuous mediums does not apply in the upper atmosphere, the possible propagation being able to concern only infrasound. In addition to causing vibratory nuisance, this infrasound is inaudible to the human ear but not to animals such as horses. These arguments intervened to prohibit the passage of the sound barrier, in one direction or the other, to the fighter planes, not only over the land, but near the coasts, which was not the case in the years 1950-60.



At the same time, as part of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), an international network of monitoring stations (ISS) was set up, dedicated in particular to listening to the infrasound band. These stations therefore provide information on many natural or man-made phenomena, in particular atmospheric re-entry. In France, network stations such as Flers (Orne) depend on the CEA, which regularly publishes work on its observations [4]. With regard to the UAP, direct witnesses almost always stress the silent nature of their movements, even those which appear extremely fast. The crew of a helicopter overtaken by a large UAP reported the complete absence of aerological disturbance as it passed, although its apparently supersonic speed should logically have created a strong shock wake. In fact, the phenomenology of UAP seems totally foreign to classical aeroacoustics and shock physics to which infrasound is related.

5.7.9 Conclusion

The sonic boom is the hallmark of all supersonic aircraft, launchers and missiles. This includes cruise missiles and stratospheric gliders, whether propelled or not. The jet noise which is subject to strong absorption in the upper atmosphere in comparison becomes a completely negligible acoustic source.

Infrasound, which accompanies many natural phenomena (waves, wind, storms, earthquakes, eruptions, etc.), are also produced by supersonic wakes such as those of meteorites and other bodies reentering the atmosphere. The stations of the SSI international monitoring network, depending in France on the CEA, are intended to detect and analyze them.

It should be noted that the PANs are generally distinguished by a remarkable acoustic discretion, even when their apparent speed is supersonic. It is difficult to know whether or not they may be sources of infrasound.



5.8 Observation of traces on the ground

5.8.1 General - Mechanical - thermal traces - EM

Regarding interactions with the soil, we have a few rare photographic and analytical documents, whether it is the soil itself or the vegetation for ancient events that occurred in France.

Radiological effects have been mentioned in at least two cases: that of Gulf Breeze from September 11, 1992 and that of Rendelsham Forest from December 27 to 29, 1980. However, the rough measurements carried out did not make it possible to characterize the suspected emissions, but did allow to differentiate them from the natural radioactivity of the soil (case of Rendelsham Forest). But these cases are rare.

Some observations in limited number report ejections of matter (ejecta) by UFO. The interest of these materials raises many questions as to their supposed or measured properties and their use, for example for propulsion systems of very advanced technologies. The chemical analyses carried out on debris revealed various but known elements ... sometimes with unusual properties, from the point of view of purity, of certain secondary elements present, or even of alloys a priori unknown and whose metallurgy relates to nanotechnologies difficult to access today. Metamaterials based on multi-layered alloys, some of which at the atomic scale are the subject of research today, their properties being discovered little by little. They were completely unknown in the 60s to 80s, for example during the collection of certain exotic materials as it would have been reported in Russia in 1987.

5.8.2 French case examples

These observations relate to close testimonies or to allegations of UAP landings / take-offs. The effects reported are varied: mechanical traces on or near the ground, traces on vegetation, thermal traces, biological traces, radiological traces, ejected debris. The cases mentioned come from old archives of the gendarmerie and are quite rare.

- **Soil case that occurred in 1967 near Dijon**

The case shows mechanical traces, dehydration effects and chemical traces which were noted by the gendarmerie.

A polygonal basin of 15 m² representing six furrows 12 cm wide and 20 deep (length varying from 1.55 to 2.80 m) radiating around a circular trace 40 cm in diameter and 30 in depth; a narrow crack in the ground penetrates the nearby barley field over a length of 10 m and a depth of 20 cm; it ends with an excavation 20 cm in diameter. In this axis, clods of earth were projected and scattered over 10 m wide at the start and 30 m at the end; they are compacted.

The central part of the polygon seems to have undergone a strong pressure (compacted and dehydrated earth) but the grass present in this place is intact. All traces of moisture have disappeared within a radius of 8 m.

The walls of the furrows are covered with a granular material of a shade varying from gray to mauve, material found in the cracked part going into the barley field. In the furrows, six cylindrical indentations 12 cm in diameter are located between 63 cm and 1.58 m from the center with depths varying from 20 to 40 cm. The vertical walls of the holes are smooth; they end in a form of double cylinder itself continuing with a hole 4 cm in diameter and between 20 cm and 1 m deep directed outwards; penetration into the earth is greater in the east where the earth has been thrown.

The colored material was taken and analyzed: "its slightly purplish coloring could have been due to the presence of cobalt" but "no trace of it was found either on the soiled earth or on the control earth". In addition, this material presents "the appearance of fine particles which would seem to have undergone a partial fusion, which is in formal contradiction with the absence of any trace of fire on the impact left in the field, as evidenced by vegetation simply dried out but not charred".

The insolubility characteristics of the suspect haze suggest that the product could belong to the class of a refractory oxide (silica or alumina) without the chemical analysis having been able to confirm this hypothesis.

- **Soil case identified in northern France in 1973**

Another case was identified in the north in 1973 (see Figure 5.8.2.1 opposite).

Three semi-spherical prints in the frozen ground were found by the gendarmerie, measuring 10 cm in diameter and 4 cm in depth.

No chemical trace was reported, nor thermal except the fact that the frozen ground was dug in a regular way.

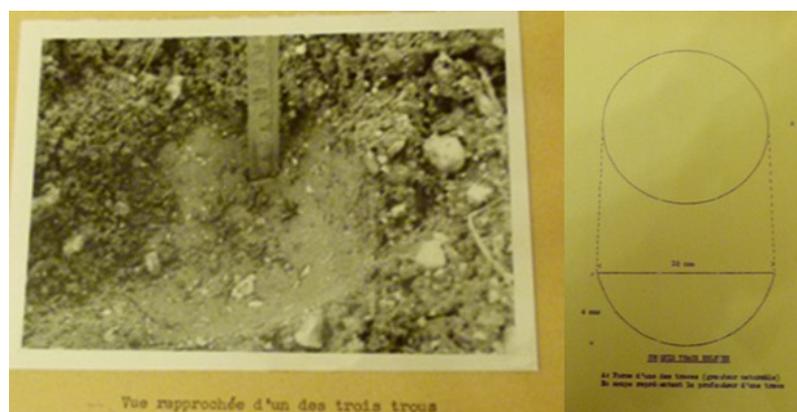


Figure 5.8.2.1 : mechanical traces in the ground- North of France - 1973

- **The case of Trans-en-Provence**



The case of Trans-en-Provence of January 8, 1981 is the most famous case on French soil along with that of Valensole.

It is described in the report in § 4.2.1.4 and was the subject of a detailed GEIPAN note²² GEIPAN N ° 13 of March 1, 1983. This case (see Figure 5.8.1.2 opposite) is the subject of mechanical traces (gyration, shifting), traces left on vegetation (dehydrated alfalfa) and chemical traces. Certain aspects of the traces on the ground are disputed, in particular the chemical elements which may correspond to traces of paint. They are therefore not conclusive.

The aging of the vegetation, which has only been partially measured on an axis, shows a progressivity comparable to the influence of an EM field. We compared this effect to other cases in the § on the EME effect case, to a possible cause by microwave radiation. Some cases showed an orientation of the vegetation or a direction of dehydration corresponding to the take-off axis described by a witness. This is the case of Valensole where the vegetation of the apricot trees has been dried out in a direction assumed to be that of the UAP movement.

We are therefore seeing the effects of dehydration of the earth or vegetation, or even of melting ice in the frozen ground without any trace of excessive heating which would produce oxidation of materials (earth, chemical residues from combustion, vegetation).



Figure 5.8.2.2 : mechanical traces - Trans en Provence

5.8.3 Chemical traces and materials

We can cite a few articles concerning chemical analyses of residues.

5.8.3.1 Ten cases analyzed by J. Vallée

The first article was written by Jacques Vallée in 1998²³ and published in the Journal of Scientific Exploration, (see Appendix A 5.8.3.1). 10 cases of residues linked to the

²² TRANS-EN-PROVENCE_83_08.01.1981_T-M_PV_T_S_A_1981308305-28-1981-R.pdf

²³ Physical Analyses in Ten Cases of Unexplained Aerial Objects with Material Samples- Journal of Scientific Exploration, Vol.12,No.3,pp.359±375



presence of a UAP, assimilated to ejecta or debris, are commented on in relation to reports specifying the circumstances and physical details, as well as analyses of materials recovered in connection with the observation.

Overall, it emerges that two classes of materials have been identified: on the one hand, lightweight, highly conductive materials such as aluminum, on the other hand, metallic materials with a glassy finish.

Jacques Vallée summarizes the ten cases analyzed in the following table (Figure 5.8.3.1.1).

| Case No. | Location | “Slag” | | “Light Silvery Alloy” | |
|----------|----------------|----------------|--------------------------------------|------------------------------------|--------------|
| | | Primary | Secondary | Primary | Secondary |
| 1 | Ubatuba | | none | Mg | Al,Ca,Fe |
| 2 | Maury Is. | Ca, Fe, Zn, Ti | | Si, Cu, Ni, Pb, Cr, Al, Mg, Mn, Sr | Ag, Sn, Cd |
| 3 | Washington | | none | Mg, Si | |
| 4 | Campinas | | none | Sn? (90%) | |
| 5 | Sweden | W(94.9%), | Co (4.1%) Zr(0.6%), Fe(0.3%) | | none |
| 6 | Maumee | | none | Mg(92%) | |
| 7 | Kiana | | none | | YES |
| 8 | Bogota | | none | Al(94%) | P(5%),Fe(1%) |
| 9 | Council Bluffs | Fe | Ni,Cr,Mn,Si,Ti | | none |
| 10 | Jopala | Fe | Si(1%), Mn(0.8%) Cr(0.8%),C(0.3%) | | none |

Figure 5.8.3.1.1 - Composition table of recognized samples

- Case n ° 1: Ubatuba. A disc was observed in Brazil in 1947, exploding and spreading metal fragments. The composition is essentially based on magnesium and magnesium oxide with impurities.
- Case N ° 2 Maury Island (Washington): this case dates from 1947. A witness sees objects in the shape of a crown. One of them lets out material-like material like dark blocks of molten lava. The collected residue resembles either glassy material or aluminum foil. The samples were reportedly collected and analyzed by the FBI. Dark glassy samples would correspond to a composition of calcium, titanium steel and zinc. Other traces have been analyzed. For the silver leaves silver, selenium and cadmium are mentioned.
- Case N ° 3: this case dates from 1957 in Washington. The journalist mentions a metal fragment detached from a UAP chased by a fighter. Analysis reports a metallic structure of magnesium oxide with a 15 micron period matrix.



- Case N ° 4: December 1954- Campinas - Brazil: this case concerns an object in difficulty, in the shape of a disc, which would have lost liquid materials above an urban area. Samples would have been analyzed ... Selenium would have been mentioned along with other substances.
- Case N ° 5: Sweden: November 11, 1956: Vaddö: an object would have lost a metal part. Analysis carried out by Saab factories reveals a cobalt carbide alloy, an alloy known in aeronautics but with an unusual degree of purity.
- Case N ° 6: July 13, 1967: Ohio: two sailors driving a car saw a luminous object on the road and avoided or came close to a collision; mechanical traces are noted on the vehicle, as well as metallic traces, mainly of magnesium, in particular a fibrous material.
- Case No. 7: silvery material appearing to have been poured in the state of fusion.
- Case N ° 8: 1975: Bogota: Colombia: two witnesses observe a circular object whose trajectory is oscillating... It ejects liquid metallic residues. Their analysis reveals an alloy of aluminum with tin and magnesium, soft in appearance and easy to cut. Additional analyses will be carried out in the USA also revealing traces of magnesium (often linked to the manufacturing process), the absence of sulphide, and an unusual layer of carbide.
- Case No. 9: December 1977: Council Bluffs Iowa: Witnesses observe the crash of an object. A molten substance appears to be flowing. The analyses will reveal an alloy of steel mainly with impurities from different materials.
- Case N ° 10: Circa 1978-Jopala (Mexico): a case was reported to the author during a trip to Mexico. Samples were reportedly analyzed showing an alloy of steel with silicon and traces of chromium, manganese, carbon.

In summary, J. Vallée concludes that the materials recovered under these extraordinary circumstances do not reveal unusual compositions at the stage of the analyses carried out. On the other hand, liquid ejecta of highly conductive metallic materials raise questions. One could think they were made of liquid materials usable in propulsion systems for homopolar vehicles (discussion J. Vallée- JR Bumby- Durham University 1983)²⁴, with superconducting propulsion or not, or for MHD generators using a liquid metallic fluid which would have been tested in the 1970s (reference by J. Vallée to the work of Watt 1970, Doyle 1974)²⁵, or in flying machines (reference to the work of Southhall & Oberly, 1979)²⁶. Nevertheless, it is accepted that the alloys and metallic materials mentioned in the table exhibit melting temperatures much higher than ambient temperature. The idea of using a nuclear reactor with an MHD generator is also

²⁴ Bumby, J. R. (1983). Superconducting Rotating Electrical Machines. Oxford: Clarendon Press.

²⁵ Doyle, J. T. (1974). Shaped field superconductive d.c. ship drive systems. Adv. Cryo. Engng., 19, 162.

²⁶ Southhall, H. L. and Oberly, C. E. (1979). System considerations for airborne, high power super- conducting generators. IEEE Mag-15,1, 711.



mentioned by J. Roser with J. Vallée. He thinks that an aluminum alloy with a percentage of phosphorus could be used in an MHD machine with a nuclear reactor, at melting temperature. The ejecta could then present traces of isotopes whose nucleus is close to aluminum and phosphorus, for example sodium, manganese, sulfur, as a result of nuclear reactions ... An isotopic analysis of the samples from Bogota could reveal such traces according to discussions with J. Roser and therefore confirm the usefulness of these liquid alloys.

5.8.3.2 Traces of magnesium in Brazil

This article was written by Peter A. Sturrock²⁷ (see Annex A 5.8.3.2) on analyses of reputed magnesium samples collected in Brazil of unknown origin (is it Ubatuba mentioned in the previous paragraph, nothing proves it says the author but it is probable).

Sample analyzes were done by the Rio de Janeiro Mineral Production Laboratory, using a Hilger mass spectrograph (destructive method). Analyzes made on September 24, 1957 reveal a high degree of purity.

Further measurements were carried out on a second sample, by another lab, the crystallography laboratory of the national department of mineral production, by a method of non-destructive X-ray analysis. No impurity detected in both cases, which is very rare.

From November 4, 1957, other analyses were carried out by the Military Institute of Technology and a laboratory of the naval arsenal in Rio de Janeiro: neither the samples nor the results were returned.

At the end of 1957, the first sample was sent to the United States for APRO, which handed the sample to a US Air Force laboratory: the sample was accidentally destroyed without providing the results. Subsequently analyses were carried out on a sample preserved by a US national laboratory with the help of APRO which demonstrated the purity of magnesium as the main component, but identified secondary components aluminum, steel, iron at 100-1000 ppm (see Figure 5.8.2.2.1). **According to the conclusions, the metal analyzed does not show any mechanical or conduction properties justifying its realization with this unusual degree of purity.**

Another analysis is carried out in 1961 by another laboratory which confirms the results. **However, the presence of strontium impurities seems surprising. It would be linked to an intentional manufacturing process that was unexplained at the time.**

Isotope analyzes were continued in 1976, notably at the French University of Pierre and Marie Curie laboratory²⁸. They reveal no isotopic difference from known magnesium.

Surface analyses were carried out. They show different levels of impurities between the surface samples. It is the same for the material in depth.

²⁷ https://www.researchgate.net/publication/237233241_Composition_Analysis_of_the_Brazil_Magnesium

²⁸ Pr JC Lorin et Pr A. Havette – Laboratoire de minéralogie et cristallographie- Université Pierre et Marie Curie



The analyses carried out between 1957 and 1997 ultimately do not allow us to conclude a priori as to the strangeness of this magnesium metal or to a demonstrated exogenous origin. However, the degree of purity observed is unusual, the interest of the pure metal not being understood, nor that of the impurities present, such as strontium.

Early Composition Analysis of Brazil Magnesium Specimens

| Element | | At no | Group | National lab sample 2 | Dow sample 2 | Colorado SU-E | Paris SU-E | Colorado DOW |
|-----------|----|-------|-------|--------------------------|-----------------|------------------|---------------|-----------------|
| Magnesium | Mg | 12 | 14 | major | major | major | major | major |
| Aluminum | Al | 13 | 13 | 100–1000 | <20 | <10 | | <5 |
| Silicon | Si | 14 | 14 | 100–1000 | | | | |
| Calcium | Ca | 20 | 2 | 1–10 | 100 | | 8500 | |
| Chromium | Cr | 24 | 6 | <1 | | 32 | | 5.9 |
| Manganese | Mn | 25 | 7 | <40 | 2 | 35 | | 4.8 |
| Iron | Fe | 26 | 8 | 100–1000 | <2 | | | |
| Copper | Cu | 29 | 11 | 1–10 | 2 | 3 | | 0.4 |
| Zinc | Zn | 30 | 12 | <300 | | 500 | | 5.0 |
| Strontium | Sr | 38 | 2 | <1200 | 30 | 500 | 700 | |
| Barium | Ba | 56 | 2 | <1200 | 30 | 160 | | |
| Mercury | Hg | 80 | 13 | <1200 | | | | 2.6 |

Note: Abundances all in ppm. Blank entries indicate “not detected.”

Figure 5.8.3.2.1 - Magnesium sample analysis results

5.8.3.3 Russian cases: Dalnegorsk: 01/29/1986

On the evening of January 29, 1986, a reddish sphere was observed and crashed on a hill in Dalnegorsk. Different types of materials will be collected:

- Lead
- black beads in the shape of a glassy drop
- iron balls
- metal mesh type materials

The KGB UFO Files Book²⁹ (see Appendix A 5.8.3.3) relates these facts and the recovery of exotic materials.

The balls analyzed would be made of ultra pure molybdenum on the surface which is not explained because this material does not exist natively in this form (only in the form of molybdenum sulphide or lead molybdate). According to this file, molybdenum in the pure manufactured state is not of industrial interest (mechanical or thermal). On the other hand, it is useful as a compound in aeronautical or nuclear alloys, the hardness of which it improves at high temperatures.

These 17 micron metal balls are said to be of unknown origin and technology.

Analyses were performed by three academic research centers and eleven research centers³⁰. The collected iron balls are an alloy of iron, aluminum, manganese, nickel, chromium, tungsten and cobalt, a heterogeneous mixture composite with a gold

²⁹ UFO files of KGB- pages 222 à 228

³⁰ including institut polytechnic Institute of Tomsk, institute of Earth and ionosphere magnetism and of propagation of FR waves (Leningrad)



braiding (a few microns) or coated with pure molybdenum.

The beads would have amazing properties:

- disappearance / reappearance under the influence of radiation during the measurements, suggesting surprising properties, qualified as anti-gravitational according to the witnesses of the experiments?
- abnormal inter-atomic distance of iron atoms.
- interference during measurements.
- isotopic composition not corresponding to terrestrial compositions.
- very high hardness like alpha iron.

In addition, the analyses of micro-structures showed a marbling and a veining of layers of materials which intrigued the scientists (one finds layers in the shape of waves described by Dr. Puthoff in his presentation - see § 5.8.3.4).

At the site of the supposed crash, a concentration of energy similar to that of a laser was noted on a partly charred tree trunk, while the other part was intact as a tree trunk, which was charred partly intact elsewhere.

5.8.3.4 Metamaterials

Metamaterials are artificial composites with the electromagnetic, acoustic³¹ or mechanical properties of a homogeneous material that does not exist in nature. They typically consist of an assembly of dielectric or metallic structures periodically arranged in order to obtain a specific response to a given excitation.

In the field of electromagnetic optics, these arrangements make it possible, among other things, to control the amplitude and the sign of the refractive index of a medium by modifying its permeabilities and relative permittivities ($n = \pm\sqrt{\epsilon_r \mu_r}$).

The applications of such a technology are numerous, from the creation of "invisibility cloaks"³² by the use of two-dimensional zero-index layers leading the incident EM radiation around an area to be hidden, to the manufacture of super lenses whose resolution is no longer limited by diffraction^{33,34}.

Metamaterials also make it possible to manipulate very high frequency emissions such as Terahertz by assembling three-dimensional micro and nano waveguides³⁵ (Figure 5.8.3.4.1). In recent years, they have also found applications in the radar band^{36,37}.

31 <https://hal-lara.archives-ouvertes.fr/LAUM/tel-03092327v1>

32 <https://www.nature.com/articles/s41377-018-0052-7>

33 <https://www.nature.com/articles/nmat2141>

34 <https://www.nature.com/articles/s41598-021-81091-0>

35 <https://www.nature.com/articles/srep43334>

36 T. Sleasman et al., "Experimental Synthetic Aperture Radar With Dynamic Metasurfaces," in IEEE Transactions on Antennas and Propagation, vol. 65, no. 12, pp. 6864-6877, Dec. 2017, doi: 10.1109/TAP.2017.2758797.

37 <https://ieeexplore.ieee.org/document/7944466>

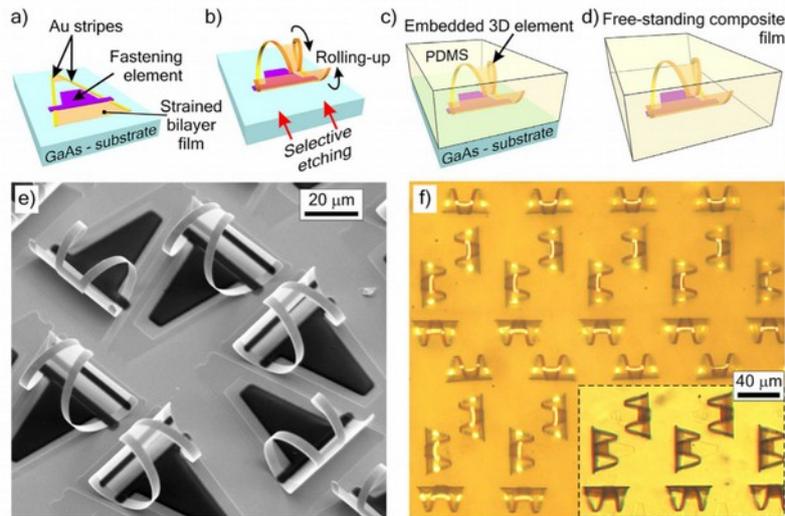


Figure 4. Approach 5: Embedding of rolled-up 3D elements into a polymer film. Schematic of the embedding process: (a) initial lithographic element, (b) rolled-up element fastened to the substrate with a special fastening element (violet), (c) 3D element in liquid silicone, (d) cured silicone film with embedded 3D element after detachment from the substrate. (e) SEM-image of the array of rolled-up elements on GaAs substrate (Ti/Au, 4/50 nm) on partially tubular carcasses (GaAs/In_{0.15}Ga_{0.85}As/GaAs, 6/20/75 nm). (f) Reflected-light and (f, Inset) transmitted-light photomicrographs of the same array embedded into a free PDMS film.

Figure 5.8.3.4.1 – example of metamaterials made up of micro and nano structures in 3D to create very high frequency (terahertz) waveguides

Dr. Hal Puthoff's (TTSA) presentation at UC Berkeley³⁸ in February 2020 on DIA's AATIP research refers to research on invisibility and “invisibility cloaks”, as well as the conduction of EM radiation up to terahertz, in connection with metamaterials and samples of materials that would have been found at crash sites.

In particular, Dr. Puthoff cites a sample of unnamed material that was allegedly recovered from a UFO crash site. It is a multi-layered Bi-Mg Bi alloy metamaterial with 4 micron (bismuth) undulating layers, alternating with 150 micron (magnesium) undulating layers. Such dimensions are reminiscent of those of terahertz waveguides and fall under nanotechnology if the artificial origin of the samples is confirmed.

Interestingly, some metamaterials could be used for very high frequency gravitational wave (HFGW) measurement and other types of space-time curvature measurements. A prototype detector has been produced and could in theory make such measurements.

Finally, changing the refractive index means changing the speed of propagation of the signal (sound, light, etc.) in the medium. In quantum field theory, a vacuum is a medium. In general relativity, to change the speed of light is to change the metric of space-time. Under these conditions, can we imagine one day finding a link between metamaterials and gravitation echoing the unexpected properties that would have been observed by the Russian laboratories that analyzed the Dalnegorsk beads (for example)?

These subjects deserve further analysis.

5.8.4 Conclusions - SIGMA2 comments

While we cannot draw clear conclusions about the origin of the inventoried materials,

³⁸ https://m.youtube.com/watch?feature=share&v=-199qc_6090



we observe:

- The existence of samples of light and conductive materials, such as magnesium in particular, the degree of purity of which cannot be explained either by a natural origin or by manufacturing methods known at the time of the analyzes. In addition, the inclusion of impurities of aluminum, strontium and selenium in the magnesium alloy could seem related at the time of the analyses to the manufacturing process and to the tools employed. It is now recognized that these particles significantly enhance the corrosion resistance of magnesium alloys and their mechanical plasticity.
- The existence of samples corresponding to the metamaterials mentioned on the American side (Hal Putthoff, exhibited at Berkeley) but also on the Russian side. These multi-layered materials, some of which would have been collected in the 1980s (Dalnegorsk), correspond to very advanced technologies of today, involving thin-film nanomaterials with surprising theoretical properties currently being studied: very high frequency EM waves (terahertz), directional anisotropy, stealth, interaction with gravitational waves?
- “Ejecta” type materials, residues lost by UAP, show particular properties that could contribute to exotic propulsion technologies involving these materials in the liquid state (speculative hypotheses of MHD using a nuclear reactor with metal ionized, as cited in the article by J. Vallée?).
- Finally, mechanical and electromagnetic traces have been identified in French cases such as Trans en Provence (Valensole, Amarante) which raise questions about the type of radiation and the interaction with the natural environment, in the case of UAP deemed to have been in contact with the ground. Unfortunately, the chemical analyses carried out have not been able to reveal any conclusive evidence so far.

5.9 Electromagnetic effects (EME)

5.9.1 The findings

Several visual observations of UAP were accompanied by the observation of disturbances in electrical and electronic equipment (some cases are reported in § 5.9 and the main EME cases are described in § 4.2.5):

- In 1954, in the Antananarivo affair, blackouts appeared throughout the trajectory of the “machine”.
- Numerous testimonies have been reported concerning power outages occurring in vehicles in the close presence of a UAP.
- In the aeronautical field, cases of disruptions have been reported on US air bases in the US Air Force “Blue Book” report, as on the bases of Malmstrom or Minot (disruption of command posts and transmissions). Similar disturbances were noted in the former Warsaw Pact, for example on the



Usovo ballistic missile base near Byolokovoriche in Ukraine in 1982 (ground control electronics disturbed during the overflight of the base by a UAP), also in 1991 (fighter plane board electronics). It should be noted that Russia and the USA also signed a cooperation agreement in 1971 on the risks of accidental launching from their strategic bases in connection with the interference effects induced on the launch facilities by unknown machines ... These cases are apparently studied by Bigelow Aerospace in the AATIP program under the Northern Tier reference.

- In 1976, in the Tehran affair, the first F4 Phantom fighter launched in pursuit of the UFO must return because its communication systems no longer function; the second fighter replacing him, feeling assaulted, engages a missile fire ... The weapon system no longer works with each attack pass and works again when the plane moves away.
- Examples of disturbance of navigation compass, emission of electromagnetic radiation disturbing radar receivers, car engine stoppage.
- More recently, the interruption of the operation of mobile phones, the blocking of the operation of video cameras have been observed...

At the same time, in some cases, superficial or internal burns have also been observed, comparable to those observed after exposure to microwave radiation (see § 5.11 on physiological effects). Similar effects are cited by Dr Green who spoke on the AATIP program concerning the physiological effects of radiation³⁹. Effects induced on materials qualified as metamaterials⁴⁰ by tera-hertz radiation are also mentioned by Dr Hal Puthoff (TTSA). These effects are known to be similar to those produced by UAP (references to samples of exotic materials), including on radiation side effects.

For example, a preliminary report of the NARCAP of 2001⁴¹ gathered the reports carried out during 50 years highlighting transient or permanent disturbances on aircraft in flight noted in the presence of one or more UAP. Many other files show the same kind of phenomenon.

In the past, most of the compass disturbances have been observed, highlighting the existence of a disturbing magnetic field. More recently, disruption of electronic equipment has been reported.

Very few cases give measurements of the radiation received. A frequency of the order of 3 GHz is mentioned several times. In particular, this frequency (2800 MHz) would have been observed in 1957 during a flight of a US electronic warfare aircraft RB47 (therefore well equipped to do signal acquisition). This case is described in more detail in § 4.2.5. An analogous frequency was recorded at 3 GHz by the ELINT monitoring system of a B52 followed by a UFO (Blue Book file, Malmstrom 1959) as well as at 9 GHz (see § 4.2.5).

39 <https://ufos-scientificresearch.blogspot.com/2020/02/kit-greens-defense-intelligence.html?m=1>

40 https://m.youtube.com/watch?feature=share&v=-199qc_6090

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5.9.2 The interactions

The interaction of electromagnetic radiation with electronic equipment has become a matter of increasing concern with the sophistication of equipment containing increasingly integrated electronics. We must remember the disturbances on the first cars with electronic ignition when they passed under high voltage lines. Let us also remember the unintentional acrobatics performed by "Tornado" planes when flying over NATO radar installations.

The disturbance of electronic equipment depends on its vulnerability to interaction with surrounding electromagnetic radiation. This is called susceptibility and it varies depending on the frequency and amplitude of the signal received.

Several parameters are involved:

- The protection provided ("faradization") by the structure of the equipment.
- The existence of devices allowing the penetration of parasitic radiation (voluntary or involuntary receiving antennas - screws, connectors, etc.).
- The functional architecture of the equipment.
- The susceptibility of circuits (electronic boards and associated wiring) and electronic components. For the latter, it is necessary to take into account the possible protection provided by the cowling. These cowls tend to disappear or, at the very least, to be very thin and made of a composite material transparent to radiation. The intrinsic architecture of the component and in particular of its substrate plays a key role. In addition, its susceptibility depends on its architecture, which itself depends on the function supported: logic or analog.

In the still recent past, work on these susceptibilities was covered by classified work. Much work has been carried out during the hardening of strategic installations and weapons systems to the effects of nuclear weapons ("electromagnetic pulse").

Recently, academic work has been carried out on the susceptibility of components to electromagnetic radiation. As an example, we can cite a thesis defended on October 21, 2009 at the Académie de Montpellier, Institut d'Électronique du Sud - UMR CNRS 5214 - Université Montpellier 2 - Sciences et Techniques du Languedoc. Focusing on "The study of the effect of electromagnetic waves on the operation of electronic circuits - Establishment of a system test method". It was presented publicly by Tristan Dubois, with Sylvie Jarrix as Thesis Director.

After a reminder of the different modes of interaction of electromagnetic radiation with antennas and boxes, the thesis focuses on the direct interaction with electronic components.

We can read there:

Chapter I: General information on electromagnetic compatibility studies, pages 16 and 17



a) Digital circuits

Other errors may also appear, such as a reduction in the logic level resulting in a reduction in the noise margin of the circuit [Tront et al, 1985] or even an increase in the current consumed, due to the modification of the static characteristics of the circuit.

b) Analog circuits

Analog circuits have much higher electromagnetic sensitivities than digital circuits. Knowing that all electronic circuits use diodes and transistors, such as for example operational amplifiers, a modification of their operating point can lead to the appearance of offsets on the output signal of the circuits [Graffi et al, 1991], [Masetti et al, 1996]. As many analog applications are based on the use of operational amplifiers (AOps), the creation of offsets can lead to their saturation [Fiori et al, 2002] and to a decrease in the dynamics of the circuit.

These two simple observations can explain malfunctions such as, for example, the incidents noted by three Canadian hunters on August 28, 2013 (case submitted by the SCU - Scientific Coalition for Ufology) on their “Sony HD Camera” (impossibility of starting it.) and “New Droid Phone” (battery drain). This equipment is not shielded and is known for its sensitivity to radiation. The engines of their vehicles have not stopped because they are less sensitive. We can assume that this is the result of campaigns to improve the resistance of vehicle and aircraft electronics to parasitic radiation.

- **The case (a) of digital circuits explains the generation of overconsumption likely to drain the battery (case observed on mobile phones ceasing to function with a dead battery and which operated normally again after recharging).**
- **Case (b) of analog circuits makes it possible to understand the blockages observed in the "On / Off" commands of the video shooting camera.**

The susceptibility of equipment is used by more or less sophisticated electromagnetic radiation weapons. We can therefore see that we are touching a very sensitive area where transparency does not reign. Presumably, these weapons have been tested and even demonstrated to show their deterrence.

The world of electronic warfare is protected by very strict rules of secrecy. It is unlikely that useful information will come from this sector when it is best equipped to provide interesting data.

The spectrum of electromagnetic radiation is very busy. Its occupation is particularly monitored by the various government authorities. In addition, an almost systematic watch is carried out to detect possible clandestine emissions. Here again, we cannot hope to see these organizations reporting abnormal radiation measurements.



5.9.3 Conclusions

If the existence of fairly powerful electromagnetic radiation (in at least one case, the magnetic field has caused permanent magnetization effects of metallic parts of a vehicle) has been observed in many cases of observation of UAP, it is impossible to determine which energies are involved. In fact, on the one hand, the radiated fields decrease very quickly with distance, on the other hand the susceptibility of the equipment is a value specific to the equipment which varies according to the frequency emitted.

We should not hope to benefit from open sources of observation of this radiation because this sector of activity is covered by secrecy.

However, the observation made of the existence of a frequency around 3 GHz makes it possible to explain certain interactions, both on materials and on living beings.

However, despite the sophistication of advanced directed energy weapons technologies (see § 5.10) at the end of the 20th Century and the beginning of the 21st Century, it is surprising to see the various EME effects produced by UAP on the environment, on military installations from the 1950s, on electric and electronic circuit technologies spanning more than 70 years.



5.10 Directed Energy Weapons (DEW)

5.10.1 Introduction to DEW

Directed energy weapons are the superlative of electromagnetic aggression in that they are designed to be as “damaging” as possible. Their study and that of their interactions with electronic equipment and systems therefore encompass all other forms of disturbance. The open literature on the subject gives a good overview of the problems that concern us. It is not possible, in this short report, to address all aspects. We will focus on what can be useful for ufologists. Namely the capacity to identify, in the testimonies which we are brought to analyze, what can be (or not) similar or attributed to the effects of possible directed energy weapons. The physics of EME effects on electronic components is discussed in § 5.9. We agree here on the description of DEW and how they work.

A few preliminary remarks are in order.

Directed energy weapons are generally considered to be lasers, electromagnetic weapons, sonic weapons, particle beams, and even devices that launch passive projectiles using electromagnetic catapult-type thrusters. We will only deal with the first two items. Indeed, sound manifestations are rarely mentioned in the testimonies that we analyze in connection with electronic equipment. However, acoustic effects are briefly mentioned in physiological effects on humans or animals (see § 5.11). The impact of microwaves or infrasound-like sound waves is sometimes referred to as a sizzle, a buzz that is often assumed to be attributed to EM propulsion. The conjunction of EM disturbance and buzzing / sizzling phenomena is also evoked by human witnesses. But if it is not recorded by equipment, it can be marked by the effect produced on human tissue. In the event of a close encounter of witnesses with a UAP, the problems observed with the ignition of their vehicle is sometimes also associated with physiological sensations such as altered taste (metallic taste), sensations of overheating, etc. These appear to involve radiation of the microwave type, which ties in with the mechanisms associated with DEW. This subject will be discussed again in the synthesis of § 5.14 on the attempt at correlation between radiation phenomena.

Particle beam devices have apparently never left the labs, and electromagnetic thrusters practically fall into the category of kinetic weapons. The MHD, mentioned in § 5.13 participates in the EM propulsion modes.

When, in a testimony, there appear light phenomena, electromagnetic, or unusual malfunctions of electronic equipment, it should be borne in mind that, while these phenomena can possibly be attributed to directed energy weapons, it does not say who uses them, but it allows to assess the performances of the attacking device compared to what we could do. In this sense, the observed effects can be an interesting “marker”.

We will place particular emphasis on understanding the mechanisms of action of electromagnetic weapons (EM effects on electronics are described in § 5.10).

Indeed, while the effect of laser weapons can be understood by simple observation, the effect of electromagnetic weapons is much more invisible, as is always the case with Electronic Warfare actions. You can only analyze testimonials if you have the



mechanisms of action in mind. We add that access to the equipment repair report could be valuable.

Definition; advantages and limitations

Directed Energy Weapons, often referred to by their acronym as DEW, operate by sending beams of energy to the target, using no projectiles. The energy vectors they use are waves. Classically, a distinction is made between microwave or microwave weapons and laser weapons.

The figure below represents the entire radiation spectrum. The designation boundaries between the different frequency bands are quite fluctuating and depend on the fields of study.

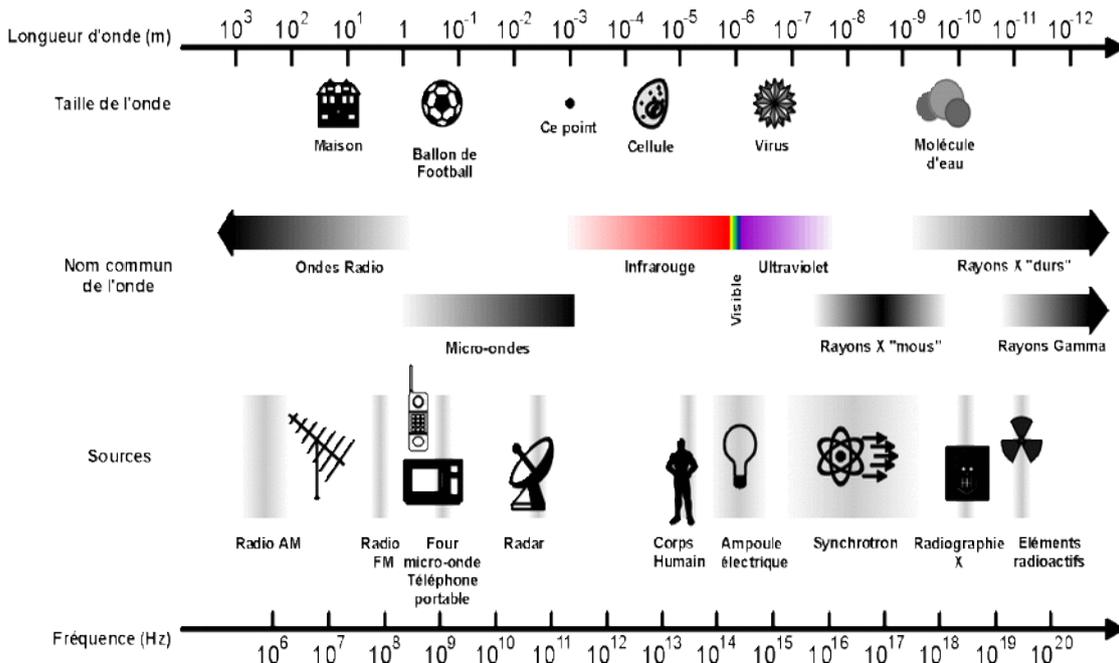


Figure 5.10.1.1 - Full spectrum of radiation

Overall, with regard to microwave weapons, it is assumed that they cover the bands ranging from 300 MHz to 300 GHz, that is to say wavelengths ranging from 1 mm to 1 m (a very small part of the spectrum). In the field of laser weapons, they cover the visible and near infrared bands. The higher the frequency of the wave, the greater the directivity of the beam, and therefore the density of energy deposited on the target will be important. The laser, of course, will allow the greatest deposition of energy density on the target, and even on a point of the target and will cause damage by thermal effects. On the other hand, electromagnetic waves, whose wavelengths are comparable to the dimensions of objects, will induce resonances, and therefore electrical surges which will attack electronics. Indeed, the equipment and systems built by men often have dimensions between a millimeter and a meter.

The birth of directed energy weapons followed distinct paths involving laser and electromagnetic weapons, respectively.



5.10.2 Laser weapons

As for laser weapons, they differ from electromagnetic weapons in that they do not attack the functioning, but the structure of the targets, with a destructive effect. From the start, everyone understood that the very low divergence of the laser beam made it possible to transfer concentrated energy over a long distance. Two major problems arose, the packaging of the lasers and the aiming. Indeed, if the beam propagates at the speed of light, the transfer of energy on the target requires several seconds on a precise point (unlike a conventional ammunition, which propagates slowly, but instantly transfers its kinetic energy). Major technological developments (we can even speak of a breakthrough with regard to the appearance of fiber lasers) have completely changed the situation and make the laser weapon a major candidate, in particular of what is emerging under the name of space war, especially as regards the offensive means. It will undoubtedly be different with regard to defensive means.

Now let's take a look at the advantages of these new weapons and the limitations attached to them. On the laser side, the ability to alter or destroy a mechanical structure and / or optronic or other sensors, with ammunition that moves at the speed of light, is an obvious advantage, especially when the attack against which one wants to defend oneself is "sudden" and requires a very rapid response. The limitation lies, as always with optical devices, in the difficulty of propagation in a disturbed atmosphere (which will not be the case in space).

5.10.3 Electromagnetic weapons

Regarding electromagnetic weapons, they appear in the seventies and eighties when we realize that the vulnerability of equipment and systems is growing in an irreversible logic pattern due to the proliferation of on-board electronics. The more time passes, the more sophisticated the systems, civil and military. Thermal problems appear in the equipment. The simplest remedy is to increase the impedance of the components to limit their release of heat; at the same time, their switching energy is reduced, therefore, as a consequence, their sensitivity to EM disturbances is increased.

There is a need to define an acceptable balance between the sensitivity of the components and circuits, the shielding capacity of the packaging (while respecting the volume and weight constraints) and the environments to which they will be exposed; and this is the whole purpose of the development of standards, directives and specifications which then popped up everywhere.

They were established on the basis of reasonable assumptions concerning the environments, taking into account attacks relating to canonical cases, namely: electromagnetic attacks emanating from neighboring equipment, in conducted and radiated modes; electromagnetic fields induced by surrounding transmitters, radio, radar, etc.; electrostatic discharges, lightning attacks, in conducted or radiated mode, and, possibly, for certain rather military equipment, but not only, the radiation associated with the Electro-Magnetic Impulse of Nuclear Origin.

Manufacturers were then obliged to have equipment and systems designed, manufactured, tested and qualified on the basis of these standards. And this was done.



Then another question arose: are we able to manufacture radiation sources capable of creating at great distance (a few km) illuminations whose levels exceed the values acceptable by the materials thus designed? Clearly the answer was yes; electromagnetic directed energy weapons were born.

The advantages of electromagnetic weapons, with limited collateral effects, are also numerous and explain the multiplicity of effects observed temporarily and not definitively, except in certain cases on the natural or human environment which is permanently marked.

- These weapons produce little (or no) collateral damage; they are non-lethal to humans.
- Most defense systems are not “hardened”, nor are military or civilian standards required. And to make them evolve in a way that restores credibility in their survivability, you have to deal with the whole system, which takes a lot of money and a lot of skill.
- The attack modes can be multiple, since we can target so-called “front door” penetration by sensors and openings, or “back door” by structural imperfections or diffusion through its walls.
- One can attack on an entire area containing several targets (the case of drone swarms immediately comes to mind).
- Very little sensitivity to atmospheric conditions (unlike lasers).
- Few legal or regulatory barriers to their use thanks to their non-lethal nature (unlike lasers for which the Treaty of Rome imposes strong and justified restrictions).
- Very low cost of use compared to conventional ammunition.
- Simplified logistics, even zero (important, in particular in the case of implantation in space).
- The repair of the damage committed requires a high level of technicality and cannot in general be carried out on the ground by the adversary.
- These weapons offer a great dynamic of reactions; this gradual nature gives great freedom of action to decision-makers in the field.
- The action remains invisible, inaudible and anonymous.
- From the point of view of limitations, the most important is the evaluation of the results of the action (kill assessment) which, for the operational staff, is a major problem: we will come back to this later.

5.10.4 UAP and electromagnetic weapons

With regard to the UAP, we recalled in § 5.9 and in the case descriptions recalling the effects of EM weapons, concerning the disturbances of military communications, those of electronic control bays on US bases (case of Malsmstrom), EM wave recordings on airborne wiretapping devices (RB47), the interaction or faulting of aircraft electronics, etc.

These properties of EM weapons make it possible to better understand the multiple temporary effects of certain cases of UAP on the electronics of civilian and military equipment but also on the natural environment, depending on the frequencies emitted and the coupling capacity to “targets” and the emitted power. In the case of the natural



environment, such as on human or animal tissue, the effects appear to be more pronounced over time. It would seem then that the effects and sources may be different. For example, in some cases the desired EM effect is targeted, incapacitating and temporary. In other cases, the observed effect could be physiological and more lasting, a side effect induced, for example, by a propulsion system emitting waves of higher power?

Developments in technology may explain a difference in susceptibility between, for example, aeronautical equipment, between civil and military equipment, as mentioned in the NARCAP report on EME effects⁴².

What appeared very quickly in the design of EM weapons is that on all the materials tested, the cross sections of coupling between the radiations and the equipment varied very quickly as a function of the frequency, but also as a function of the polarization and of the incidence of the aggressive wave (which was obviously linked to the mechanisms of penetration into the structure). This observation only confirmed the intuition that everyone had that the geometric resonances internal or external to the structure were the main cause of the appearance of these discrete frequencies of vulnerability.

In all cases, it was also necessary to take into account the movements of the target which caused the incidence to vary. In short, everyone understood that the weapon that "hit hard", but anywhere, anyhow, had no chance of success; the smart weapon was born.

It appears that we are able at distances of the order of a kilometer to radiate (in current technology) powers capable of causing systems designed to malfunction in accordance with the civil or military standards in force.

It is therefore remarkable that the EME effects of UAP seem to be sometimes intelligently tuned to the structures of disturbed equipment, to disturb them several kilometers away without having experienced the "EME effects" on components and materials, whereas research carried out by USA in particular, include a phase of characterization of the susceptibility of the targeted materials.

Our work does not aim to explain the entire physics and history of EM weapons but rather to characterize their mode of action and the effects induced on different media, so as to then be able to compare remarkable UAP cases, aeronautical, land, etc.

What we know about Directed Energy Weapons today and what we can reasonably imagine for the near future may allow us to identify certain a priori "abnormal" phenomena that may be due to them.

From the point of view of lasers, light phenomena due to reflections on structures, or to scattering of light in dispersive media, can lead to disturbing observations. These luminous appearances can move at very high speeds, or have completely erratic trajectories, not corresponding to what is conventional to see in the case of any vehicle, land or air.

Likewise, devices can be put out of operation, or even destroyed by irradiation of very short duration. Infrared missile seeker heads were put out of order with shots of a few

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tens of femtoseconds and of very modest power.

Signal propagation anomalies have been obtained due to the presence of laser-created screens with short pulse duration and high repetition rate. Finally, we can attend violent demonstrations, such as the cutting of thick metallic materials, in a very short time, thanks to fiber lasers whose average power can easily reach a few tens of kW.

From the point of view of electromagnetic weapons, the effects are less visible. These are, in general, induced malfunctions in the equipment, which cause a system to no longer function or to function otherwise than expected. It is clear that in this case the operator is not immediately aware of the cause of the malfunction; in particular it does not, in general, attribute it to an exogenous cause...

It is clear that, in certain testimonies, such as those of the cases of Antananarivo, Tehran..., where we see several radio or weapon systems ceasing to function successively, we cannot rule out the idea that the cause of these problems are to be found in the means of defense of the target they were pursuing... but this is by no means proof!

5.10.5 Some examples of DEW

5.10.5.1 The American CHAMP program

The Americans have done a lot of work on these issues. It should be noted that what is published on the American side is confined in the technological field, nothing on the operational side. We will see later that, on the Russian side, it is the opposite because they are more expounding their operational conclusions.

A large-scale project has been carried out in recent years, considered in the United States as the bible to which we must refer in matters of directed electromagnetic energy weapons.

This is a program which led to a demonstrator which has been successfully tested in real life. We can imagine that it had a follow-up in terms of operational programs; but here, of course, we know nothing.

Let's come back to the “Counter-electronics High-powered Advanced Missile Project (CHAMP)” program. It is, according to the American name of a “Joint Concept Technology Demonstration (JCTD)”.

This system, installed on board a missile, designed and produced by Boeing and the US Air Force Research Laboratory - Directed Energy Directorate of Kirkland Air Force Base in New Mexico, was successfully tested during a flight at the Utah Test and Training Range on October 16, 2012.

As for the program itself, the objectives have been kept very confidential. However, the



Air Force said the missile met specifications for multiple and controlled assaults on small and multiple targets. We can translate without too much risk of being mistaken that they succeeded in neutralizing a swarm of UAV by adapting individually to each of them. It teaches us a lot of things. First of all, we use a missile (this means that, in this case, we approached the targets with a short range weapon: we cannot help thinking of “Foo-Fighters”). It also means that “the method can work”. In order for all the targets to be neutralized, we have to move from the statistical nature of what is commonly called asymmetry to something much more deterministic. Finally, this means that, to achieve this result, they had to master the modes of action on electronics. In short, that means that what they said about the analysis they made concerning the mode of action of their system interests us at the highest point, because it allows us to better understand the modes of action.

This analysis shows that the action of aggression on electronics can take two forms: the thermal effect and the upset effect (change of state of a component).

It is not our intention to go into more detail on the physics that require specialized reporting appendices, but we will simply say that thermal effects deteriorate components by temperature rise, depending on frequency and pulse durations. At the same time, the upset effects lead to electrical malfunctions of the components. These effects were mentioned in § 5.9 referring, for example, to the case of close observation of UAP in Canada with blocking of the cell phone and the video camera. This upset effect then seems privileged.

We have just seen that the Americans had worked a lot on the technical approach, we do not know much about the applications that followed the CHAMP Program; it is very likely that there is.

On the Russian side, on the contrary, the operational strategy for the use of Electronic Warfare resources is much better known, through documents which have just arrived in the public domain. We give here a short summary of the idea that can be made of it, based on a very interesting analysis carried out by the Swedish Ministry of Defense. It is clear that if we put American technical analysis and Russian operational analysis end to end, the world of Electronic Warfare is changing... and we, interested in UAP, must have it clearly in mind.

And what are the Russians doing?

An in-depth analysis of the evolutions of Electronic Warfare in Russia (Analysis of Russian Electronic Warfare - document published by the Swedish Ministry of Defense, (Jonas Kjellén) shows the breakthrough in terms of concepts of use of electronic warfare. We will not go into the detail of the analysis of this very interesting document. It must be recognized that a great deal of work has been carried out on the Russian side to broaden the field of electronic or electromagnetic warfare to directed energy weapons, to measure the effects of aggression between different modes of action aimed at reducing, through different effects, opposing capacities.

5.10.5.2 Active Denial, built by Raytheon



Figure 5.10.5.2.1 – Active Denial by Raytheon

Beams of microwave energy can cause severe pain without leading to injury. This “pain gun” uses a 94 Ghz microwave beam. At this frequency, the beam undergoes almost no attenuation during its propagation in the atmosphere. It is also very directive. Its energy is absorbed into the surface layers of the target individual's skin, to a depth that corresponds just to the tips of the nerve endings, where water molecules in the skin absorb the energy. Although there is no burning, the sensation is the same as if you touched a flame.

This device is used in the United States to disperse crowds, especially when it is believed that dangerous individuals are hiding among them. It is also used to prevent access to heavily protected sites, or to repel pirates at sea. It has been very well designed, and its compactness allows land use, as shown in the figures above.

5.10.5.3 Vigilant Eagle, built by Raytheon

The proliferation of portable air defense systems (MANPAD) is a growing threat to civil and military aircraft, taking off or landing. The Vigilant Eagle system, using an electromagnetic process, is a set of several devices for scanning an area, detecting and tracking missiles entering the protected area. These devices are installed on towers that surround the airport under protection. In the event of detection, synthetic antennas emit, in the direction of the intruder, microwave frequencies having a chosen waveform (in a database) to interfere with the electronics of the missile's guidance systems, and cause its mission to fail.

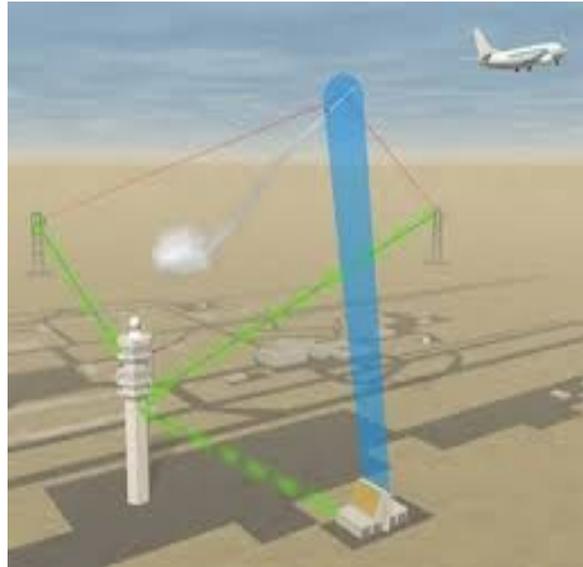


Figure 5.10.5.3.1 - Vigilent Eagle, built by Raytheon

5.10.5.4 SOUVIM; manufactured by DCD-Dorbyl Ltd

In the context of the development of short-range electromagnetic weapons, let us cite the SOUVIM, a machine dedicated to demining. It was developed for the South African Army by DCD-Dorbyl Ltd. The French Army bought five copies. The DGA (French Procurement Executive) asked MBDA to create the French version in 1999 (SOUVIM 2), in view of the war in Afghanistan (2001).



Figure 5.10.5.4.1 - SOUVIM; manufactured by DCD-Dorbyl Ltd

5.10.5.5 LaWS (Laser Weapon System); developed by the Office of Naval Research

The United States, Russia, China and many other countries, including European countries, are developing laser weapons. They are particularly well suited when the reaction time is very short, and they are much cheaper than using missiles.

Most of the programs are classified. However, some American programs have been declassified (that is to say that they are outdated, but that still gives an idea). In particular, the LaWS (Laser Weapon System) program which was installed and tested on the ship USS Ponce, deployed in the Gulf. In this context, its mission was to put out of harm's way small targets (boats or drones). It is clear that, for this type of use, the use of the laser weapon is less expensive than the use of missiles.

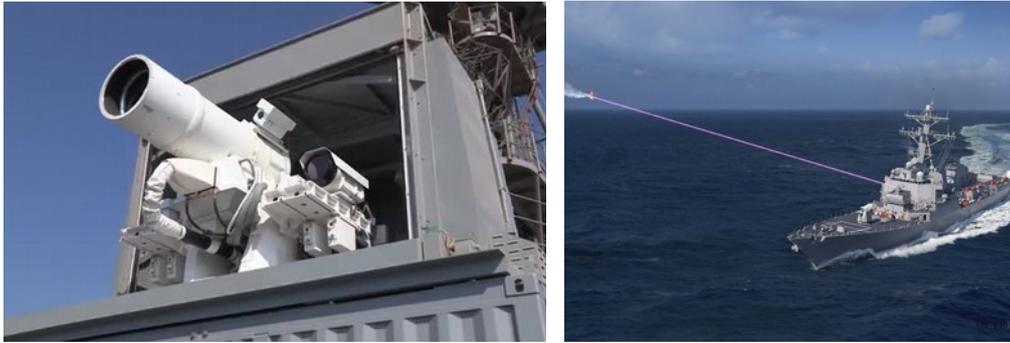


Figure 5.10.5.5.1 - LaWS (Laser Weapon System)

5.11 Effects of EM microwaves on humans - symptoms observed in PAN witnesses

5.11.1 Introduction

The aim of this work is to analyze the effects of acute overexposure to MW in humans and to compare with the effects observed in PAN controls described in the literature.

The starting premise is that the symptoms described in the UAP witnesses could be caused by strong OEM and microwave intensities in particular, but not only.

It should be noted that the effects of Electro-magnetic MW are particularly studied in humans in the context of the use of cell phones or exposure to high voltage electrical lines and this over the long term over periods of several years.

As it is out of the question to subject subjects to MW overexposures for short durations corresponding to what one could observe in PAN witnesses, we will refer to a few accidental cases described in the medical literature and we will refer to a few accidental cases described in the medical literature. compare them to data collected in laboratory animals.

Can we extrapolate the data from animals to humans? We can respond favorably to the extent that animals are mammals (even if there may be physiological differences that are never very important) but in general terms the finding seems positive and can be used.

Clinical experiments with therapeutic products are almost always carried out first on a laboratory animal (mice, rats, rabbits, primates, etc.).

The methodology (even elementary) of this study will endeavor to respect the constraints closest to the scientific method:

- Only cases presenting guarantees of seriousness (observations by soldiers, civilian and military pilots, scientists, police, etc.) are retained.
- Those which correspond to the pure and simple observation of an unexpected luminous phenomenon with a certain number of physical signs accompanying this observation and which disappear after a more or less long time.
- We eliminate from the outset everything that goes outside the field of the



rational and in particular the observation of humanoid beings and exotic demonstrations relating more to science fiction than to physical reality in the current state of our knowledge.

Neuropsychological manifestations will not be discussed in this presentation. They may be the subject of a separate study.

5.11.2 EM Microwaves (MW) - a brief reminder

Electromagnetic fields include a wide range of frequencies - from 1 to 3000GHz - and to study their effects, we will separate them into very low frequency fields, radiofrequency waves, and microwaves.

It is especially the MW that will hold our attention. Their characteristics are as follows:

- Wavelength from 1 mm to 30 cm
- Frequency from 1 GHz to 300 GHz
- The specific absorption rate, ie the amount of energy deposited in living tissue.

Expressed in W / Kg.

MW are used in many areas of the daily life medicine industry ...

There are two types of MW effects on living beings: non-thermal and thermal.

Non-thermal effects have been studied in bacterial organisms whose physiological outlines are very similar to those of mammalian cells.

5.11.3 Non-thermal effects

They have been described by the work of Milligand and Brigid (2000) of Beckwith Olsen (1931) of Carpenter (1958) more recently of Fabian and Graham (1994).

Studies on bacteria such as salmonella typhimurium (typhoid) Escherichia coli, among other species, have shown that non-thermal effects lead to cell death. This mode of action is manifested by the modification of the ionic distribution in cellular biological fluids. These effects would be relayed by an interaction with the electric dipole formed by the water molecule (70% of living beings) and this would disrupt major vital metabolic functions. In addition, MW interfere with a number of enzymes such as G6PD (glucose6phosphate dehydrogenase) or ADPase (adenosine diphosphatase) essential in metabolism and cell dynamics.

To remember:

The non-thermal effects relayed by the dipole of the water molecule and alteration of cellular metabolic pathways.

These results are interesting insofar as they can occur during acute exposure as well as during chronic exposure.

Effects observed in vertebrates



Rats, mice, amphibians, primates were used as study material.

We observed for the non-thermal effects:

Changes in major metabolic pathways in animals kept at constant temperature (Ray and Behari 1993), changes in the immune system (Budd and Czerski 1985 Nageswari and allii 1991).

In addition, MW induce a moderate and non-specific stress effect on the entire organism. Thus, acute exposure to high intensities causes the secretion in the brain of natural endogenous opioids, which causes a decrease in the activity of the cholinergic pathways (using acetylcholine as a neurotransmitter) and therefore the activity of certain regions. brain such as the hippocampus and prefrontal cortex which play a role in memory, thinking, "consciousness" and other important higher functions. (Lai et al. 1986, Lai 1992).

Finally, the work of Cherniakov (1980) demonstrated that the irradiation by these same MW of skin fragments in anesthetized frogs caused changes in heart rate. The same phenomenon is found in rats with MOs of 57 to 78 GHz (Potekhuma et allii 2000).

The particular case of man - observed and experimental aspects:

Few cases of overexposure have been published, but those that have been are of sufficient quality to be used as a reference. For their precision, we will mainly cite the work of

- C. Schilling: effects of acute exposure to ultrahigh radiofrequency radiations in three antenna engineers, *Occup. Newspaper Approx. Med.* 1997; 54: 281-284.
- Bruce Hocking FAFOM FRAGCP Camberwell Australia 2005 Management of radiofrequency radiation exposure.

The other references can be found in the bibliography.

5.11.4 Thermal effects in humans

They will vary with the degree of penetration and the energy deposited:

MW with a frequency greater than 3 GHz have a penetration beyond 10 mm. Above 10 GHz lesions are superficial and can be difficult to distinguish from infrared ones. At the cutaneous level, the most superficial lesions are:

- Erythema (redness) with a more or less intense burning sensation, rarely a first degree burn.
- Deeper penetration will create larger lesions depending on the energy deposited.

The work of Gandhi and Riazi in 1986 showed that the irradiation of a skin surface of 37 cm² at the level of the forehead will cause a burning sensation for frequencies from 3 to 10 GHz and absorption rates from 12.5 to 29.2 mW / cm².

The appearance of deep lesions is linked to the morphology of the human (and animal) body. MW are distributed non-uniformly on this surface, which results in variable energy transfers ranging from low doses to high doses (hot spots): irradiation of the



thorax in dogs causes few lesions at high doses. superficial but irregularly distributed subcutaneous lesions with destruction of subcutaneous fat, lesions of intercostal muscles (coagulation by denaturing protein molecular structures), "cooking effect".

Along with these attacks, there is a dilation of the blood vessels which become permeable, the serum accumulates in the tissues thus reducing the arterial pressure and reducing the irrigation of the organs which can then lead to renal failure and also other essential organs. All this is aggravated by the formation of clots (thrombi) in these vessels, causing heart attacks in the organs they supply, or thrombophlebitis if they are veins with a risk of pulmonary embolism.

The accumulation of serum in the tissues can result in the compression of the muscles which are surrounded by an inextensible sheath which can necrose (compartment syndrome) and compress the adjacent motor nerves with motor paralysis.

While the effects described above relate to a localized area of the body (which may be large), OM may also induce an increase in body temperature. Thus, the absorption of an amount of energy of 10 mW / cm² increases the body temperature by 1 ° C.

A significant rise will be comparable to a high fever which can exceed the mechanisms of temperature regulation (sweating, chills) and cause dehydration.

Will the release of histamine from injured tissues (mast cells specialized skin cells) cause additional vasodilation and increased gastric secretion with possible ulcer-like damage to the stomach mucous membranes? This can be considered as a working hypothesis. Note that MW, by an action probably on the sympathetic system, can increase intestinal motricity.

To remember :

skin lesions

Denaturation of cellular proteins

Vascular lesions with leakage of serum into the tissues

Hypovolaemia and hypotension

Muscle and nerve compression syndrome (compartment syndrome)

Gastric hypersecretion

Intestinal mobility Increased Acute renal failure

Possible hyperthermia-related brain damage

5.11.5 Cardiovascular effects

Cardiovascular effects. The heart is an electrical organ that has an autonomous pace maker. As a result, it is particularly sensitive to radiations which can induce an electric field: the work of Reilly showed in 1998 that exposure to a 50/60 Hz field induces an electric current which is liable to cause rhythm disturbances. A recent publication by David R Bock and Louis N Heynick in Bioelectromagnetic supplement vol 6: 5187-5195 provides a number of data:



stimulation of the sympathetic nervous system (ortho and parasympathetic) by hyperthermia causes tachycardia. Brain absorption of energy could induce bradycardia. As it stands, we cannot say that MW have a deleterious action on the myocardium. The effects observed are secondary: ultra-structural studies of the rat myocardium subjected to very high doses show no modification. (work of Soker, Sert, Deniz, Int Journal Morphology 29 (3): 960-964, 2011).

The non-thermal effects could play through the problems of ionic distribution; thus the threshold of excitability at the cardiac level is 12.0 V / m which, if exceeded, can lead to fatal arrhythmias.

It is therefore by the action of induced currents that MW could act on the myocardium.

5.11.6 Effects on the digestive system

The signs observed, diarrhea, stomach pain, nausea and vomiting, are most likely related to hyperthermia (especially if localized) and the release of histamine; other polypeptides that may increase histamine secretion and intestinal motility. We cannot exclude the non-thermal action at the level of the digestive organs, but this is only a hypothesis.

5.11.7 Central nervous system effects

The central nervous system is also an electrical organ producing electromagnetic waves that can be recorded by the electroencephalogram (EEG). Brain waves are:

- alpha waves from 8 to 12 Hz
- beta waves from 12 to 30 Hz
- delta waves greater than 30 Hz
- theta waves from 4 to 8 Hz

Most of the work on cerebral effects concerns the possible mechanisms of carcinogenesis linked to the use of cell phones, but little concerns cases of overexposure.

These cases studied by the Russians L K Yeresheva D. Yu Dumonski in the 1980s using low intensity MW showed slight brain dysfunctions.

EMFs appear to be able to increase alpha wave activity, but these results have not been reproduced by other studies.

Nevertheless we can enumerate the signs caused by the action of MW highlighted by the study. NIOSH Technical Report from 1978:

- bradycardia hypotension
- change in thyroid activity, change in hormonal secretions (see below)
- headache, irritability, severe fatigue, trouble concentrating
- change in taste



In the rat, changes in neuronal activity are demonstrated. Also in the rat, the normal behavior is modified in the laboratory under the action of MW in a linear fashion according to the specific absorption rate (D R Justassen NW King 1980).

While other studies such as that by Reeves (2000) have shown in 34 subjects subjected to acute exposure that the neuropsychological symptoms observed were linked to a psychiatric condition, in 66% of cases, these results are questionable because the prevalence of psychiatric conditions is 15% in the general population.

As for the heart, we can hypothesize that MW act by both non-thermal (ionic distribution, induced currents) and thermal mechanisms.

Finally, one can exclude the action of MW on the blood-brain barrier (which only allows certain molecules from the blood to pass to neurons and other brain cells).

Studies with the functional MRI technique could be useful but it would be surprising if they were applied to this field.

5.11.8 Effects on peripheral nerves

MW can by direct interaction with ionic movements, such as induced currents, disrupt and interrupt nerve impulses, or even act on both agonist and antagonist muscles (flexion-extension, for example) and cause total paralysis but reversible of one or more limbs more or less painful. These non-thermal effects can also be manifested at the sensory level by tingling, feelings of heaviness and numbness.

5.11.9 Effects on the vegetative nervous system

This nervous system responsible for controlling non-voluntary functions (heart rate, pupil dilation, etc.) can be “stimulated” by MW. One can observe blood pressure disorders (sudden and reversible hypertension), heart rate disturbances by adrenal adrenaline discharge linked to stress, sensations of chest striction by bronchial spasm but which may be linked to anxiety.

Finally, to finish in the neurological framework, we cannot ignore the phenomena of sudden anxiety, emotional shock, which can lead in some personalities to a post-traumatic stress syndrome with recurring dreams, irritability, anxiety and anguish, withdrawal into self which can be disabling.

5.11.10 Effects on other organs

5.11.10.1 Effects on the eyes

The crystalline lens is a very fragile non-vascularized lens which poorly dissipates the heat it receives and whose regeneration capacities are almost nil. The lens is very sensitive to all attacks and its exposure to MW will denature the stereochemical



structure of the proteins that compose it (crystalline) and which are responsible for its transparency. Cataract occurs. The lens no longer allows photons to pass. (Kramar et al. 1975, 1978).

Thermal lesions are dependent on the energy deposited and cataracts can appear after a few weeks in both rabbits and macaques (work by Mc Affee and allii 1979, 1989).

Acute exposure to a frequency of 2.45 GHz for 2 to 4 hours with an absorption rate of 26.5W / Kg produces cataracts and edema of the cornea. There is also an inflammatory reaction in the anterior chamber of the eye with deposits of fibrin. In anesthetized monkeys lesions of the cornea and iris have been found inconsistently.

Finally, changes in the electrical activity of the retina (electroretinogram) have been observed which are not well understood.

5.11.10.2 Effects on the blood and immune systems

An important study carried out by the WHO in 1993 took stock of this subject and concluded that the phenomena observed were related to the hyperthermia of the body above a deposited energy of 4 W / kg. There is a change in the number of white blood cells (lymphocytes) and a decrease in the number of their precursors in the bone marrow.

5.11.10.3 Effects on reproductive organs

Exposure of the testes in males produces a decrease in spermatogenesis and an alteration in the testicular cells that produce testosterone, which leads to impaired fertility and sexual potency. These effects are thermal and can cause breaks and other damage to sperm stem cells which can cause problems for future offspring if possible.

In the female, strong intensities at the beginning of pregnancy cause an abortion. Nothing is known about the long-term effects.

5.11.10.4 Effects on chromosomes

In humans, many cancers are known which are accompanied by chromosomal abnormalities. The effects of ionizing radiation are known.

The Russians A Kapustin, M I Rudnov, G I Leonskaia described chromosomal abnormalities in cells exposed to MW delivering energy of 5 to 50 $\mu\text{W} / \text{cm}^2$, 7 hours per day and for 7 days. We are far from an acute exposure but we cannot rule out the possibility that during such an exposure chromosomal lesions occur and are talked about after several years.

Cells exposed for short periods of time to energy levels of 15-2950 W / cm^2 as pulsed MW have chromosomes abnormalities.

5.11.10.5 Respiratory



Nothing has been described regarding the lungs.

5.11.10.6 Kidneys and urinary tract

Strong absorption from a renal compartment could produce damage. It should also be borne in mind that if muscle damage occurs there may be passage of myoglobin (protein which fixes oxygen in the muscle and gives it its red color) into the blood which is eliminated by the kidneys. , which can create lesions.

5.11.10.7 Human hearing system

The study of the literature in this field highlights the work of James C. LIN of the University of Chicago on pulsed microwaves and perception in humans.

The human ear is able to perceive MW in a range of frequencies going from a few hundred MHz to a few tens of GHz.

The phenomenon may seem surprising, but it has been verified. Very high energy pulsed OM follow a precise path: they propagate through the bones of the skull by delivering a little energy to the surrounding tissues, which raises the temperature and induces a dilation (thermoplastic mechanism) which is linked to the morphology cranial. This results in the formation of an acoustic wave that is detected by cells in the inner ear (cochlea).

ref: James C LIN, PMID 174 956 64 Pub Med.

Implants in animals have made it possible to determine the frequencies of pulsed MW triggering the excitation of the cochlea (inner ear and auditory nerve).

In humans for a radius of the skull of 7cm, this frequency is 10 to 15 Khz and the energy density is evaluated at 2183mW / cm² which is enormous and can be dangerous. The standards in the EU recommend in case of brief exposure an energy limit of 10mW / cm².

These facts may be one of the possible explanations for the severe pain experienced by some witnesses and may be dizziness and disturbance of balance.

5.11.10.8 Olfactory apparatus

By referring to the few works in this field (olfactory effect of UAP), we quickly arrive at the notion of plasma ball which is responsible for the formation of metastable nitrogen (from atmospheric nitrogen) and also of free radicals, from the formation from nitrogen excited by interaction with water vapor, to ammonia but also to nitric oxide and ozone.

Sulfur odors would be linked to the presence of pollutants in the air, reacting with the excited nitrogen.

These different chemical “markers” can be the cause of many physiological signs



(nausea, vomiting, irritation of the eyes, respiratory tract, etc.).

We are very reserved about this part because it would require measurements on the ground which is almost impossible ...

On the other hand, the effects of pulsed MW on soils can very well cause the formation of abnormal chemical compounds as in the following case:

On November 2, 1971 in Delphos, Kansas where a mushroom-shaped PAN was seen near the ground emitting a sound that has been compared to a washing machine vibrating, with blinding light, stress reactions in animals (dogs) - the details of this observation are online - but above all a ring on the ground at the place of the landing whose analysis revealed in its composition soluble salts of carboxylic acids (R-COOH) which were destroyed in heating them to 100 ° or washing them with methyl alcohol.

5.11.10.9 Effects identified in humans of MW associated with UAP

Although this is not the primary concern in studies of UAP, the effects on controls were often mentioned. The cases selected for this study come from the literature, mainly foreign, and their choice must be careful.

Many descriptions are articulated around the observation of luminous devices with the presence of various humanoid entities often having an aggressive attitude towards the witness which results in the projection on the latter of a light ray causing paralysis. We will not argue over these cases, which will not be retained. This is not to deny the existence of such descriptions but they deserve a full study in the neuropsychological and neurobiological framework.

The cases selected come from limited sources:

- the book by John F Schuessler, one of the founders of the MUFON⁴³ medical committee which compiled without distinction more than 300 observations of physiological effects in humans in 1995 with a large number of humanoid observations.

Some articles:

- Serthold Eric MD consultant of the brain waves laboratory New Jersey 1971
- Richard C Niemtow MD project UFDMO California 1978
- The book by Richard H Hall from 2000 which presents a number of cases (sometimes common with those of Schuessler)

The cases rigorously selected (as far as possible) were based on the following criteria:

- unexpected observation of a variable luminous phenomenon and concomitant appearance of symptoms which are reversible after disappearance of the phenomenon.
- The cases reported by military or civilian pilots, scientists (engineers), soldiers or police officers were selected in priority because of their

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precision and also of the personality of these individuals who are the subject of a rigorous selection. physically and psychologically.

From the data collected by Schuessler, a comparative study of the French and European cases is carried out. It shows a convergence of signs observed in the witnesses compared to the experimental signs.

All cases are taken from John Schuessler's collection:

Catalog of UFO related human physiological effects

1996 Houston Texas

From this census, it was retained among the global cases going from the 19th century to the end of the 20th century, those cases concerning France for a period going from 1954 to 1983. This does not mean in any case that other similar observations did not take place after that date but, to my knowledge, they have not been studied.

5.11.11 Effects identified in humans of MW associated with UAP

5.11.11.1 French cases

The number of cases collected by Schuessler for France is 31 (excluding abduction cases).

Geographically the entire national territory is concerned, from the Ardennes to Brittany and from the North to Provence.

The majority of these cases relate to the 1954 wave, ie a rate of 70.96%.

The observations are staggered from 1954 to 1983 and we therefore have:

- For 1954: 70.96% of cases
- From 1954 to 1983: 29.04% of cases.

In terms of information related to these data, we can regret their laconic character and the lack of elements such as the age, the socio-professional status of the witnesses and especially the absence of important details on the descriptive aspects of the physiological effects.

Abduction cases have been deliberately excluded because of their very special character with respect to the study of UAP.

The physiological effects will be examined, followed by a summary analysis of the characters of the witnesses, the form of the UAP, the circumstances of encounter and the behavior of the humanoids.

The physiological effects observed:

Digestive: 1 case of nausea with anorexia (duration not specified). This is entirely compatible with overexposure to MW by direct action on the stomach or at the encephalic level (less likely).



Ophthalmological:

3 cases (9.67%) of more or less severe eye burns with one case of transient blindness (one week) which can very well be explained by the action of type B UV radiation, especially with acute inflammatory conjunctivitis (thermal effect) and corneal damage in the case of blindness with corneal edema, explaining the sharp drop in vision.

Neurological:

Paralysis are the most frequent manifestations identified with 17 cases, ie 54.8%. In two cases they are accompanied by an inability to speak, incorrectly qualified as aphasia. These paralyzes can evoke a sudden disorganization of the peripheral nervous circuits by “superimposition” of an EMF (Electromagnetic Field) on the axonal neuronal action potentials.

The aphasia which can be explained by an attack of the muscles concerned with the motricity of the language, central cerebral attack of the motor centers of the word.

Note a case of loss of consciousness which could be explained either by sudden brain damage (loss of consciousness) unlikely, or by stimulation of the vagus nerve with vagal discomfort (hypotension bradycardia syncope).

A panic attack (acute anxiety attack) occurring after the end of the phenomenon and which may be the result of a pre-existing generalized anxiety disorder; similarly, a case of recurring dreams and insomnia occurring after a meeting could at least suggest post-traumatic stress syndrome.

In these last two cases, the role of MW takes a back seat because it is the whole event that activates or reactivates a more or less pathological previous state.

These disorders are concentrated in two cases, ie 6.45%.

Other reported effects:

- sensation of heat in the skin in relation to the thermal effects of MW.
- Sensation of cold either probable neurovegetative dysregulation or modification of the ambient temperature.
- Tingling and pricking sensations in the skin: direct excitation of receptors by MW.

7 cases or 22.5%.

Electric shock: direct action of an electric current.

5 cases reported, i.e. 16.12%.

A case of difficulty in breathing without further details which may be the result of anxiety related to the phenomenon rather than a possible action of MW in the respiratory muscles or any cardiopulmonary impairment.

Perception of sounds: reported in two cases, i.e. 6.45%, of which we know that they can be observed during exposure to MW by propagation to the inner ear through the bones of the skull.

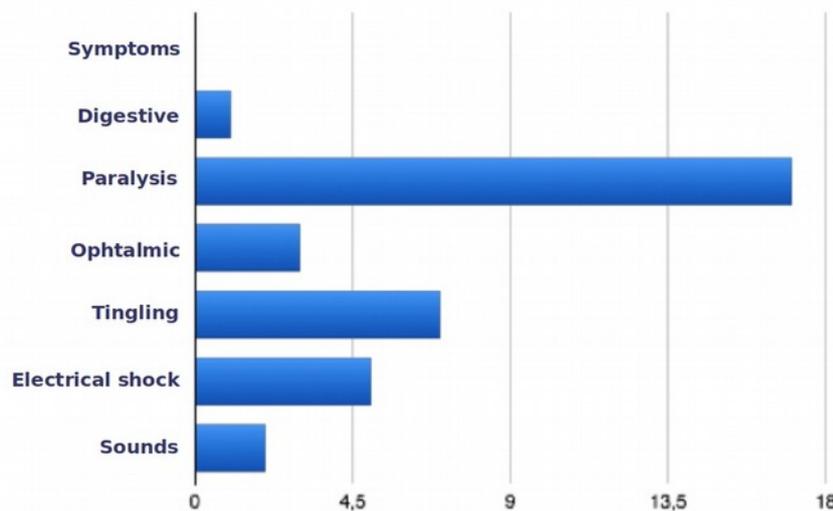


Figure 5.11.11.1.1 - Number of cases found in the study

Characteristics of witnesses

31 cases concerning 48 witnesses in total and certainly more because many were not counted.

46 men and 2 women

Situation of witnesses at the time of the meeting:

Pedestrians: 17 or 54%

Cyclists: 2 cases or 6.45%

Conductors: 18 cases or 58%.

To note 3 cases with animals (dogs and a horse) and animal reactions of panic in one case, of partial paralysis of a dog which had gone towards the object on the ground, and for a horse, a real levitation with fall to the ground after a few moments once the object which had passed over it had disappeared (without any action on the farmer who was driving it).

Morphology of UAP

Disc: 6 cases or 19.3%

Circular: 2 cases or 6.45%

Cylindrical: 2 cases or 6.45%

Conical: 1 case or 3.2%

Oval: 1 case or 3.2%

Lenticular: 1 case or 3.2%

No details for the remaining 32.3% of cases.

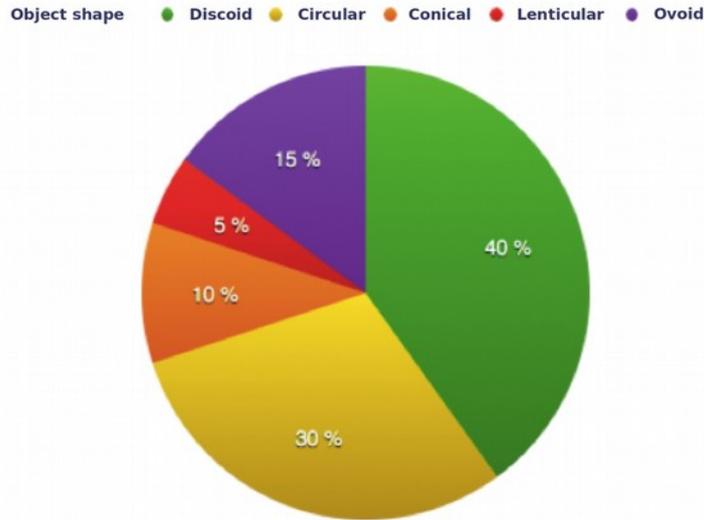


Figure 5.11.11.1.2 – Morphology of UAP

On the ground: 13 times or 41.9%
 Vehicle overflight: 4 times or 12.9%
 Going towards the witness (s): 7 times, i.e. 22.5%
 Hovering flight: 4 times or 12.9%

In all, this synthesis of physiological effects that Schuessler took the initiative to identify concerns for France especially the wave of 1954 and it does not seem that such numerous cases have been recorded since 1983 or at least they have not been collected.. GEIPAN should have an idea on this subject. A reconciliation would be useful.

The results of the effects lean strongly for the action of CEM / MW on the organism (and in animals). The morphological characteristics of UAP are those conventionally described.

There remains the case of the levitation of a horse which is difficult to explain without considering a sudden depression with updrafts caused by an unknown physical (and atmospheric) phenomenon. But we prefer to stay outside what is not our area of expertise.

5.11.11.2 Physiological effects in other European countries

We retain 25 cases concerning certain countries:
 Germany, Italy, Belgium, Spain, Sweden, Denmark, Great Britain.

Distribution of cases

GB: 40%
 Italy: 28%
 Sweden: 12%



Belgium: 8%
Denmark: 4%
East Germany: 4%
Spain: 4%
The years range from 1933 to 1980
No particularities concerning the 1954 wave (8% of cases).

Physiological effects other European countries

Neurological: 32%
Amnesia: 32%
Loss of consciousness: 12%
Headache: 4%
Burns: 4%
Damage to other organs: 4%
Respiratory problems: 4% /

Animal reactions: 3 cases or 12%:

Paralyzed cows in a field
Birds emitting shrill calls
Dog transiently paralyzed⁴⁴

Synthesis Europe

31 French cases, 25 cases from other European countries, i.e. 56 cases selected.
The selection criteria are based on phenomena which overlap and which have a completely plausible aspect with a known natural phenomenon (lights, luminous balls, etc.) and the description of medically known effects.

Cases of abduction of voice perception and other phenomena that may be related to parapsychology have been deliberately excluded.

This does not amount to saying that they are to be neglected but to study in a completely different register which touches on psychopathology, psychiatry, neurobiology.

Summary of physiological effects across Europe

Paralysis: 48%
Ophthalmological effects: 9.67%
Headache: 14.2%
Psychological shock: 3.5%
Burns: 14.2%

Situation of the UAP

On the ground: 12.6%
Hover: 21.4%

The list of physiological effects can be drawn up from the data retained and it is

⁴⁴ These cases of animals are censored to report evidence of paralysis of mammals



undoubtedly not exhaustive but it highlights a series of types of organs which are predominant and compatible with the consequences of the action of physical agents, such as EMF / MW.

Symptoms identified during the observation of UAP

- More or less complete transient paralysis
- Transitional Mutuality
- Feeling hot
- Feeling cold
- Physical thrust with fall
- Burns of varying degrees to skin or deep structures
- Tingling paresthesias
- Electrical shock
- Headache
- Amnesia
- Tinnitus
- Loss of consciousness
- Transient blindness and various eye disorders
- Respiratory problems
- Digestive disorders
- Acute anxiety attacks
- Minimal post-traumatic stress syndrome
- Muscle concussion
- Myoglobinuria
- Acute localized inflammatory reactions
- Sound perception
- Perception of abnormal odors
- Transient abnormal body odors, Hair removal alopecia.

We note the preponderance of neurological signs (48%)

Analysis of some of these signs

Paralysis

They can result from the action of electric fields on the nerve fibers which will be superimposed on the physiological action potential of the nerve and block it, themselves will be able to gain the neuromuscular junction (motor plate) and cause stimulation at the same time agonist and antagonist muscles (extensor and flexor for example) of a limb and lead to stiffness, real muscle amazement. The voluntary contraction is totally defused. The absence of pain seems curious in this state but this hypothesis remains the most plausible to explain this sign. In no case are they paralyzes linked to cerebral damage which would be definitive and could be objectified by medical imaging.

Headache

More than the mechanical excitation by MW of sensitive structures of the cranial vault such as the meningeal envelopes (the dura mater for example), they could be induced



by the stimulation of deep brain structures (endogenous dopaminergic and opioid circuits) which play a role in migraine pain. If this hypothesis seems attractive, we cannot rule out the role of MW on the permeability of the blood-brain barrier (vascular barrier which only allows selective molecules to pass to the brain) and whose role in this situation, if it is poorly understood, is almost certain.

Loss of consciousness

We can suggest a vagal discomfort by direct stimulation of the vagus nerve with bradycardia and drop in blood pressure or a rhythm disturbance related to the disturbance of circulation of the physiological electric current of the heart. These phenomena are linked to direct interactions between MW and cardiac electrogenesis. No case of sudden death seems to have been reported after observation of UAP.

Ophthalmologic

The lesions of conjunctivitis (redness, tearing, pain) are most likely linked to the action of UV rays. The reported case of transient blindness lasting one week is probably related to edema (thermal effect) of the anterior corneal epithelium.

Respiratory problems

The reported case is related to the inhalation of irritating substances probably created by PAN from the components of the ambient air and its pollutants and this would induce the appearance of a bronchospasm, that is to say an attack of asthma caused. The sour taste in the mouth is caused by the dissolution of these same compounds in the saliva.

Damage to other organs

An increase in the size of the lymph nodes and testes as well as urinary difficulties has been reported in a patient who has been exposed to the glow of a UAP.

It can be deduced from this case that the pelvic region was subjected to a MW which resulted in acute inflammation (thermal or non-thermal effect) with ganglionic reaction and increase in volume and in the testes, inflammatory reaction linked may be to microlesions. diffuse. The notion of pain is not mentioned but it is very probable. As for urinary problems, we can think that they are voiding difficulties linked to the involvement of the prostate of the bladder and pelvic congestion in connection with the inflammatory reaction.

Amnesias

The cases of amnesia reported (especially in GB) and attributed to abduction phenomena, may find a more rational explanation.

It is established with certainty that EM radiation occurs during the explosion of projectiles and this radiation is at the origin of what was called "shell shock" during the First World War and which has since been dubbed post traumatic stress disorder. Russian studies have demonstrated these effects, among others, and were carried out from 1940 to 1999: **Charepenin VA, Schumihir VP: Mechanism of Wide band microwaves radiation at explosion of condensed high explosive, Journal of radioelectronic N1 1998.**



In extreme cases this shock wave can produce a pressure equal to 500,000 times that of atmospheric pressure, propagate at a speed of 10 km / s and its power can reach 20 million W / cm².

The traumatic nature of these pulsed MW being demonstrated, we can assume that a physical phenomenon like UAP emits radiation of such power that it can cause a mild head trauma (TCL), the characteristics of which are the loss of knowledge and amnesia of events that can last.

The notion of TCL has been reviewed and reassessed in recent years in medicine. The hypothesis of an electric shock does not hold because it would cause a generalized seizure.

Alopecia

The East German case reports skin burns and alopecia after observation of a UAP near a USAF base. It is reminiscent of exposure to IR because from a dose of 4 Gy depilation occurs (hair and hair) in the following two weeks. This depilation can be total for doses of 6-8 Gy and faster. This case is therefore specific and evokes exposure to an RA source.

Sound perception

It is known that EM radiation can partly by thermal effect induce a wave that propagates through the bones of the skull to the inner ear.

What is interesting in a case in GB is that of a man who had transient paralysis after hearing a deaf sound coming from a hill.

Myoglobinuria

It corresponds to the presence of myoglobin (which takes up oxygen in the red muscles) in the urine and can be seen after a muscle concussion (case of Imjarvi in Finland).

In total we see that through this limited study a certain number of constants emerge whose neurological signs are in the foreground with the thermal and ophthalmic effects which reinforces the idea of the action of a phenomenon emitting MW .

Skin burns

In this context it is reported the case of healing of a melanoma (malignant skin tumor) which seems unlikely because it is a radio resistant tumor. Or maybe it was another skin tumor.

Reporting of abnormal body odors may be due to the sweat shedding of abnormal metabolites caused by the effect of INRs.

The psychological side mentions states of anxiety and anguish which are reactive in subjects with an anxious personality, and only one minimal post-traumatic stress disorder (recurrent dreams) is reported; this type of reaction is very likely to be more widespread and further studies would be needed.



Finally, a case of sudden death from cerebral hemorrhage at a doctor's office three days after the observation of an intense luminous object is puzzling: simple chance or rupture of a cerebral aneurysm under the effect of / or radiation ...

By adding these 56 cases to Schuessler's 50, we can make a summary cross-study of the percentages of effects:

Summary analysis of the cases of R.HALL and SCHUESSLER
total of 106 cases:

Paralysis: 48.1%
Ophthalmology: 17.9%
Headache: 10%
Amnesia: 13.2%
Digestive disorders: 7.5%

Either for neurological effects: 71.3%

These results, even if they are not completely superimposable, nevertheless present great convergences, in particular with regard to the neurological, neuro-sensory and physical effects (burns, stinging) and one cannot deny the clear similarity between experimental effects and the symptoms described. by witnesses.

All this is in favor of a physical phenomenon still unknown and which could emit RNI responsible for effects comparable to the rare observations of cases of overexposure to MW in humans and which match the experimental data observed in animals. in brief intense exposure experiences.

The ideal would be to be able to have precise medical data (precise interrogation, physical examination), minimal biological data (standard assessment) and to adapt the behavior to be taken on a case-by-case basis. A follow-up would also be useful in certain cases. Such measures have been recommended by MUFON but overall there are few detailed observations accessible to date in terms of physiological effects after observation of UAP.

5.11.12 Sensitivity of animals to Electromagnetic Waves

The sensitivity of some animals to the Earth's magnetic field has long been suspected and this fact has been demonstrated by several studies.

In the laboratory, but also in the natural environment, different species (especially migratory ones) were subjected to carefully calibrated magnetic fields and the modifications of their orientation were noted.

Whether in a basin containing sea turtles or migrating fish, or in a dovecote, the fact of placing a ferromagnetic bar modifies the orientation of the subjects and in particular



their navigation.

These animals have internal structures called magneto-receptors related to nerve threads themselves connected to areas of the brain whose electrical activity when recorded is modified by the action of external magnetic fields.

This system of perception and analysis of the terrestrial magnetic field allows these migrating animals to keep a constant course and it seems that for some of them it allows them a real geolocation on their migratory path. They know the positions of the lines of force of the Earth's Magnetic Field of the territories they cross and move relatively precisely from one point to another.

Which animals are affected?

Migratory birds and pigeons (in which the phenomenon has been well studied and for which the solar compass plays an important role), certain fish (trout, salmon)⁴⁵, chickens, and mammals such as the rat, the mole, the platypus (electro reception); in invertebrates such systems are found in magneto-tactical bacteria and some molluscs and the field of exploration is vast.

Analysis

Sudden action of a violent and unusual light source sufficient to trigger a stress reaction by conventional neurobiological pathways, but the action of other physical agents of the Non ionizing radiation/ MW type cannot be ruled out.

Cattle are used to living in a physical and human environment that they know well and the vision of planes passing at low altitude, vehicles, trains is perfectly integrated into their neurosensory universe.

What tends in favor of the action of Non Ionizing Radiation is the unfortunately not detailed report of physiological effects in the controls in at least 5 cases:

Dogs:

| | |
|----------------------|----------|
| Hypervigilance alert | 30 cases |
| Acute stress anxiety | 16 cases |
| Barking howling | 11cases |
| Curiosity | 8 cases |
| No response | 17 cases |

Triggering factors apart from the presence of the object: sounds, which is not surprising when we know the hearing capacities of this animal, the high frequencies in particular, which were responsible for painful sensations in the witnesses in 4 cases. The howling we have already mentioned is associated here with abnormal behaviors such as acute stress, this dissociation could be caused by factors such as RNI in the brain by causing a disconnection of certain pathways of the stress reaction system.

⁴⁵ Among fishes, electro receivers do exist for shark and rays which detect the move through the Earth Magnetic Field and operate like indirect magnetic reception.



The data collected in animals are far from respecting methodological scientific rigor and are essentially based on human testimonies, the inter-individual variability and subjective nature of which are known.

Nevertheless, they present a certain consistency by the identity of the signs observed.



5.12 Physical causes to explain UAP

5.12.1 Examples of various cases

The testimonies concerning the UAP, since the 1950s, are extremely numerous. They relate to a wide variety of observables, such as shape, light emitted, color, speed or acceleration, size, electromagnetic emissions, disturbances of all kinds that their presence can induce, and, of course, temporal evolutions of all these observables.

Over so many years, of course, much has changed, both in the ability to observe and in the ability to interpret; but also in the communication which is made concerning these testimonies and their interpretation.

We will discuss, in the following paragraph, a significant sampling of the testimonies and the vision that we have, to this day, of what emerges from natural phenomena, and, from what emerges more particularly, from **atmospheric phenomena**.

5.12.1.1 MOD UK testimonials

The UK MOD has analyzed and widely opened up to the community a very large number of testimonies recorded over thirty years.

The initial goal of this work, for the United Kingdom, was to assess the level of risk that this UFO phenomenon could represent for the security of the United Kingdom airspace, as well as to derive from these analyzes ideas that could possibly be used to ensure this security. Particular interest was focused on the one hand on the effects of UAP on the environment and human beings, on the other hand on the phenomena of plasmas (so-called floating) by trying to find explanations in connection with the re-entry of meteoroids, ball lightning phenomena.

The major conclusion is that the risk seems low, but that certain testimonies, being the object of physical recordings, remain inexplicable, in particular by the kinematic characteristics without comparison, acceleration beyond technological reach, but also the capacity to land.

5.12.1.2 KGB UFO files book

In recent years (90's), the KGB, among other Russian institutions, has opened up a large number of files regarding UFO phenomena to the public. Their number is such that it is impossible to summarize them. What should be remembered is that their conclusion, like that of the United Kingdom, attests that there remain a large number of cases considered unexplainable with our current knowledge. In particular, one can recall the case of Kapustin Yar which we evoked in more details in § 4.2.5, 5.9 and 5.10. The cases observed were manifested by EME effects on the one hand on the electronic control bays on the ground (1971) and on the control electronics of fighter planes during an interception attempt (1991).



5.12.1.3 Sandia file; green fireballs

Green fireballs are UFOs that have been listed since the 1950s. The first testimonies appear in 1948, in the southwestern United States, in New Mexico, flying over American military bases where the development of weapons was carried out.

On the night of December 5, 1948, two crews, one civilian and the other military, reported encountering "green fireballs."

Other testimonies follow in the same region, in particular in Alamogordo; more recently others, in Japan and Australia. Numerous debates, at a very high level, both scientific and political, have opposed, and still oppose, the proponents of an explanation described as "natural" and those of an extraterrestrial option. To date, no convincing conclusion has emerged.

5.12.1.4 NARCAP R. Haines-D.Weinstein testimonial

On May 15, 2001, R. Haines and D. Weinstein published an interesting study by NARCAP US which presents the conclusions of an analysis of a considerable number of pilot testimonies accumulated over the past fifty years, and which relates the electromagnetic effects observed in flight in the presence of UAP.

In 1300 cases studied, the effects are varied, but reproducible. They can relate to the electrical system of the aircraft itself, but also to radio transmissions, radars or onboard compasses.

This testimony constitutes an important database for understanding the characteristics of UAP and, above all, their electromagnetic influence.

5.12.1.5 Hessdalen spheres

These are recurring luminous phenomena in the Hessdalen Valley, Norway. Many explanations have been offered, including hypotheses involving aliens. Serious studies have shown that this was probably an aerial process of incomplete combustion involving dust from the valley floor containing Scandium. But no definitive conclusion has been drawn to date.

5.12.1.6 Lakenheath

This event (see § 4.2.2 for more details), by the precision and extent of the testimonies and associated measures of which it was the subject, is one of the most important and most disturbing in the history of ufology.

On the night of August 13-14, 1956, it all began with the detection, by ground radars of two air bases, of a mysterious echo.

The object appears to be moving at 6400 km / h without any sonic boom being mentioned. The ground radars observe that it connects the phases of stop and movement. Visual contacts are obtained on luminous objects.

A fighter plane is sent by the RAF. The pilot sees the target and locks it on radar. Seen by ground radars, it seems to duplicate, one of the parts coming to the rear of the



fighter. The pilot made a series of brutal evolutions to “evade” his pursuer, but without success. The scene lasts a long time, observed from end to end by several radars but also visually. The observations are characterized by the kinematics of multiple objects, in geometric formation, passing from a state at zero speed to an instantaneous speed step exceeding 1000 km / h (according to the estimates of the Air traffic controllers).

The official conclusions of the Condon Commission, similar to those of the USAF Blue Book, are very interesting: “Even if, of course, one cannot rule out classical or natural explanations, the probability of these seems low in the present case and the probability that at least one real UFO is involved appears quite high”.

Can we compare the observations observed with floating plasma phenomena or ball lightning?

5.12.1.7 Foofighters

These “ghost fighters” are appearances of luminous balls (white, yellow or red) which were evoked on numerous occasions by the pilots of the Allied armies as of those of the Axis, during the Second World War.

For ufologists, it is considered one of the founding elements.

To date, no certainty has been imposed on their nature or origin.

The hypothesis are however numerous. For the record, the etymology of the expression is interesting. In a 1938 comic book, William Holman features firefighter Smokey Stover and his boss Cash U intervening with a curious red spherical vehicle that evokes what pilots describe. Smokey's favorite slogan is “where there's foo, there's fire”, where “foo” is an English pronunciation of “feu”.

More seriously, from 1942, many American or British crew members, but also German or Japanese testify to having been accompanied during bombing flight missions, often at night, by formations of luminous spheres. All reported the impression they had, that the objects that followed them had a non-erratic flight, and actually followed them.

The most popular explanation during the war was that they were enemy tested secret weapons. This hypothesis was formulated by both camps. When the war was over, access to the archives of the two protagonists seemed to invalidate this hypothesis ...

Classical atmospheric phenomena have also been mentioned; Saint Elmo's fires, ball lightning,... not very credible hypothesis, because the pilots were not beginners. However, as will be discussed in the following chapters, phenomena related to ball lightning, and to Transient Stormy Light Phenomena (P.L.O.T) respond to poorly understood physical, chemical and electromagnetic mechanisms. Some studies seem to highlight the presence of dust as catalysts for confined reactions with ionization phenomena. Could the presence of electrical phenomena in an atmosphere loaded with dust but also various pollutants from airplanes (bombers and fighters) in large numbers have contributed to such phenomena?

Some spoke of collective hysteria due to stress, always present in combat situations.



Doctors spoke, them, of persistence of retinal impression due to the explosions of shells.

Some said the only reasonable guess was UFO type ...

Another hypothesis has been mentioned. Although it is not validated, it deserves to be studied. When American planes began to be equipped with radars, their superiority became important, especially at night. The Germans would then have had the idea of making microwave jamming. Their microwave sources being too weak to make the jamming from a distance, they would have developed these vehicles which approached, locked to the planes (infrared?) emitted at short distance. They could mix with friendly and enemy planes, safe for their friends, since they were not equipped with radars.

This hypothesis seems supported by the fact that the testimony ceased immediately after the War, except, perhaps, in New Mexico where it seems that German weapons engineers were taken (perhaps with the archives?)

All this remains to be verified, but both the idea and the idea seem interesting, and well in line with what we now know about directed energy weapons and their use in Electronic Warfare. However, it seems very sophisticated for the time when we know that the first self-steering missiles appeared during the Vietnam War in the 1960s. At the same time, similar phenomena, ghost rockets have been observed over the Baltic and Sweden in particular in the years 33 to 36 then after the 2nd world war (45-46). Rocket craft without a tail were seen flying over the lakes. No wreckage has been found despite military investigations. Foreign delegations were sent there after the 2nd World War (2nd Air Force Office, US OSS, ...).

5.12.1.8 Cases cited by the Lightning Research Laboratory (France)

The Lightning Research Laboratory (Laboratoire de Recherche sur la Foudre- France) reported two pilot sightings:

- In May 1990, a group of US Navy Grumman A-6E Intruder planes found themselves surrounded at 3500 m in stormy weather by six small bluish globes. These globes followed the planes before disappearing into the clouds. This observation recalls that of the "Foo Fighters" in Europe during the Second World War.
- On October 15, 1983, a Mirage IVA was struck at 8000 m by a large ball of light on a clear day. His anemometer pole was damaged.



Figure 5.12.1.8.1 - Image of a ball lightning phenomenon⁴⁶

It is curious that knowledge about globular lightning is so poor, being a phenomenon both old and quite frequent.

The hypothesis of ionized clouds or plasma balls (see § 5.12.2.3.2 Ball lightning and globular lightning - plasma balls) was officially considered by Great Britain to explain the UAP observations visually (effects of luminous halos visible and detectable by radar).

5.12.1.9 Saint Christol-Albion

The incident took place in 1980 at the Albion Plateau ballistic missile launch site. Orange luminous balls, static or moving, are observed by the soldiers guarding the base, moving alone or in groups, towards the launch area. Their apparent size is that of a balloon seen a few kilometers away. They merge and separate above the air base. The light is pulsing flashing (with a period of 6 s). The descending movements are oscillating, with a luminous trail, the ascending movements are continuous.

Observations were only visual; there are no known recordings, no mention of electromagnetic interference, no noise. The weather was stormy, with lightning. The case is difficult to interpret.

5.12.1.10 Ball lightning cases cited by C. Gary

Ball lightning having only human testimonies as a basis for analysis, it is important to present some of them to show both the diversity and the constants of the phenomenon. The literature on the subject shows a large number of them. Claude Gary has collected a number of them which have appeared over time; from those related by Camille Flammarion in his popular astronomy to much more recent cases. These different examples are presented in Appendix A 5.12.2.3.4.

⁴⁶ BALL LIGHTNING OBSERVED AFTER A "SUPERBOLT" IMPACT DURING AN EXCEPTIONAL THUNDERSTORM
Raymond PICCOLI 1, Raymond BLUNDELL 2

1- Laboratoire de Recherche sur la Foudre, unité de recherche Pégase, Champs/Tarentaine, France

2- Harvard-Smithsonian Center for Astrophysics, Radio and Geoastronomy division, Cambridge, USA



Case N ° 1. On August 28, 1839, during a violent thunderstorm over Paris, lightning fell in the middle of the courtyard of the central granting office, which was still unfinished. This lightning had the shape of a large globe of fire, and was accompanied by a vapor trail. It formed two indentations in the ground and moved over several tens of meters.

Case N ° 2. One day, not far from Scondigny (in Deux-Sèvres Département- France), two young children aged 12 and 15 are playing on the road. Suddenly, they see a fireball the size of an orange rolling in front of them that will explode.

Case N ° 3. In October 1898, ball lightning appeared in an apartment in Marseille and, approaching a young girl, came out through the exploding chimney on the roof.

Case N ° 4. In 1927 or 1928: a 17-year-old girl observes an orange fireball 20 to 25 cm in diameter.

Case N ° 5. Much more recently. An observation in England in stormy weather, following a horizontal lightning, of a series of luminous orange-yellow balls in the path of the lightning.

Case N ° 6. A luminous globe descends from the clouds during a severe thunderstorm, moves, stops, then strikes a wooden pillar and detonates it.

5.12.1.11 Duboc case, AF flight

Jean-Charles Duboc was a Air France Captain. On 28 01 94, he was captain of flight AF 3532 which made a connection between Nice and London. He, along with his co-pilot and a flight attendant, witnessed an event he considered extraordinary. The three of them saw, when the weather was fine and the visibility was perfect, a dark red object whose size they estimated at 300m, moving in the left sector (11am to 9am). They have time to observe it for 2.5 minutes before the craft dematerializes before their eyes.

What makes their testimony extremely interesting is that the ground based air defense radar at exactly the same time identified an echo. This echo, which was moving in the right sector of the aircraft on a trajectory converging towards the route of the aircraft (which it was going to cut within 2 NM), has the astonishing characteristic of suddenly disappearing, without a flight path, at precise moment when the crew saw the object dematerialize.

No explanation has been found after careful investigation and to this day.

5.12.2 Candidate natural phenomena

We saw, in 5-12-1, that, for about fifty years, the testimonies had accumulated, but also, important progress had been made in the methods and the means of observing them.

In the area of interpretations, there has also been considerable progress. These advances have concerned the ability to differentiate them by category, and, in most cases, to begin to develop physical explanations for their appearance and evolution. We will take a quick look at the state of the art in the lines that follow.

5.12.2.1 The clouds

There are lenticular clouds and precipitation-induced cloud holes (see Figures 5.12.2.1.1 and 5.12.2.1.2). These phenomena are difficult to confuse with UFOs if the latter move quickly.

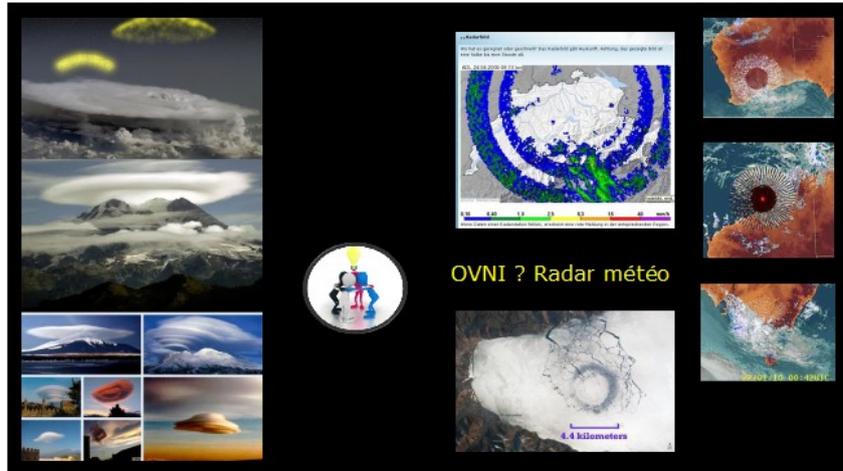


Figure 5.12.2.1.1 - Weather phenomena such as lenticular clouds can look like circular or discoidal shapes of UAP.



Figure 5.12.2.1.2. - The Bergeron Findeissen effect⁴⁷ (courtesy National Aviation Reporting Center on Anomalous Phenomena)

5.12.2.2 Elves Sprites Blue jet

ELFES (Emission of Light and very low frequency disturbances From Electromagnetic pulse Sources), or halos.

Elves take the form of faintly luminous discs (or rings, according to observers), and appear in strong lightning, at the base of the ionosphere (at altitudes of the order of a hundred kilometers). These lights are expanding. Their diameter reaches 400km. These disks seem to be caused by electromagnetic pulses, resulting from a thunderstorm, which propagate in all directions, forming a sphere, and accelerating electrons. When this sphere reaches an altitude of about 100km, the nitrogen gas molecules in the

⁴⁷ The Bergeron-Findeissen effect generates in specific atmospheric temperature conditions a circular hole in the clouds as a result of water particles freezing and fall as seen on the photo. This photo is extracted from a report where a link is made with the UAP case in 2006 at O'Hare Chicago airport. It left a circular print in the clouds coverage. (NARCAP report on UAP and its safety implications at O'Hare international airport on November 7, 2006 www.narcap.org)

atmosphere light up, following their excitation during collisions with the accelerated electrons. The observed disc shape is due to the intersection between this sphere and this flat layer of the atmosphere. Their short duration (about 1 to 5 milliseconds) and their altitude make them difficult to observe from the ground. Their color remained an enigma for a long time, but it is now believed (2009) that they have a red tint.

Sprites, also called red sylphs, appear in groups of two or three, during strong lightning, in the mesosphere (upper atmosphere). Their short duration (from a few milliseconds to a few hundred milliseconds) and their altitude make them difficult to observe from the ground.

- Sprite jellyfish - Very wide, 48km / 48km (30x30 miles), jellyfish shape, whose filaments surmounted by arcs hang in the direction of the Earth, and form between 80km and 145km of altitude, to descend towards 40km of altitude
- Column Sprite (C-sprite) - Large-scale electrical discharges above the earth that are not yet fully understood
- Carrot Sprite - A columnar sprite with long dangling tendrils.

Blue jets are blue gleams rising from storm clouds towards the stratosphere. They differ from sprites in that they project from the top of a cumulonimbus cloud, above a thunderstorm, generally in the form of a narrow cone, with an angle of around 15 °, towards the lower levels of the ionosphere, 40km to 50km above the Earth. Additionally, while sprites tend to be associated with significant lightning activity, blue jets do not appear to be directly triggered by lightning. However, they appear to be associated with hail, during thunderstorms. They are also brighter than sprites and, as the name suggests, blue in color. It is believed that this is due to a set of emission spectral lines in the blue and near ultraviolet, attributed to molecular nitrogen, neutral and ionized. The ascent speed of the blue jets is of the order of 100 km / s.



Figure 5.12.2.2.1 – a) Elves - b) sprites- c) blue jets

5.12.2.3 Ball lightning - similar phenomena - plasma

5.12.2.3.1 History-context- similar phenomena

Ball lightning is a luminous phenomenon observed for centuries (we see written testimonies since the first century AD). The literature on the subject has always been very abundant. It should be kept in mind that the content of the term ball lightning has changed a lot over time. For a long time, it included a large number of phenomena which had in common only the appearance of luminous phenomena **in the atmosphere or on the ground**. Thus in the 19th century, François Arago, in his popular astronomy of 1854, mentions meteors, bolides and shooting stars; what we designate today by the



term ball lightning was then cataloged as a slow bolid. Similar approaches can be found in the popular astronomy of Camille Flammarion of 1890. What should be remembered is that, for a long time, observations have been recorded, and, above all, that they present a great continuity and a great consistency. This is very important, because this physical phenomenon has the particularity of being able to be approached only through testimonies, until a minimum understanding is obtained, which allows attempts at reconstructions; that's about where we are. During the long period of testimonies alone, the classification and differentiation of these phenomena was gradually refined. Several of them have received satisfactory scientific explanations. As for ball lightning, even if a complete scientific understanding is not definitively fixed, we are now able to isolate the phenomenon with physical explanations that have become credible.

Before giving the definition of what it is agreed today to call ball lightning, we will list, without being exhaustive, the main phenomena which are manifested by luminous appearances in the atmosphere and which were found, a little loose in the testimonials. Some are perfectly explained, others less, but at a minimum, they are all differentiated. We will keep, in the body of the text, only the descriptions and explanations relating to what we retain today as "ball lightning" properly so called, namely, what was called, until recently as "ball lightning on the ground.". We will give, in the appendix, some information concerning the other phenomena. Indeed, they are not part, strictly speaking, of the theme treated in this short work which is devoted only to ball lightning. However, they must be taken into account in the analysis carried out by SIGMA2 on the cases submitted to us. Let us quote the fireballs which sometimes appeared in the old submarines in the event of short circuits; bead lightning; Saint-Elmo's fires, earthquake lights; swamp lights; ghost planes (foo fighters); ionospheric discharges; and a number of diffuse atmospheric discharges.

First, the figure below summarizes the observables that are related to ball lightning. This synthesis is due to Raymond Piccoli, Director of the lightning research laboratory (Pégase Research Unit).



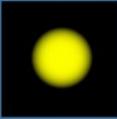


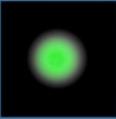
BALL LIGHTNING VISUAL TYPOLOGY

Based on 406 observations between 1994 and 2020

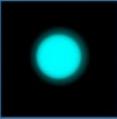
The following typologies of the different types of ball lightning represent faithful reproductions of the visual appearances of the phenomena observed by witnesses. They are not necessarily exact, as they depend on observations reported.

I - BALL LIGHTNING



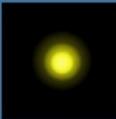
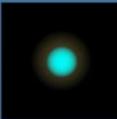
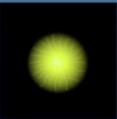
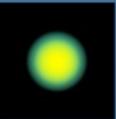
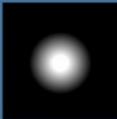






Ball lightning is characterized by the appearance of a luminous phenomenon during a thunderstorm, occurring simultaneously with a thunderbolt or a few seconds later. Several other criteria are required: the shape, which must be spherical; the size, which must not exceed fifty centimeters; the lifespan, which must typically not exceed 30 seconds; and the altitude of evolution, which must not exceed five meters above its surroundings. The luminous ball can be static or mobile, and its displacement is relatively fast.

II - GLOBULAR LIGHTNING

Globular lightning is characterized by the appearance of a luminous phenomenon during a thunderstorm or under stormy conditions, such as heavy atmosphere with the presence of intense natural electric or magnetic fields, and sporadic lightning or thunder). Unlike ball lightning, globular lightning is not necessarily spherical in appearance, it can change dimensions and shape during its evolution, it may become may be obloid, prolate, or even crest-like. The lifespan of globular lightning can vary from just a few seconds to several minutes, or under exceptional circumstances it may last several tens of minutes. The luminous meteor can be static or mobile; it can move over distances up to several hundreds of meters. Its size can vary from a few tens of centimeters to several meters in extent, and its evolving altitude can range from ground level to several hundred meters in height. Changes in altitude or bouncing off the ground are regularly observed.

III - T.S.L.P

Transient Stormy Luminous Phenomena






Transient Stormy Luminous Phenomena are characterized by an atmospheric luminous object with variable size and appearance, appearing either in stormy weather or outside the envelope of an active storm under apparently good weather conditions., but in the presence of very high electric, magnetic, electromagnetic or electrostatic fields. Phenomena of this type are also observed before, during, or after earthquakes, and more rarely in the plume of a volcanic eruption when electrical discharges occur. A P.L.O.T can have static phases during part of its lifespan ranging from a few seconds to several minutes, and may be found at all altitudes, from the ground to the tropopause.

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Figure 5.12.2.3.1.1 – Visual typology of ball lightning

5.12.2.3.2 Definition and observables related to ball lightning

Although this ball lightning phenomenon has been observed for a long time, it is quite rare and, above all, unpredictable, which made its experimental study in situ particularly difficult (luckily there were some strokes of luck, as we will see further). Being able to rely only on testimonies, the analysis could only begin with work of



classification which related to the environment, the behavior or somewhat gratuitous assumptions of physical functioning. This is how various rankings emerged.

- * Ball lightning near the ground and ball lightning at medium altitude; near the ground, ball lightning mostly appears during a thunderstorm; at medium altitude, observations are much rarer; it can appear in cloudy environments or even in clear skies; these characteristics, as well as the progress which have been made by scientists, lead us to believe that medium-altitude ball lightning should be classified as related phenomena.

- * according to the origin of the lightning; cloud-to-ground or cloud-to-cloud; this classification falls within the framework of the remark made in the previous paragraph

- * following the movement; free or attached to a driver

- * depending on the type of disappearance; instantaneous and noiseless or explosive and noisy.

- * depending on the supposed maintenance nature of the phenomenon, internal or external; this is a classification no longer based on observation alone, but on the understanding that we think we have of the mode of operation of this phenomenon, it is therefore dangerous insofar as it emits presuppositions in a physics not known.

Let us come to the observables linked to low-altitude ball lightning.

(Syntheses by P Kuentzmann and R Piccoli)

- * appearance most often in the immediate vicinity of a lightning strike on the ground

- * duration: from a few seconds to a few minutes (an exceptional case of two hours was reported in Japan, and a case of 50 min in France, in the Morvan).

- * disappearance: either instantaneous and without noise; or explosive (Cases of destruction are rare, but regularly observed; the case of the destruction of an earthen hut is reported)

- * dimensions: from 1 cm to 40 cm; some cases at 1m; some cases of 10 to 20 m, very short in time.

- * color: different colors of the visible area; sometimes the ball is described as translucent (this is not the majority of cases); light emission seems to emanate from the surface; some cases of composite balls with nested spheres and different light emissions at the interfaces; sometimes presence of moving luminous points (fireflies).

- * noise: in general, no noise; sometimes hissing or crackling.

- * odor: sometimes pungent odor (ozone? NO?)

- * movements: slow linear (a few m / s) or erratic, sometimes rotation and / or vibration; there appears to be no sensitivity to the wind.

- * energy aspect: from the point of view of luminosity in the visible spectrum, a 30 cm ball is generally described as a light source comparable to a 70W incandescent bulb. The energy must be greater elsewhere than in visible radiation. Indeed, estimates could be made of the total energy contained, from the effects produced on the surrounding bodies. This is how it is generally assumed that the stored energy is between 10 and 1000 MJ (a typical flash contains 10,000 MJ); from the point of view of energy density, the few cases where ball lightning has annihilated itself in water tanks have made it possible to evaluate the energy densities between 6 kJ / cm³ and 10 kJ / cm³.

- * thermal aspect: the testimonies of people who have been approached closely state the almost absence of a sensation of heat, on the other hand the contact can cause micro-burns and pigmentations of the skin and the scalp.

- * paradoxical aspect: ball lightning can pass through interstices, or even pass through a



window, a solid wall or a wall.

These phenomenological descriptions have, of course, been supplemented by a difficult statistical approach; the language of testimony is not that of the laboratory. However, the study was carried out in France. For sixteen years, the Lightning Research Laboratory has compiled all this data. We summarize the most significant results.

* the statistics relate to 282 observations made between February 1994 and September 2011.

* 33.3% of observations outside, 1.4% in aircraft

* 82.6% in stormy weather, 1.4% in clear weather (outdoors)

* 59.6% of the duration of the phenomenon between 1 and 5 s (outside)

* 50% of visible dimensions between 10 and 30cm (outside)

* 45.7% of ground heights between 1 and 2 m (exterior)

Characteristics such as duration or diameter obey a lognormal distribution. In short, these results confirm the consistency of the observations that have been the subject of testimonies and their belonging to a unique type of phenomenon, but do not allow us to go much further in its interpretation.

For the study of UAP, it can be extremely useful to compare these statistical data with the characteristics of a certain number of phenomena which can appear in the sky (see § 6, observation where its listed various phenomena likely to be observed by camera networks).

5.12.2.3.3 Interactions with the environment

On reading all the testimonies, it seems that ball lightning exchanges very little with the external environment when it moves in the air. On the other hand, everything happens as if, not having "burned" all its "fuel", an encounter with an object causes a brutal reaction.

This is the problem of the diversity of observations in cases of direct contact with the environment. Sometimes the phenomenon disappears during an explosion on contact with an object (furniture, tree, various objects ...), sometimes ball lightning will bypass or even interfere through windows, doors, locks, cracks, etc ... with disconcerting ease.

In rarer cases, ball lightning suddenly changes color during its evolution and fragments into small sparks with solid residues. These solid substrates (geofulgurites) generally resemble pozzolana of variable particle size. Very thorough analyzes would be desirable on these residues in order to determine their nature and certain composition.

Rarer still, the touch and dissolution of a lightning ball of large diameter (greater than 2 meters) which leaves on the ground a zone of combustion, even vitrification. It should be noted that in this case, the light phenomenon was not very mobile.

In addition, many testimonies evoke luminous phenomena which "go up in the winds"; To date, no convincing explanation has been provided for any of these findings.

Figure 5.12.2.3.3.1 describes the mechanisms of cascading interactions of lightning with the atmosphere; it is the result of the publication of work in 2017 by a team from Kyoto

University⁴⁸. This involves X-rays, inducing displacements of neutrons, then cascades of immediate gamma radiation interacting with atmospheric nitrogen, then delayed radiation. These mechanisms would ultimately reveal the possible presence of antimatter, therefore very high energies.

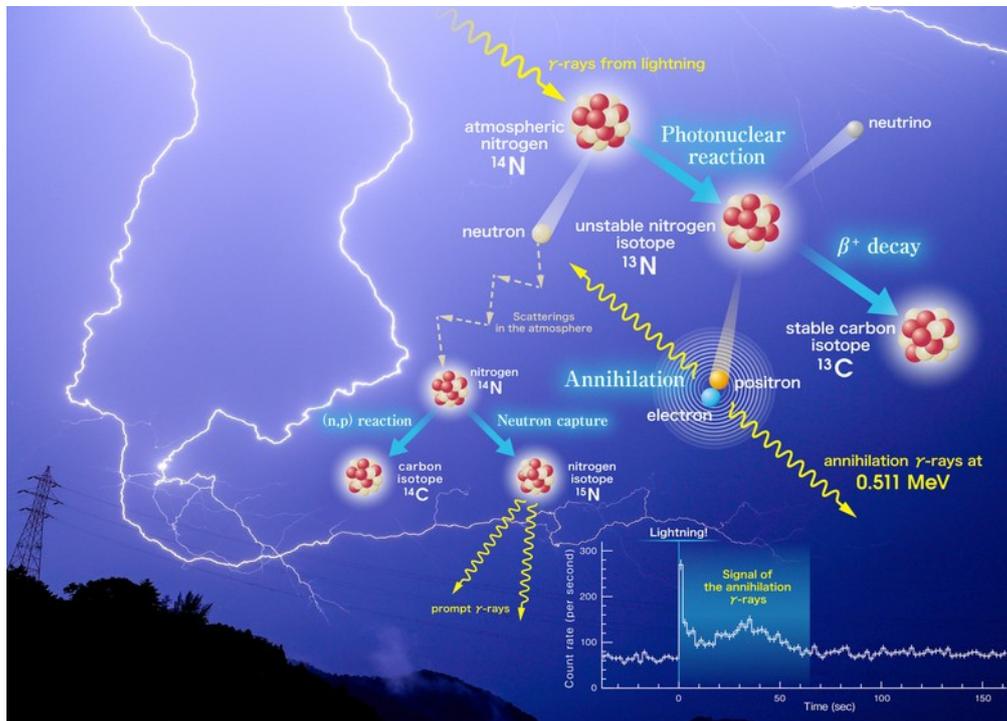


Figure 5.12.2.3.3.1 – mechanisms of interactions in a cascade of lightning with the atmosphere

5.12.2.3.4 Theories concerning the mechanisms of formation

Although this ball lightning phenomenon has been known for a very long time, its physical understanding remains incomplete. The reason for this is obviously the great difficulty there is in instrumenting a phenomenon that appears unpredictably in any place. Laboratory reconstitution attempts have been made, but none of them lead to definitive conclusions.

The questions that arise concern its mechanism of appearance and, above all, the source of energy that allows it to remain luminous for quite a long time.

We refer the reader to Appendix A.5.12.2.3.4 to see in more detail the many theoretical assumptions that have been advanced.

Let us just say here that after many explanations based only on phenomena of an electrical nature, it appeared approaches based on chemical bases; the combustion, with oxygen in the air, of materials (carbon, silicon, etc.) vaporized by the arc channel in return from lightning at the point of contact with the ground. This hypothesis, which has benefited from an experimental fluke of simultaneous optical and spectroscopic recordings of the phenomenon, is extremely interesting. In any case, for the study of

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UAP, the descriptions of appearance and behavior from the statistical treatment of testimonies are sufficient to avoid confusion.

5.12.2.3.5 "Globular" ball lightning

Observable characteristics of globular-type ball lightning

The **visual appearance** is not necessarily spherical, but can change shape or include crests, this includes changes in size and appearance during its evolution.

The *lifespan* can vary from *a few seconds* to *several minutes* (exceptionally up to 45 minutes).

The *bright meteor* can be static or moving.

The **size** can vary from a few tens of cm to several meters.

Its **altitude** can range from ground level to several hundred meters above sea level.

Its **trajectory** is erratic, no right angles are listed.

5.12.2.3.6 Transient Stormy Light Phenomenon

The **TSLP** is characterized by an atmospheric luminous phenomenon of very variable dimensions and appearances which occurs either in stormy weather, or outside the envelope of an active thunderstorm, or in good weather or during electric or magnetic fields. very high.



Figure 5.12.2.3.6.1 – Observable characteristics of T.S.L.P.

Phenomena of this type are frequently observed before, during or after earthquakes, more rarely in the plume of a volcanic eruption when electric discharges occur.



Figure 5.12.2.3.6.2 – Light phenomena “earthquake lights” preceding an earthquake (Taro Valley, Italy, August 10, 2007, Langhirano (Parma, Italy). Photo published by the Gazzetta di Parma on August 15, 2007.

The *T.S.L.P.* can have static *phases* over a part of its lifespan of between a few seconds and several minutes or on its trajectory.

The *T.S.L.P.* is observable at all *altitudes*, from the ground to the troposphere.

Its speed can reach 1000 km / h. The kinematics do not show a 90° path change or cusp.

5.12.2.4 Related Phenomena: Foo Fighter - St Elmo's Fires, earthquakes lights, fire, swamp

As we have seen previously, a few decades ago, the observers were confronted with a large number of luminous phenomena of which nothing was known from the point of view of their physical mechanisms, and not much of the point of view. view of their description.

Since then, physicists have done a lot of work and we know much better how to differentiate these phenomena and, for some of them, to attribute to them identified physical causes.

From the point of view of the study of UAP, these phenomena are well enough identified to avoid any confusion.

In a non-exhaustive way (for more details see Annex A 5.12.2.4), we quote:

- FOO FIGHTERS, which we mentioned in § 5.12.1. They are luminous balls, which followed the planes during the Second World War, and which disappeared at the end of it. Despite some plausible assumptions, no definitive explanation has been provided.
- the fires of Saint Elmo, which are perfectly known and explained. This is



called the “peak effect” which, by amplifying the local electric field, causes ionization at short range by electronic avalanches.

- Marsh fires are of chemical origin. Fumes of combustible gases come from fermentations in the middle of the swamps, ignite for some reason and give these glows.
- “earthquakes lights” are precursor phenomena of earthquakes. Some suppose they are related like swamp fires to gaseous fumes. Others consider the causes a priori linked to the stress applied to certain rocks, creating the tearing of electrons and the production of a kind of plasma or in an intermediate version, the emanation of gas and the tearing of charges which induce light phenomena⁴⁹.

5.12.2.5 Atmospheric re-entry

The most natural atmospheric re-entries are those of meteorites or meteors. The upper stages of space launchers and satellites at the end of their life have fairly similar incomes but with lower speeds and less varied incidences. These various types have in common that they give rise to a fairly regular trajectory and generate very bright plasmas accompanied by trails of debris (see Figure 5.12.2.5.1 to Figure 5.12.2.5.4). It is therefore possible to distinguish a reentry from a UAP presenting a complex trajectory with almost instantaneous accelerations alternating with stationary phases, or right-angle turns, or even reversals. Confusion can arise, however, if one attempts, as in the case of November 5, 1990, to attribute observations with very different characteristics to a re-entry.

49 Robert Thériault, France St-Laurent, Friedemann T. Freund, and John S. Derr, Prevalence of Earthquake Lights Associated with Rift Environments, *Seismological Research Letters*, January/February 2014, v. 85, p. 159-178.

Valentino Straser, Ball lightning VS earthquake lights in Northwestern Apeninnes, Italy, *Proceedings “1st International Symposium on Lightning and Storm-Related Phenomena (1st ISL-SRP 2015)”* July 2-3, 2015, Aurillac, France



Figure 5.12.2.5.3 - Atmospheric reentry of a meteorite: the case of Chelyabinsk



Figure 5.12.2.5.4 - Trace left by the reentry of the Chelyabinsk meteorite

5.12.3 Artificial objects that generate UAP

5.12.3.1 Thai lanterns

Also called sky lanterns or Chinese lanterns, Thai lanterns are small hot air balloons that work on the same principle as a hot air balloon. Traditionally used during celebrations in Asia, they are increasingly popular in the West.



Figure 5.12.3.1.1 – Release of Thai lanterns

A light frame holds a burner at the entrance to an envelope made from rice paper. The heat released by the combustion of wax or paraffin allows the balloon to rise slowly into the air, to a height of about 100 or 200 meters. Carried by the wind, the lanterns drift until their heat source is extinguished.

Thrown at dusk or at night, alone or in groups, Thai lanterns frequently arouse astonishment and incomprehension in people who are unaware of their nature. The color and shape of the envelope (cylinder, sphere, heart ...), the brightness which fluctuates according to the intensity of the combustion and a perfectly silent movement are all elements that may impress the witnesses.

At night, in the absence of landmarks, it is also extremely difficult to correctly estimate the altitude, distance and speed of an object. Several lanterns moving in perfect synchronization, carried by the wind, can thus be likened to a single and imposing object.

The varying glow of the burner may give the impression of a color change. Once extinguished, in the dark night, the lantern becomes perfectly invisible. On the other hand, it can be perceived as a dark object if the ambient lighting allows it (twilight, full moon, artificial lights ...).



In rare cases, a lantern can eventually ignite or cause a fire to start by hitting an obstacle in flight or on landing (vegetation, building, etc.).

A part of § 5.2 on optical and infrared detection is devoted to Thai lanterns whose optical and thermal signature is explained.

5.12.3.2 The hypothesis of advanced technology stealth devices

Advanced technology stealth devices (see § 5.4.1 radar detection) are intended for reconnaissance and other military missions. They could be mistaken for UAP. This appears to have been the case with the Lockheed U2 (which was not stealthy since Gary Powell's U2 was detected by Soviet radars and shot down); this could also be the case, given the advances made in stealth, more recent black programs of planes or drones.

More recently, technologies related to MHD and plasma generation have been developed for various applications aimed at improving aerodynamic flows, propulsion, but also for their stealth properties. As explained in section 5.4.2 (plasmas) and in section 5.13.1 on MHD, compression plasmas or artificially generated by radiation can be created, thus producing bluish induced radiation (for nitrogen). Such radiation could therefore be linked to the use of advanced technologies using plasmas. Microwaves around 3GHz could be a source of energy to ionize the air. What is amazing is that such frequencies have already been detected during the observation of UAP as early as the 1950s, as well as white and bluish optical radiation (see § 5.14 attempt to cross-check between EME cases). Such radiation was also observed more recently, in 1990, but also in Iran in 2015.

Finally, advanced technology vehicles, even with MHD technology, a priori respect conventional physics and are not capable of brutal acceleration which would be unbearable for potential pilots and structures. Such maneuvers were reportedly observed by the Iranian Forces.

The questioning of this point has been going on for several decades and will likely continue into the future.

5.12.3.3 Light effects generated by missile launches

Ballistic missile tests, and certain space launches, generate luminous phenomena at high altitude (see Figure 5.12.3.3.1 to Figure 5.12.3.3.3) which are associated with thruster jets and inter-stage separation devices.



5.12.3.3.1 - Probable view of a Russian missile or launcher feather launched from Plesetzsk⁵⁰



5.12.3.3.2 - Missile Pen View from the US West Coast.⁵¹



5.12.3.3.3 - Missile Pen View from the US West Coast

50 Extract from article http://www.docta.org/misperceiving_missiles.pdf P.40

51 Extract of article http://www.docta.org/misperceiving_missiles.pdf P.22



They can be the cause of confusion especially during the propelled phase of the missile where the thruster ejects a jet of gas and particles at very high temperature ($> 1000^{\circ}\text{C}$), at high speed and in rapid expansion in the very rarefied atmosphere. This jet forms a "plume" whose radiation is intense and whose size increases (from a few hundred to a few thousand m) as the missile accelerates and gains high altitudes (greater than 100 km).

This "signature" of the missile, induced by complex phenomena (recombustion, collision radiation, etc.) can be observed in the visible, infrared and UV spectrum and can take various forms depending on the nature of the propulsion (solid or liquid propellants), the speed of the craft, its altitude and its maneuvers. This results in apparent shapes which can be bizarre and also visible to the naked eye from the ground, surprise uninformed observers and be mistaken for UFOs as explained in an article on UFO sightings above California.

These phenomena are detailed in § 5.2 relating to optical signatures. It is very probable that the tests of hypersonic missiles in development will also generate surprising light effects, and variable according to the speeds and altitudes of flight. However, as explained in the previous §, despite their sophistication, these devices respect the laws of physics and flight mechanics, even if certain technologies can reduce aerodynamic effects and signatures.

These phenomena are frequently an official response to the observation of a UAP. This is a rational explanation which can be supported by the radar trajectography which reveals "normal" or non-standard kinematics.

5.12.3.4 Missiles and hypervelocity vehicles

5.12.3.4.1 Mission

Regarding air defense, beyond the evolution of air threats and classic missiles (cruise missiles, bombers and stealth fighters), we see cruise and ballistic missiles evolving by gaining in range / altitude, in maneuverability, precision and speed towards hypervelocity, or even hypersonic flight domain ($> \text{Mach } 5$), adding to the speed and range of the carrier vehicle (airplane, booster) that of the missile itself. With the use of "classical" technologies, hypersonic speeds can only be achieved at high altitudes (above the dense atmosphere ($z > 20 \text{ km}$)) and for a limited time.

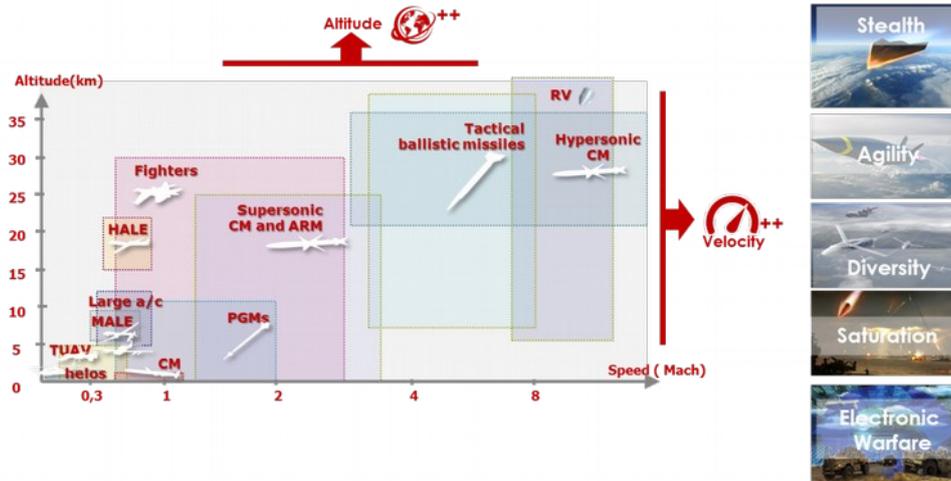


Figure 5.12.3.4.1.1 – Kinematic domain of flying machines - evolution towards hypervelocity

The desired objective is multiple:

- Increase the radius of action: missile + carrier range in the case of missiles fired from aircraft, for example - Air Launched Ballistic Missiles. This makes it possible to increase range, but also to make the point and direction of launch of the missile less predictable, which complicates the operation of the detection and interception chain (modifications of engagement plans, reassignment of means, pre-pointing of the sensors biased by changes in direction and trajectory).
- Increase the hit accuracy of a ballistic missile which requires maneuvering, first to break re-entry speed and slow down, then to adjust the trajectory during the phase of terminal guidance to the target. Precision is sought either to maximize the effect of destruction on the target on impact or to correct during flight the movement of the moving target (for example in the case of a ship).
- Penetration of air defenses thanks to stealth or speed and maneuverability (a few g to a few tens of g), and the diversity of trajectories. In fact, maneuverability can be used to modify the (ballistic) trajectories planned by the defense and deceive the Command and Planning Centers and the detection / tracking radar resources, or even evade interceptors, by exploiting a penetration corridor at in altitude. In this case, the missile searches for an intermediate flight domain between the ceiling of conventional anti-aircraft defense (25-30 km) and the floor of anti-ballistic missile layers above the atmosphere ($z > 100$ km), making changes trajectory. In this case one can consider either hypersonic cruise missiles (cruise missiles with airbreathing propulsion, combustion of air with a fuel), or hypersonic gliders which will be put on trajectory by a ballistic missile (propellant with liquid or solid propellants). This missile releases a glide vehicle at an altitude of 90 km, which will then maneuver by gliding to bounce off the upper layers of the atmosphere, extend its trajectory and possibly change its objective. These maneuvers represent strong accelerations at high speed ($> \text{Mach } 7$). Other types of vehicles



can be considered, such as maneuvering ballistic warheads (MARV Maneuvering Reentry Vehicle), which enter the atmosphere at much higher speeds (Mach 20) and will perform maneuvers under very strong acceleration to make the RV evade the interceptor missiles and their seeker. These are final maneuvers, not aiming change of target and trajectory.

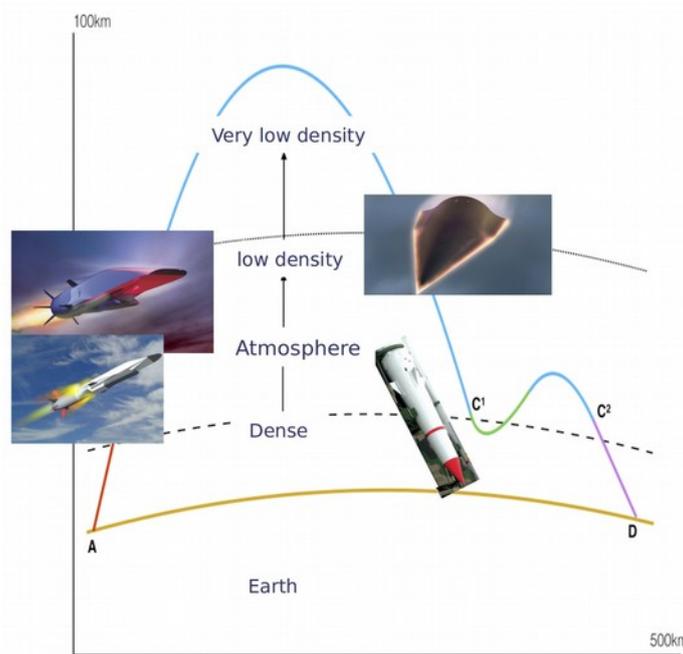


Figure 5.12.3.4.1.2: High speed ballistic missiles + maneuvering reentry body > Mach 10. Aerodynamic reentry phenomena with ablation of materials. Problem of thermal and mechanical resistance of materials according to speed. Guidance equipment-flight time in the atmosphere. Reduced speed for maneuvering-gliding. Interest of certain advanced technologies such as MHD that can improve the aerodynamic flow at the wall, or even be used to perform maneuvers.

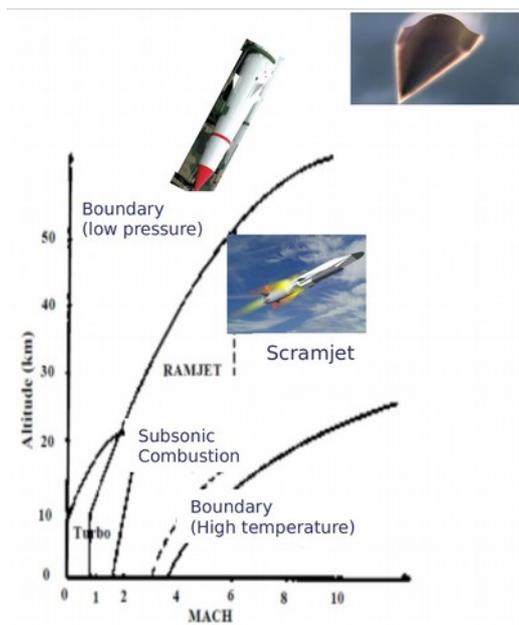


Figure 5.12.3.4.1.3 : Hypersonic cruise missiles (fuel + air combustion) using super ramjets (scramjets) requiring materials resistant to high temperatures and shock effects in high supersonic / hypersonic flight regime for the duration of flight (air inlet of the scramjet-chamber of combustion - leading edges). Interest in advanced technologies such as MHD to reduce hypersonic effects on materials.

Examples of hypersonic missile trajectories with bounces and hypersonic cruise missiles (Figure 5.12.3.4.1.2) - cruise missile flight envelope (Figure 5.12.3.4.1.3) Reference report Committee 5 - 51st SNAED



5.12.3.4.2 Characteristics - maturity

Of course, much publicity is being given to hypersonic missiles today. President Obama himself launched Project Prompt Global Strike (PGS) targeting conventional strategic strikes in less than an hour anywhere on the planet, which initiated US DARPA research projects including Project Falcon HTV2 of the hypersonic glider type (see Figure 5.12.3.4.2.1). President Putin (speech of 03/01/2018) has also made a large part of hypersonic missiles newly developed by Russia such as the Avangard (hypersonic glider type, Figure 5.12.3.4.2.2), the Kinzhal ballistic missile SCUD maneuvering pulled from an airplane to increase its range (see Figure 5.12.3.4.2.3), the Zircon high-altitude cruise missile (with supersonic ramjet or Scramjet, Figure 5.12.3.4.2.4) and its equivalent US type X51A (see Figure 5.12.3.4.2.5), or the 9M730 long-range cruise missile (very large range due to nuclear propulsion). Other countries like China are developing hypersonic missiles like the DF21 anti-ship maneuvering ballistic missile and probably hypersonic cruise missiles as well.

The GAO bulletin⁵² reports on the advancement of technologies which in the USA (according to GAO) are reaching a maturity level TRL 6 or 7 (operational development level TRL 9) for the HGV hypersonic missile (tactical) whose range remains limited by heating conditions.

| Type | Name | Mission | Propulsion | Range Altitude Speed Agility | Comments Evolutions |
|---------------------------------------|------------------------------------|---|---|---|--|
| Improved Hypersonic Glider | Avangard YU74 (RU) | Penetration Gliding trajectory with bounces in the upper atmosphere | Initial Ballistic Missile booster + glider RV ballistic trajectory MHD + gliding + bouncing | > 10 000 km Mach 20 a 27 90km Intermediate altitudes | Velocity limitations in the upper atmosphere to avoid ablation Possible improvements: boundary layer control - MHD – stealth – (plasma control) |
| Hypersonic Glider(HGV) | Falcon HTV-X51 (US) DF ZF (RPC) | Penetration Gliding trajectory with bounces in the upper atmosphere | Ballistic Missile booster + glider RV | X000 km Mach 10 90km | |
| Hypersonic cruise missile (HCM) | 3M22 Zircon (RU) | | Scramjet hypersonic | Range:1000 - 2000 km Mach 8 40 km | Possible Use of MHD Ajax- improvement of supersonic mode-increase range and flight duration |
| Air launched Ballistic Missile (ALBM) | Kinzhal (KH 47M2) | Penetration with maneuvers (accuracy) - range / direction adapted by air launch | Ballistic + air launch | Portée:2000 km + aircraft Mach 10 30 km to 40 km altitude | |
| Cruise Missile | SSC8 Screw driver (9M729) | Low altitude penetration No range limitation | | No range (autonomy) limitation | Nuclear propulsion Diversity of trajectories- low doppler- low RCS |

52 <https://www.gao.gov/assets/710/701369.pdf>

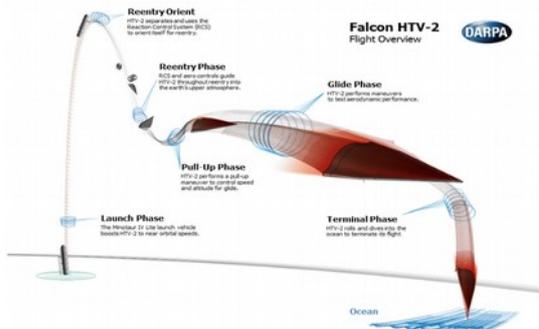


Figure 5.12.3.4.2.1 : HTV Glider (US)



Figure 5.12.3.4.2.2 : Glider Avangard (RU)



Figure 5.12.3.4.2.3 : Kinzhal maneuvering ballistic missile fired from M10 aircraft



Figure 5.12.3.4.2.4: Zircon Hypersonic Cruise Missile (RU)

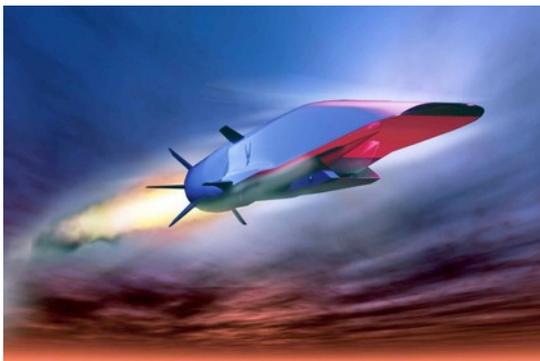


Figure 5.12.3.4.2.5 : Hypersonic cruise missile X51 A (US)

Hypersonic missiles require technological challenges such as temperature resistance (speeds of the order of Mach 7 in the layers of the atmosphere induce high temperatures of 800 ° to more than 1000 ° C), as well as sufficient structural resistance to the forces induced at high temperature for the duration of the flight. This can be as long as an hour, much longer than the reentry time of a warhead or a space shuttle. Resistance to sudden accelerations (shocks) is also a challenge. Propulsion by ramjet or super-ramjet (scramjet, see Figure 5.12.3.4.1.3) also poses a challenge for air inlets which must withstand very high temperatures during flight and changes in attitude during maneuvers. Despite all these technological challenges, the modes of propulsion and maneuver remain subject to the rules of aerodynamics, flight mechanics and chemical or ballistic propulsion, or even nuclear propulsion of the Russian SSC-X-9



Skyfall missile. . Nevertheless, this missile remains a “classic” subsonic cruise missile from a kinematic (subsonic) point of view, where the nuclear core replaces the heat of combustion by oxidant / fuel reaction, by heating air to very high temperature. . It thus avoids the range limitations associated with carrying fuel. The use of liquid hydrogen, used for cryogenic space propulsion, may be possible for very specific vehicles, supersonic reconnaissance vehicles and flying at high altitude such as the SR71 Blackbird, but the use of cryogenic liquid propellants does not is not simple (storage) and requires precautions for use that are hardly compatible with operational military systems stored for long months.

Moreover, if it is possible that MHD / EHD type techniques have been used (in particular on the Avangard), for example to improve the drag or the piloting of missiles⁵³, it does not seem that such techniques have been used in terms of propulsion. Using MHD for propulsion itself requires much higher energies as we know it today. Hypersonic missile projects with ramjet coupled to an MHD generator (improvement of combustion efficiency) are cited by ONERA relating the Russian AJAX project dating from the 2000s. The interest of this technology would be to push back the limits of subsonic / supersonic or those of the mixed ramjet but it remains an advanced technology, or would it be applied to Russian projects like the Zircon or the Avangard, or even to the enigmatic American Aurora project?

5.12.3.4.3 Perspectives on the performance of the UAP

The systems mentioned above have kinematic performances which in certain cases (notably the Avangard with speeds reached of Mach 27), approach those of the PANs. In terms of maneuverability and handling, however, sudden changes in direction and / or speed remain the prerogative of UAP. Even if the various systems mentioned are capable of maneuvers beyond the reach of those of more conventional ballistic missiles, they remain very far from what could be observed (stop / stationary mode then lightning accelerations, reversal of trajectories, right or acute angles, ...).

MHD devices (see § 5.13.1 and appendices relating to MHD research and Ajax project) could constitute a beginning of explanation of the speeds reached, **but current knowledge does not allow for the moment to explain the behaviors in terms of inertia.**

5.12.3.5 UAV type air vehicles

The following table presents characteristics of UAV within the framework of the general classification of UAV established by NATO.

⁵³ see the letter 3AF Special issue 32 / July-August 2018, pages 35 to 38, § 5.13 dedicated to MHD and appendices A 5.13.1, A 5.13.2, A 5.13.3



| | Class I | | | Class II | Class III | |
|------------------------------|---|---|---|--|---|---|
| | < 150 kg | | | 150–600 kg | > 600 kg | |
| | Micro < 2 kg | Mini 2 – 20 kg | Small > 20 kg | Tactical | MALE | HALE |
| |  |  |  |  |  |  |
| Example | Phantom 4 | Spyranger | Scan Eagle | RQ7 Shadow | Reaper | Global Hawk |
| Operational range (km) | 5 | 25 | 50 | 200 | 1850 | 3000 |
| Altitude (km) | < 1 | < 1 | < 1 | < 3 | < 15 | < 20 |
| Velocity domain (km/h) | 0/72 | -/160 | -/180 | -/200 | 100/480 | -/635 |
| Propulsion | 4 electrical engines | 1 electrical engine | 1 thermal engine | 1 thermal engine | 1 turbo-prop | 1 turbo reactor |
| RCS (m2) | < 0,01 | < 0,05 | < 0,1 | < 0,1 | 0,5 - 1 | 1 – 10 |
| Dimensions (m) span./Length. | < 0,7 | 3,9 / - | 3 / 1,2 | 4,3 / 3,4 | 20 / 11 | 40 / 15 |
| IR source | engines | engine | engine | engine | Engine + plume | Engine+plume |
| Temp engine.(°C) | 35 | ? | ? | 200 ? | | 680 |
| Temp plume (°C) | SO | SO | SO | SO | 200 / 300 | 580 / 650 |

The UAV considered in this section are Class I UAV, that is to say:

- Micro-drones: mass less than 2 kg
- Mini / small drones: mass from 2 to 50 kg

UAV are characterized by several design principles:

- Fixed or rotary wing
- Thermal or electric motor

Reports and analyzes of drone performance are given in appendix A 5.12.3.5.1.

5.12.3.4.1 Quadricopters

These UAV include recreational UAV and observation UAV.

The following table shows performance characteristics of quadcopter UAV^{54 55 56}, in particular maximum speed and altitude performance.

54 <https://auteldrones.com/pages/evo-ii-specification>

55 <https://www.dji.com/fr>

56 <https://www.parrot.com/fr/drones/anafi>



| | Masse | Vmax horizontal | V montée | V descente | Batterie | M batterie | Capa/Mbatt | Mbat/Mdrone | Plafond |
|-------------------|-------|-----------------|----------|------------|----------|------------|------------|-------------|---------|
| | kg | m/s | m/s | m/s | Wh | kg | Wh/kg | | m |
| Autel Evo 2 | 1,999 | 20 | 8 | 4 | 82 | 0,365 | 225 | 0,18 | 7000 |
| DJI Mavic Air 2 | 0,57 | 19 | 4 | 3 | 40,42 | 0,198 | 204 | 0,35 | 5000 |
| DJI Mini 2 | 0,249 | 16 | 5 | 3,5 | 17,32 | 0,0862 | 201 | 0,35 | 4000 |
| DJI Inspire 2 | 4,25 | 26 | 6 | 4 | 97,58 | 0,515 | 189 | 0,12 | 2500 |
| DJI Phantom 3 | 1,28 | 17 | 5 | 3 | 68 | 0,365 | 186 | 0,29 | 6000 |
| DJI Phantom 2 vis | 1,35 | 15 | 6 | 2 | 57,7 | 0,37 | 156 | 0,27 | 3500 |
| DJI Spark | 0,3 | 16 | 3 | 3 | 16,87 | 0,095 | 178 | 0,32 | 4000 |
| DJI Mavic Mini | 0,249 | 13 | 4 | 3 | 17,28 | 0,1 | 173 | 0,40 | 3000 |
| DJI Mavic Pro | 0,74 | 18 | 5 | 3 | 43,6 | 0,24 | 182 | 0,32 | 5000 |
| DJI Phantom 4P | 1,388 | 20 | 6 | 4 | 82,2 | 0,468 | 176 | 0,34 | 6000 |
| Parrot Anafi | 0,32 | 15 | 4 | N/A | 20,5 | 0,125 | 164 | 0,39 | 4800 |

It can be shown that the maximum altitude that a UAV of this type can climb is mainly related to the battery capacity.

Indeed, during the climb, the electrical energy stored in the battery is transformed into potential energy by means of electric motors and propellers.

This relationship is written:

$$mg h_{max} = C\eta$$

with :

m : UAV mass (kg)

g : gravity acceleration (m/s²)

h_{max} : Altitude ceiling reachable (m)

C : Battery capacity (J)

η : System yield

Considering that the battery's capacity is proportional to its mass:

$$C = k_{batt} m_{batt}$$

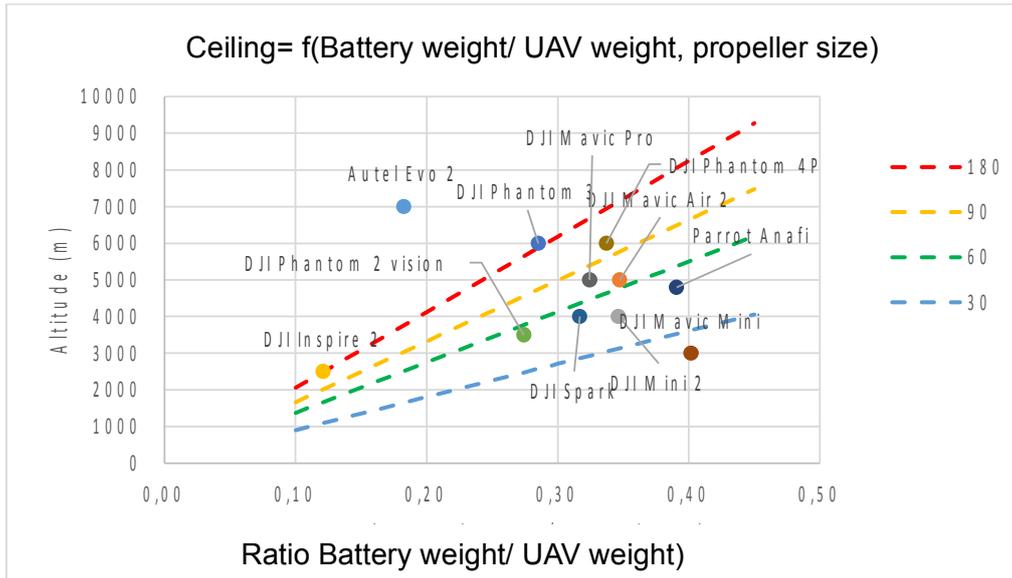
We can deduce :

$$h_{max} = \frac{m_{batt}}{m} \frac{k_{batt}}{g} \eta$$

The maximum altitude depends on the following parameters:

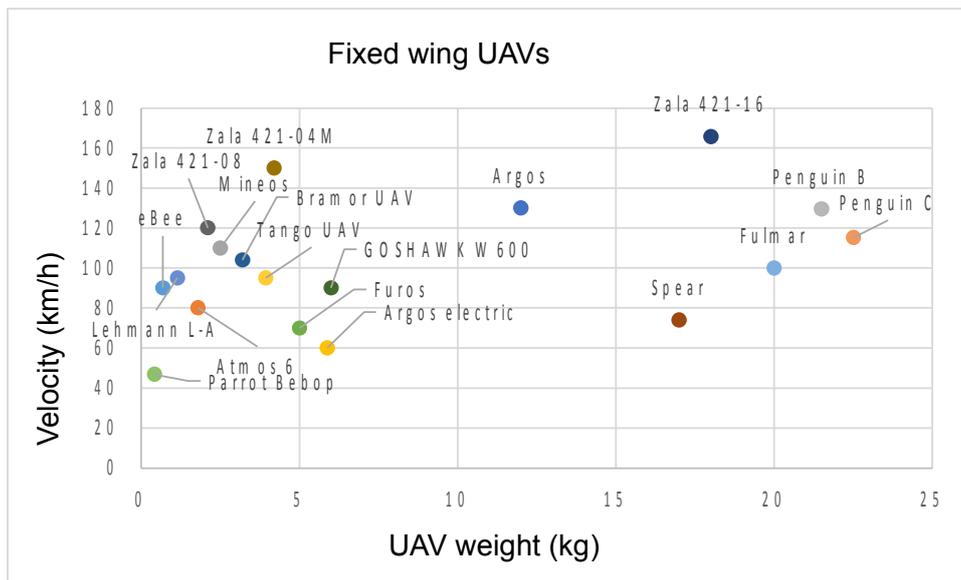
- ratio between the mass of the battery and the mass of the drone
- battery capacity / mass proportionality coefficient, which is substantially constant
 - system efficiency consisting of the engine efficiency (mechanical / electrical) and the aerodynamic efficiency of the propeller.

The following figure shows the ceiling of the quadcopters according to the battery mass / mass ratio of the drone and configured according to the radius of the propellers: 30, 60, 90 and 180 mm.



5.12.3.4.2 Fixed-wing UAV

The following figure shows a maximum speed / mass of the drone diagram for a set of fixed-wing UAV⁵⁷.



5.12.3.4.3 Fast UAV

5.12.3.4.3.1 Quadcopters

The Racer X UAV is the fastest quadcopter model. On July 20, 2017, Guinness World Records approved the performance of a remote-

⁵⁷ Study of a feasible solution for a specific mission with unmanned aerial vehicles (UAV/RPAS) Annex 108 – Ferran Lozano Rocabeyera

controlled quadcopter UAV designed by the UAV Racing League (DRL). The craft, named RacerX, was timed at an average speed of 263 km / h, becoming the fastest UAV in the world⁵⁸.

The machine is capable of peaks at nearly 290 km / h.

The analysis presented in appendix A 5.12.3.4.1 shows that the autonomy of this UAV, at full power, is only one minute.

| Name | Weight | Engine | Max Velocity | Remark | |
|---------|--------|------------------------|---------------------|-----------------------------------|--|
| Racer X | 0,8 kg | TMotor F80 2407 2500kv | 289 km/h , or 80m/s | Velocity record for a UAV in 2017 |  |

5.12.3.4.3.2 Micro-turbine UAV

To achieve higher speeds than UAV equipped with electric motors, it is necessary to use microturbines. These deliver more thrust than electric motors associated with propellers. The machines thus motorized, like the JetQuad AB5, set speed records⁵⁹: 402 km /h.

The microturbines are powered by diesel type fuel which has the advantage in terms of storage of an energy density 40 times greater than that of conventional Lithium - Polymer batteries. The total power of these engines, at full speed, is 200 HP or 149 kW. This prototype will be followed by a production version of the JetQuad AB6, which is scheduled for sale in summer 2021. This UAV, with vertical takeoff, is intended for transporting loads.

The general characteristics of the JetQuad AB6 UAV are presented in appendix A 5.12.3.4.1.

Among the fast UAV powered by microturbines, there are also models of fighter jets. These UAV are equipped with a canopy which, together with speed, gives them the necessary lift.

The following table shows an inventory of fast microturbine UAV.

58 <https://www.futura-sciences.com/tech/actualites/drone-racerx-drone-plus-rapide-monde-68000/>

59 <https://www.futura-sciences.com/tech/actualites/drone-ce-drone-survitamine-atteint-400-km-h-78651/>



| Name | Weight | Engine | Max Velocity | Remark | |
|------------------|---------|--|--------------------|--|---|
| JetQuad AB6 | 60 kg | 4 steerable micro-turbines Power : 200 CV | 250 mph , 402 km/h | 2019 velocity record for a UAV jet propelled |  |
| Inferno | 7,5kg | Turbine Behotec 180 | 770 km/h | Velocity record for a reduced scale model with remote control 23/08/2013 |  |
| Rafale 1/5 | 35 kg | Reactor de type B300F,B330F, P300 | 400 km/h | Reference |  |
| Sukhoi SU-30 1/7 | 24,5 kg | 2 reactors Jet Cat P220 RXi | 460 km/h | Estimated velocity See annex A5.13.3.4.1 |  |
| Scorpion Jet | 18 kg | Turbine AMT Pegasus, JetCat P160, P180 | 360 km/h | Flight duration: 10 – 12 minutes |  |

Inferno record⁶⁰

Rafale 1/5 scale reference⁶¹

Sukhoi SU30 tesimated velocity⁶²

Scorpion record⁶³

The following figure presents a panorama of mini-reactors by showing the unit thrust, the year of production of these models as well as the corresponding manufacturer⁶⁴.

60 [https://www.guinnessworldrecords.com/world-records/fastest-remote-controlled-jet-powered-model-aircraft-\(rc\)](https://www.guinnessworldrecords.com/world-records/fastest-remote-controlled-jet-powered-model-aircraft-(rc))

61 <https://www.aviation-design.fr/?jet-rc-kit-rafale-1-5>

62 <https://fb.watch/1UF9pQNeSG/>

63 <http://larsonconsulting.fr/scorpion/>

64 <https://minijets.org/fr/0-100>

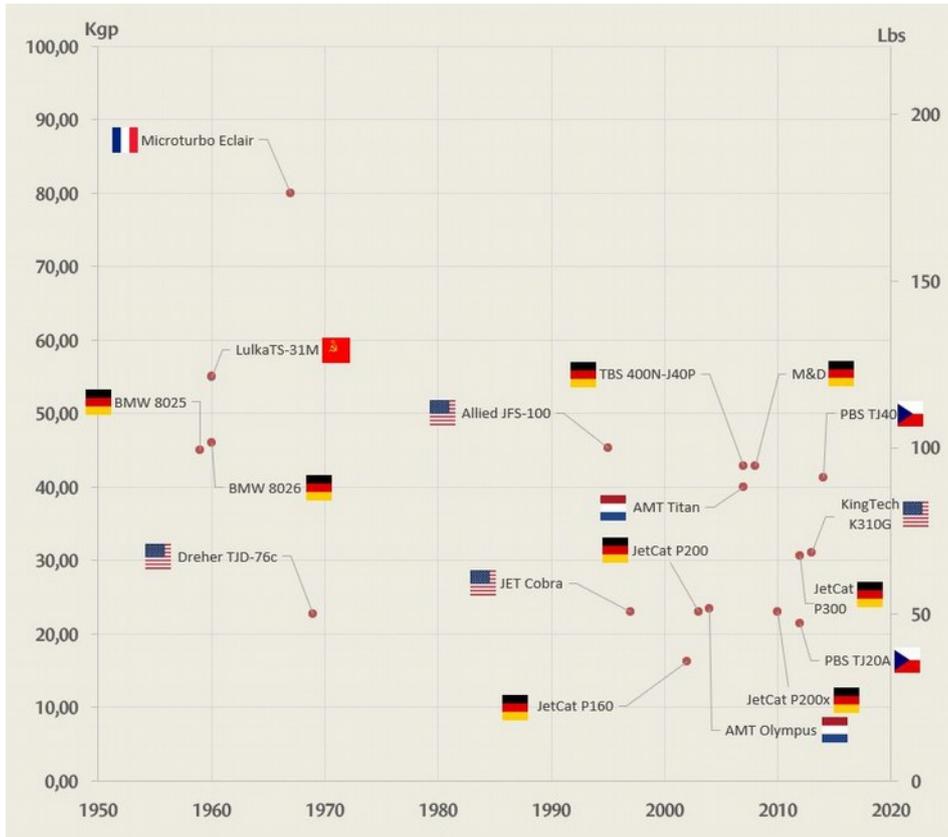


Figure 5.12.3.4.3.2.1

Reactors of the class 0 - 100 kgf of thrust: Classification by thrust and year of production

5.12.3.4.4.1 Spherical UAV with internal equipment

In Japan, Fumiyuki Sato, a researcher at the Research and Technical Development Institute of the Ministry of Defense, developed a flying sphere-type UAV in 2011. This spherical UAV has a mass of 350 grams and a diameter of 41 cm. The flight of this craft is accomplished by controlling the speed of rotation of the propeller and the angle of the piloting flaps⁶⁵.

In this type of UAV, the piloting and propulsion means are located inside the sphere so as to protect them from possible impacts. These UAV are intended to operate in environments that may present obstacles.

65 <https://www.jvejournal.com/article/14607>



Figure 5.12.3.4.4.1.1 - Spherical UAV⁶⁶

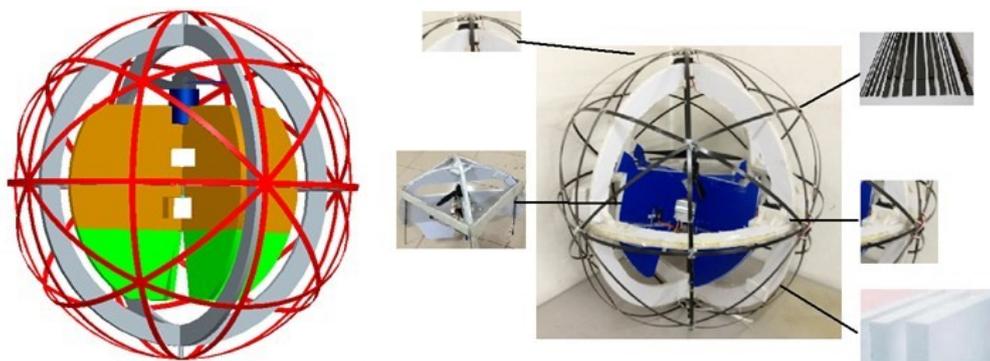


Figure 5.12.3.4.4.1.2 - Examples of spherical UAV

5.12.3.4.4.2 Spherical UAV with external motors

Another type of spherical UAV consists of a sphere associated with an external motor⁶⁷.



Figure 5.12.3.4.4.2.1 - Spherical UAV with external motorization

66 <https://newatlas.com/japanese-spherical-flying-machine/20286/>

67 <https://journals.sagepub.com/doi/pdf/10.1177/1756829320923565>

5.12.3.4.5 Splash UAV

Manufacturers are now offering multirotor UAV with waterproof fairings. These UAV are capable of landing and taking off again from the middle of a pond, a lake or a swimming pool and also of remaining maneuverable on the ocean and in extreme environments (snow, dust, sand, etc.).

An example of such a UAV is the SwellPro Splash drone 3. Its engine allows it to reach a speed of 65 km / h. Its use lies in aquatic activities such as fishing or rescue.



Figure 5.12.3.4.5.1 - SwellPro Splash Drone 3

The following figures, taken from the video⁶⁸, show the UAV's ability to take off after landing on the surface of the water.



Figure 5.12.3.4.5.2 - SwellPro Splash Drone 3

⁶⁸ <https://www.youtube.com/watch?v=36RSWemVFGU>



Figure 5.12.3.4.5.3 - SwellPro Splash Drone 3

Note the misting effect on the surface of the water.

5.12.3.4.6 IR signature of UAV

There are mainly 2 types of propulsion: electric propulsion and micro-turbo. They will be characterized by totally different IR signatures (IRS).

In electric propulsion, there is a fairly uniform heating of the UAV which leads to an IR signature of the black body or gray body type. The typical values provided by the article in reference⁶⁹ are between 30 and 50 ° C according to the models, the flight time, the initial conditions ... These values are very similar in band 2 (3 to 5 μm) and in band 3 (8 to 12 μm) which confirms the grey body appearance.



Fig. 1 (a) UAV1 DJI Phantom Pro 4 model and (b) MW image.



Fig. 2 (a) UAV2 DJI Inspire 1 model and (b) MW image.

Figure 5.12.3.4.6.1

Measurements carried out on two types of UAV (extracted from the reference document)

69 <https://www.spiedigitallibrary.org/journals/optical-engineering/volume-58/issue-5/053107/Validation-of-infrared-sensor-model-with-field-collected-imagery-of/10.1117/1.OE.58.5.053107.full>

In the case of micro-turbo propulsion, the main contributor to IRS will be the plume made up of combustion products, that is to say mainly hot gases (CO_2 , H_2O , CO , etc.).

The figure below gives an example of a IRS of a jet expressed in cm^{-1} . The 2 peaks correspond to the emission of hot CO_2 around $4.3\mu\text{m}$, the main contributor to IRS.

It is difficult, in this case, to speak of apparent temperature or grey body and the SIR is totally different in band 2 and in band 3 where the gases do not emit.

In band 2, the airframe, the temperature of which will be between 30 and 50°C (apart from the nozzle), will have a low contribution versus the plume, the apparent T of which in band 2 will typically be 200 to 300°C .

In band 3, on the other hand, the plume will be hardly visible, the airframe will be the main contributor except when the nozzle will be visible (temperature above 100°C).

In both cases (band 2 and band 3), the aspect angle of the UAV will have a significant effect on the IRS.

Example of turbo jet plume spectrum

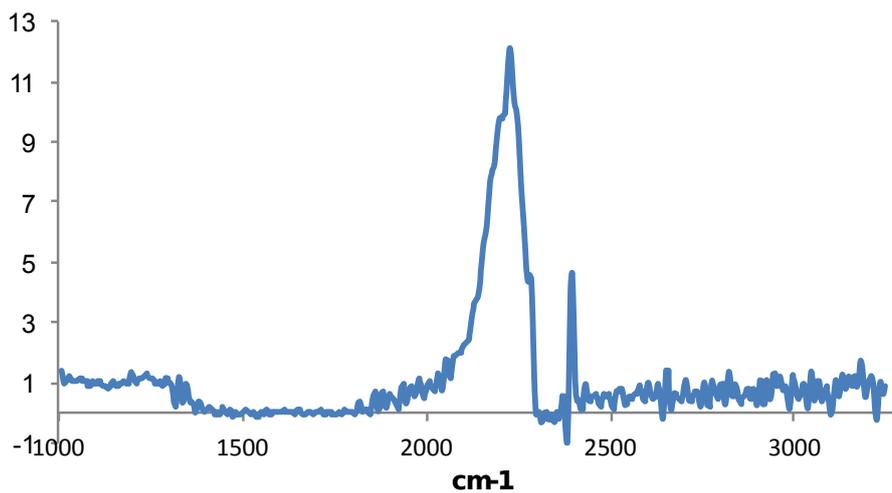


Figure 5.12.3.4.6.1 - Plume spectrum example



5.13 Physical causes to explain UAP

5.13.1 Update on MHD studies in France

With the contribution of Dr Paul Kuentzmann

5.13.1.1 MHD and aeronautics

Magnetohydrodynamics (MHD) is the scientific discipline studying the interactions between the electromagnetic field and conductive fluids. The term fluid is here to be taken in a very broad sense, the field of application of MHD extending from highly rarefied plasmas of the intergalactic medium (1-10 particles per m³) to degenerate matter at the centers of stars (>> 10³⁰ particles per m³). In aeronautics, the potential applications of MHD (we should rather speak of magneto-aerodynamics here) are fascinating. We can cite, for example, the possibility of extracting part of the kinetic energy from a hot flow upstream of a hypersonic body ("generator" effect, as at the exit of a nuclear power plant, former work of the center Kurtchatov and EDF / CEA) to restore it downstream in the form of acceleration ("engine" effect, see: "MHD bridging" 5.13.3).

This type of extreme application requires, in theory, the use of very intense currents and magnetic fields (hundreds of thousands of amperes / tens of Tesla) on strongly ionized flows (naturally by thermalization and / or artificially by alkaline seeding, and electron beams).

Research carried out in France on the subject has not been continuous due to the great difficulties encountered in putting this type of MHD into practice. The other countries appear to have encountered similar problems, although the speed and range performance apparently obtained from hypersonic missile programs may suggest the outcome of some research (see § 5.12.3.4 on hypersonic missiles), as well as the articles cited in appendix A 5.13.1.3 (ONERA work, citation of the AJAX program), Appendix A 5.13.1.4.1 (analysis of the X43 program / MHD application) and A 5.13.1.4.2 (AJAX / Aurora program).

5.13.1.2 Historical aspects

Three phases can be distinguished:

- Theoretical elements were developed from the beginning of the 1980s (J.P. Petit, B. Zappoli for the CNES). An experimental attempt was made at CERT (now the ONERA center in Toulouse) with the involvement of the DERMO and DERAT departments, without success. The only slightly tangible results of this time were related to a hydraulic analogy (manipulation of the bow wave of a ship). CORIA would have participated in the search for a short period. There were two theses defended on the subject at the universities of Aix-Marseille 1 and Poitiers in 1987 and 1988.
- ONERA "revisited" the MHD in 1998, as part of a space prospective group;



including a presentation by Dr Paul Kuentzmann to CNES on February 9, 1999.

- More recently a renewal of reflections on the subject has taken place.

5.13.1.3 Recent work by ONERA

ONERA more systematically adopted the MHD approach from 2009. The following reports have been issued:

- Definition of experimental means for the validation of MHD codes, R.Benay et al., RT1 / 17085 / DAFE, January 2011 (without mention of protection).
- Feasibility of an MHD experiment in the F4 wind tunnel of ONERA, L. Serre, RT3 / 17085 DCPS, July 2011 (restricted distribution), Summary report of the work of the “Prospective Studies” Working Group n ° 6 (GTEP6), R.Benay et al. March 2012 (confidential ONERA).

Here is a short summary of the state of the art:

- **At the theoretical level:** to model the MHD, it is necessary to couple the Navier-Stokes equations and the Maxwell equations, which is done without too much difficulty. On the other hand, at the level of fundamental models, we come across bones: electrical conductivity must be described in a tensor way, chemical reactions must be taken into account because of high temperatures, even for pure air, and the description of turbulence under these new conditions is unknown.
- **At the numerical modeling code level:** a version dedicated to MHD of the CEDRE code of aerothermal chemistry has been developed.
- **At the experimental level:** a review of European facilities likely to host MHD experiments was carried out. Such experiments are essential to validate the calculation codes. Two types of experiences were identified; fundamental experiments aiming at a laminar flow with the use of a seeded rare gas, and applied experiments interested in atmospheric reentry phenomena. Wind tunnels exist: R5Ch (ONERA) and PHEDRA (ICARE / CNRS Orléans) in the first case, HEG (DLR) and F4 (ONERA) in the second. These wind tunnels should be adapted and the MHD models designed. It is not ideas that are lacking but funding commensurate with the difficulties of MHD.
- **Annex A 5.13.1.3:** extract from letter 3AF N ° 32 (July-August 2018)

This extract from the attached letter 3AF provides additional information on research at ONERA, concerning work on MHD. The application to atmospheric reentry (reduction of the effects of hypersonic shocks, reduction of drag), but also to the reduction of the effects of shocks in the combustion chambers of super ramjet are explained there.

The question of propulsion by MHD is also briefly discussed. What should be remembered is that the MHD can be envisaged to improve the aerothermodynamic conditions of hypersonic flights, making it possible to reduce the effects of high temperatures and shocks, or even to optimize a “classic” propellant and increase its performance lifetime (example of the AJAX project, see appendices). MHD propulsion is a technology even beyond the applications described requiring a very large generation of energy to create an “MHD” thrust replacing any other form of thrust (superstator reactor, rocket motor propulsion, etc.).

5.13.1.4 MHD and UAP

There are a number of theories in the open literature attributing the propulsion of UFOs to MHD (J.P. Petit, C.K. Kouropoulos, A.Meessen). All of these theories are speculative and are based only on assumptions made from rare observations; for example A.Meessen highlights the PEP (Pulsed Electromagnetic Propulsion) from a single observation: the pulsating character comes from a case of a UFO overflight which would have given rise to oscillatory measurements of the EM field (the original article dealing with this observation was presented during a SOBEPS seminar and could not be found). However, two articles published on the internet caught our attention and are provided in appendices **A 5.13.1.4.1** and **A 5.13.1.4.2**.

- The first (Annex **A 5.13.1.4.1**), titled X43 speed record broken by an unmanned aircraft⁷⁰ written by Mr. JP. Petit in 2004, updated in 2007, describes the model of the experimental hypersonic vehicle X43. According to the author, the X43 could be equipped with an MHD device, used in the hypersonic regime (Mach 7). Some photos of a test mockup are presented in the article, which Mr. Petit wonders about, in particular that of a metal plate on the upper surface (Figure 5.13.1.4.1). It then represents on an image assembly (Figure 5.13.1.4.3), what could be the implantation of a series of comb-shaped parietal electrodes on the upper surface, in place of the metal plate, which would be intended for the MHD.



Figures 5.13.1.4.1 – 5.13.1.4.2 – 5.13.1.4.3

- The second article from 2018 (Annex **A 5.13.1.4.2**) is titled Ajax and Aurora / the American Hypersonic Vehicle⁷¹. The author successively describes an AJAX-type MHD device applicable to a hypersonic vehicle using the principle of the virtual vehicle (plasma envelope to improve aerodynamic performance) then for hypersonic propulsion (MHD bridging technique). In the case of the virtual vehicle (applied to the Aurora vehicle), the author explains that the ionization of

⁷⁰ https://www.jp-petit.org/nouv_f/X43/X43_1.htm

⁷¹ <http://sboisse.free.fr/technique/Ajax-Aurora-hypersonique.php>

the air makes it possible (see extract from the letter 3AF on the work of ONERA) to reduce the effects of shocks and temperature to the wall of a re-entry vehicle, resulting in better aerodynamic lift to drag ratio and better stealth. It can be achieved artificially by the use of microwaves at 3 GHz (ionization of nitrogen in the air) and by seeding the air with particles of cesium or sodium. The principle of MHD using microwave ionization at 3 GHz is already mentioned in the report in § 5.1 on visible detection (blue radiation from ionized nitrogen), in § 5.4 on radar detection, as well as in § 5.14 on the attempt to compare EM radiation phenomena.

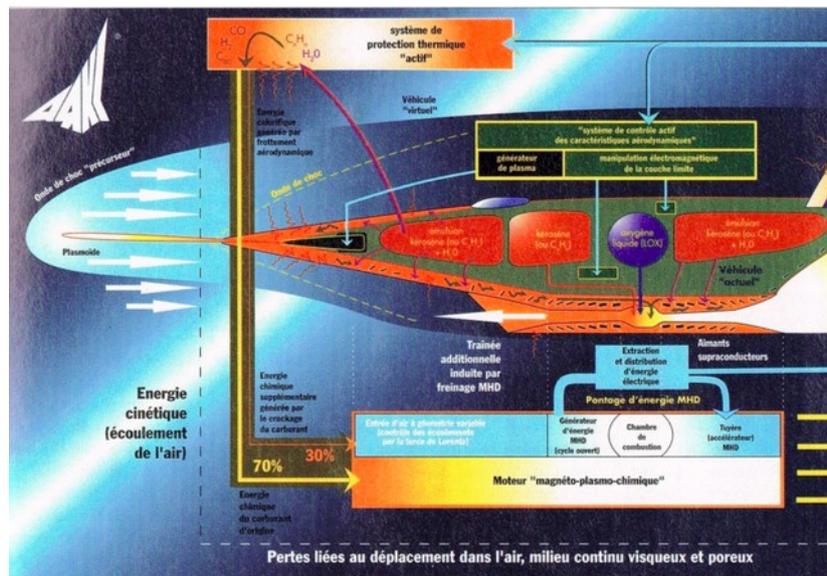


Figure 5.13.1.4.4 : MHD bridging principle

In the case of hypersonic propulsion (that of a cruise missile), AJAX uses an MHD bridging (see Figure 5.13.1.4.4) applied to a ramjet or turbojet type engine to fly at high hypersonic speeds (> Mach 7). The bridging slows down the air at very high speed entering the engine thanks to an energy-generating MHD block. This generates electrical energy by slowing down the air for which it uses kinetic energy (just as hybrid vehicles recover electrical energy when braking). This energy is then reinjected at the engine outlet to ionize the hot air from the combustion chamber and benefit from additional MHD thrust. The advantage is therefore to fly in hypersonic mode without subjecting the ramjet to thermal shocks, thus prolonging in particular its lifespan and the autonomy of the vehicle.

5.13.2 Alternative theories to explain UAP

As some UAP seem to be free from inertia (strong accelerations), as some UAP could be objects capable of moving at high speed in the atmosphere without noise or shock waves, as some observations suggest existence of strong electromagnetic fields, many theories have been put forward.



We can propose a schematic classification of these theories by distinguishing:

- theories based on natural phenomena;
- theories based on conventional knowledge;
- theories appealing to the fundamental principles of science.

The most “natural” theory is the one explaining UAP by plasma balls. A plasma is a very hot and very light medium, so it has very little inertia and could move by the action of local electromagnetic fields in an unpredictable way. "Conventional" theories suggest that some UAP are actually UFOs, that they are powered by MHD-like technology, and that the onboard power source is nuclear (fission or fusion). This approach would explain the electromagnetic environment of UAP and possibly their movement through the atmosphere at high speed without a shock wave. While some progress has been made in recent years at the theoretical and numerical level, there is, however, no convincing experimentation to support this theory.

This subject has been addressed in this report. We believe that natural plasmas can explain certain observations such as isolated or group light balls, TSLP-type stormy phenomena. On the other hand, the lifespan of these phenomena remains of the order of tens of minutes at a maximum and the kinematics are subsonic and do not follow acceleration with sudden change of direction. Our conclusions are directed in this case towards artificial plasmas which would be caused by hypervelocity and hypermanoeuvring devices, out of known limits, in any case free from the laws of inertia.

There are two types of "fundamental" theories. Those that are consistent with standard science and those that can be called divergent. We will not dwell on the divergent theories as they are numerous, contradictory and speculative, in the absence of any experimental verification. Theories starting from standard science are either entirely theoretical in nature or mixed, experimental and theoretical in nature.

Dr. Kuentzmann has left an analysis and synthesis of speculative theories that we have not had time to study sufficiently to account for in this report.

We will therefore recall various theories below, including that of Pierre Marx, member of the SIGMA2 Commission. Pierre Marx wondered about the relationship between general relativity and electromagnetism. General relativity teaches that all forms of energy, including electromagnetic energy, create gravity. Mathematical developments suggest that intense electromagnetic fields could be at the origin of a kind of electro-gravitation⁷².

This theory remains speculative in the absence of validation experience. Consequently, it is imprudent to want to use it to explain observations of UAP at this point, like that of the Mansfield case, which does not exclude noting associated observables which could be noted on future cases (local variation of the field of gravity, modification of the magnetic field etc...). Such measures could eventually support a theory so far speculative.

⁷² See article Effets gravitationnels des champs électromagnétiques intenses, Annales de la Fondation Louis de Broglie, Vol 34-1, 2009 and article published in lettre 3AF N°11 d'octobre 2014 sur Le contrôle de gravité : mythe ou réalité ?



Flight in the atmosphere or in space requires the creation of forces and the availability of a source of energy. A large number of physicists and inventors have sought to demonstrate unknown "effects", either by starting from the great scientific theories which constitute the pillars of standard science (electromagnetism, general relativity, quantum mechanics), or by carrying out ab initio of laboratory experiments.

American work (NASA's BPP program) has carried out scientific analysis of the alleged effects, often by duplicating laboratory experiments. The synthesis carried out by them made it possible, on the one hand, to recapitulate the various claimed effects and, on the other hand, to estimate their reality or likelihood by SIGMA 2. Most of the effects, generally bearing the name of their discoverer or inventor, were invalidated or not confirmed, because too weak and beyond the precision of the measurements.

In particular :

- Two effects have been confirmed but are of very limited interest for the UAP theme:
 - the Casimir force, which exists on a very small scale and is very weak
 - and the Biefeld-Brown effect of lifters, the explanation of which is prosaic (corona effect and ionic wind);
- No propellantless propulsion system has been discovered;
- No electrogravitation effect was demonstrated;
- The possibility of extracting energy from the quantum vacuum is totally speculative.

| Effé ct | Invalidated/ validated | Confirmed |
|--|---------------------------|------------------------------------|
| <u>Mach principle</u> Woodward Tajmar | x x | |
| <u>Gravity control</u> Levi-civita | x | |
| <u>Electro-gravitation</u> Podknetov Tajmar Yamishita | x x x | |
| <u>Quantic vacuum</u> Slepian Brito Casimir Shoulders Potatov | x x x x | X |
| <u>"Free" energy</u> Forward MEG | x x | |
| <u>Asymetric capacitor</u> Biefeld-Brown (Lifter) | | X (conventional explanation) |

Figure 5.13.2.1 - Summary of the effects that may explain the NAPs



5.14 EME case comparison attempt

The different cases of EME effects mentioned in § 4.2.5 are the subject of a summary comparison table below (table 5.14.2). Some of them have been the subject of a quantitative characterization, in particular of the frequencies emitted, in particular around 3 GHz. We try to identify a possible similarity between the cases to deduce some causal hypotheses which could link them and which would deserve to be studied in a systematic way. Such a study would require a larger database. We imagine this is the type of analysis the AATIP program could conduct on Northern Frontier events⁷³ involving North American bases.

Several types of similar effects are noted and have been recorded under different conditions.

5.14.1 3 GHz frequency direct recording case

We first observe cases of EM emissions at 3 GHz duly recorded by ESM (Electronic Support Measures). They are identified in the yellow part of the table. These emissions did not cause direct disturbances on the instrumentation or on-board equipment of aircraft carrying listening equipment: example of the RB 47 and the B52 (Malmstrom). We do not know the nature or the cause of this powerful radiation emitted at distances of more than one km from the aircraft which recorded the signals. On the other hand, the "radar signatures" of the observed objects are generally qualified as important, comparable to that of a large carrier of the KC 135 class, just as the visible radiation emitted is intense and surrounded by a bluish glow.

In addition, we can hypothesize the causes of radiation from other visual observables. there are mechanisms of air ionization under the effect of microwave radiation around 3 GHz⁷⁴. These induce a ball lightning-like plasmoid, ionizing nitrogen in the air, producing a characteristic bright, bluish radiation. This results in a phenomenon similar to MHD which smooths the air flow around the object, which may explain the absence of sonic boom. The induced radiation is observable in the visible spectrum and on radar. The radiation could be linked to a propellant device that generates pulsed microwave radiation at 3 GHz. When activated, they could create ionization. Hence the visual and acoustic effects mentioned.

This same type of radiation can also explain the EME effects observed on the ground with records of the aging of plants, as well as the thermal effects in depth or in the brain (loss of memory) on human beings present. Odor phenomena have been observed and can also result from microwaves in the 3 GHz range. These effects could also be naturally induced or even intentional in some cases (red rays in Alma Ata, temporary paralyzing radiation in other cases).

Likewise, an EME case was reported in Ontario, in the presence of an object surrounded

⁷³ https://m.youtube.com/watch?feature=share&v=-199qc_6090

⁷⁴ <http://jlnlabs.free.fr/plasma/gmrtst/indexfr.htm>



by bluish radiation reminiscent, according to one of the engineer witnesses, of plasma emissions. In this case, the videocam type device exhibited operating anomalies and showed recordings of spurious signals. Even if the EM emission frequencies cannot be qualified with certainty, the observed effects are reminiscent of these disturbances created in electronics by microwaves, in particular at 3 GHz (see the next section).

5.14.2 EME cases of effects on electronics

Other cases (see pale green area in the table), relate to direct EM interaction interfering with electronic equipment (radio, navigation system, electronic weapons controls) in a manner that seems intentional in certain circumstances. The induced effects are comparable to the effects of directed energy weapons using microwaves (see 5.9 and 5.10).

Moreover, the frequency of 3GHz which has not been recorded in these cases (to our knowledge) is a coupling frequency on the electronics which is conducive to the effects of microwave jamming weapons. Similar effects have been observed on ground installations or on airplanes, weapon planes in particular (with simultaneous disturbances of radios, intercoms, navigation equipment and missile control electronics, etc.). This was the case for Russian MIGs, Iranian F4s, and more recently Iranian F14s etc ...

To conclude, we observe phenomena of EM origin, manifested in different ways, both by the recording of high power signals around 3 GHz, and by interference with electronic equipment on aircraft, or on the ground, even in some cases on human witnesses, or traces left on vegetation.

We can even cite the cases of reports in Brazil or in the Blue Book file, describing the effects of water bubbling under a hovering UAP ... Is this a phenomenon of an aerodynamic nature or effects of microwave over water? Recent infrared observations by US Navy pilots could provide very useful information on these effects.

The hypotheses on the causes remain open and we must be careful given the small number of samples available. But we see a similarity around the microwave emissions which could be related in some cases to the high power induced by the propulsion causing these multiple effects, like those caused by plasma radiation, or in other cases like those caused by disturbances directly impacting the electronics, or even close witnesses ... which signifies a certain selectivity of the actions observed, their intensity and even knowledge of the electronics.



| EME case (voir §4.2.) | EM Signal | Visible sighting | Radar Return | Equipmt Jamming Nav (1) radio (2) radar (3) Weapon control (4) Engine (5) vegetation (6) | Comments |
|-----------------------------------|---|---|---|--|--|
| RB47 USA (1954) | EM pulse-F: 2.8 GHz-pulse 2 micros- signal strength Large bomber signal | white blue oscillating | Yes (recorded from | No | EM tranmission -air plasmoid ionization? MHD? |
| Malmstrom AFB (1959) USA | Signal F: 2.5 GHz et 9.1 GHz freq switch 1s | White steady -red green flashing | Yes recorded by B52- RCS*>> Fighter F89 | No | No EM jamming |
| Carpo Granio AFB USA (1966) | No detection | Very luminous object with a dome | UFO tracked by radar up to 100 Kft | Jamming of Radios coms of the emergency team (2) | |
| Malsmtrom Missiles AFB USA (1967) | No detection | Red orange light | None | Missiles control MMI (4) | Jamming of the electronic launch control panel |
| Minot Missiles AFB USA (1968) | No detection | luminous red orange size > aircraft | detection by B52 radar+ ground based radar- RCS> > KC135 | radio UHF B52 jammed 1 km range -2000 ft above (2)/ launch pad gate open (20t) (4) | radio jamming-warning neutralization-silo open |
| Usovo Air base Ukrain (1982) | No detection | Bright circular object radiating moudlated light (size 700 m) | ? | Jamming of radio Coms (2) and of missiles electronic control panel (4) | |
| Blorisoglebesk Russie (1984) | No detection | | Radar detection by MIG 21 | Missile electronic control panel frozen (4) | electronic jamming during dog fight- ejection-start of R&T on MicroWave weapons |
| Kapustin Yar (1991) | | metal large cynlinder L 600 m- Diameter 110 m | radar detection from ground radar-target Z 6600 m- V 960 km/h- acceletation up to 6800 km/h | MIG electronic missile control freezing- range 500 m during warning fire (4) | electronic and missile elctronic control freezing , engine extinction during warning shot by 2 MIG |

Tableau 5.1.4.2 : comparison of EME cases



| EME case (voir §4.2.) | EM Signal | Visible sighting | Radar Return | Equipmt Jamming Nav (1) radio (2) radar (3) Weapon control (4) Engine (5) vegetation (6) | Comments |
|--|---|--|---|--|---|
| Alma Ata at Kok Tuybe (1991) | No detection | flammes and red rays tranmitted by an object landing on a mountain | None | radio operating-vehicle engine break dwon (5)-temporary amnesis (6) | vehciles engine break dwon while scanned by red rays- loss of memory by the crews |
| NARCAP US Files | depending on cases | Yes | | statistics 31% compass (rotation 360°), 7% gyro compass (30°), DME at short range (100 ft) (1) | aero EME on aircraft up to 5000 m |
| Iranian F4 (1976) | No record | Star shape bright object- multicolor flashes- main star object divides into 2 or 3 objects | Likely from ground radar and onboard (F4) radar | radio phone (2)- gyro compass (1)- electronic missile fire control (4) | EME initiated when activation of missile firing electronic control |
| Rendesham-Benwaters UK (1980) UAP ground case | No record | Bright objects? | ? | radiological traces in the ground at the landing site | radiological and mechanical traces |
| ground case in Delphos Kansas USA (1971) | None | | | EME effect on testimony-olfactory signs | Olfactory signs can be induced by interaction by MW and pollutants in the air or ground |
| Ground cases Trans en Provence (1981)- Amaranthes- Valencoles France | None | Spherical object | None | Trans: chlorophyle DNA disapearance (5)-watch perturbation (slowed down) (6) | Mechanical effects and EME on vegetation- No EME on human- chemical analysis non conclusive |
| Iranian F14 (2013) | ? | UAVs- bluish radiation | vitesse stationnary to Mach 10 | Missile firing electronic control freezing (4) | stationnary to M10- missiles ectronic control F14 |
| SCU Ontario case (2013) | video spurious signal on camera cybershot- 465 ms period- 11 modulated pulses | doucle disk surrounded by a blueish light plasma type- sparkling conical queue | NA | camera freezing - smartphone reboot stopped- overheating (4) | |

Tableau 5.1.4.2 : comparison of EME cases (continued)



6 Observation

Human visual observation is useful but insufficient. Quality photos are not numerous, despite the proliferation of digital cameras. Effective image analyzes exist to detect hoaxes (example IPACO software, Figures 6.1.1.1 to Figure 6.1.3.5).

Military radar observation means (primary radars which detect aircraft objects, missiles, UAV by the reflection of a radar wave on the object, Figures 6.2.1 to 6.2.4) are improving in coverage (range , precision, botton altitude) but keep limitations (ceiling, speed, object size, accelerations) adapted to their missions (aerial surveillance, long-range missile detection alert) and to their operating modes. They favor the filtering of false alarms (parasites) or leads of secondary interest in order to focus on priority missions (operations, security against suspicious theft, monitoring of illicit trafficking).

The recording of raw radar data also poses a problem because the aerial situations are for the most part synthetic (presentations of graphic symbols and not of the video radar signal as on the old cathode-ray radar screens) even if the recording of detection plots¹ can be used at the level of radar stations but within a limited time frame. Civilian radars are mainly secondary (they detect the response of a “beacon” transponder, which does not exist in the case of a non-cooperative object), or even primary and secondary (see Figure 6.2.5) in the vicinity of airport approaches but with a synthetic visualization of the airtracks (modernized software replaces the visualization of the primary video signal - clutter of radar echoes - by a synthetic visualization of the runways much clearer for the controller, i.e. graphic icons on a computer screen). However, a few recent cases, such as that of Jersey in 2006, allow us to study a primary radar situation in the presence of raw radar echoes. The radar thus makes it possible to measure the distance of the tracked object and its angular coordinates, so it locates the object in 3D (see Figure 6.2.6).

Infrared (IR) or visible (operating in the infrared and visible spectra) camera type sensors mounted on surveillance and security platforms (aircraft, helicopters, patrollers, UAV) can provide opportunities for visible and IR video recording at high 2D angular resolution (see Figure 6.2.7), but do not allow distance measurements, except when using a laser rangefinder (limited to ranges of the order of 10 to 20 km depending on the size of the object and weather conditions). These data are complementary to those of the radars, subject to a good calibration of the cameras (it is necessary to compare the measured signal with a standard signal to restore the temperature of the object and to know the processing, otherwise the available data may be altered).

The overlap between radar and infrared measurements allows the study of PAN cases with precision, removing ambiguity about the position of the UAP. IR camera images without any distance information do not make it possible to restore the position and trajectory of the object, except to make speed assumptions what we tested in the Aguadilla case with ambiguous results.

¹ A plot is a digitized quantity specific of the radar return measured and converted into digital signal. It features the strength of the returned EM signal together with other indications of geographical coordinates and time. It therefore depicts the object observation and its radar signature.



The instability of the electromagnetic and kinematic behavior (very low speed or sudden accelerations) of some UAP poses a detection problem, for active radar tracking algorithms in particular. This was the case when observing the UAP in the Nimitz case, where the Princeton cruiser radar (see Figure 6.2.4) appeared to have lost radar echoes when objects appeared to be moving rapidly from their altitude position (80 kft) down to sea level (according to witnesses - see § 4.2.3).

The increase in air traffic, particularly at very low altitude (VLA) with the appearance of UAV and mini-drones, constitutes an additional difficulty for aerial surveillance due to the multiplicity of objects, of various shapes, which can fly over areas without a flightplan (soon to be equipped with identification chips) which can thus create confusion with UAP. Conversely, the surveillance efforts undertaken to combat this type of "threat" with various means, IR cameras, passive radars (see Figure 6.2.8), ground surveillance radars and air defense radar with very low altitude capacity, could alleviate the current difficulties and generate new observations. To try to follow the densification of air traffic, with its multiple radar echoes, we can use Artificial Intelligence (AI) technics to analyze quantities of digital "Big Data" data and then be able to extract unusual signals. China is believed to have put such techniques into practice to track UAP, according to an article² published shortly after the NY Times comments on the UAP TF report on June 3, 2021.

Radar surveillance of space (Figure 6.2.9 to Figure 6.2.11) allows the observation of objects in orbit that follow a known Keplerian trajectory (parabolic ballistic trajectory like that of a cannonball or elliptical or circular like that of satellites). It is not designed to observe trans-atmospheric objects which pass through the atmosphere at altitudes intermediate between the dense atmospheric environment where conventional aerial surveillance radars operate (altitude <30 km) and space, above 100 km altitude. These objects evolve according to classic flight mechanics but with hypersonic aerodynamics linked to an environment where air is very rarefied, possibly improved by advanced technologies such as MHD (see § 5.13.1). In this altitude range, it is also possible to observe meteorites entering the atmosphere, but also objects (ballistic missile warheads, possibly reconnaissance planes, hypersonic missiles, etc.) compatible with propulsion modes suitable for large speeds and reduced atmosphere (ramjets for example).

Specialized anti-ballistic missile radars (existing in a few countries) cover these intermediate altitudes to detect and track very fast and ballistic (up to 7 km / s) or even maneuvering targets. These observation systems (Figures 6.2.1 to 6.2.4) are rare (mainly American, Russian, ...) and their characteristics are generally confidential. The effectiveness of their tracking on hypersonic objects still depends on the processing algorithms and the assumptions about the observed phenomena (signature, kinematics). A UAP moving at high speed on a straight path can be detected and tracked if it remains in the high speed range of these radars designed to track hypersonic objects. On the other hand, a UAP which would be present at low altitude at low speed, then accelerate according to an erratic trajectory towards higher altitudes would

² <https://thedebrief.org/china-confirms-it-has-its-own-ufo-task-force/>



probably not be seen, except to have radars with high measurement rate and equipped with algorithms adapted not only to detect slow targets, but also to follow very maneuvering targets. The possible loss of tracking of the Princeton radar (anti-missile radar) can be explained by unforeseen accelerations by the tracking algorithms. As explained in the chapter on physical elements, one of the major challenges is to ensure robust tracking of objects with unpredictable kinematics. If one uses an aerial surveillance radar which scans the space regularly (period of a few seconds to ten), it is very difficult to detect and especially to initiate a tracking on an object whose rapid maneuvers in one second exceed acceleration of conventional aircraft. There are also high performance electronic scanning multifunction radars that have a tracking function, and once detection is assured, can track the detected target to measure its position and speed accurately. It is then necessary to anticipate the movement of the target in order to re-aim the beams and continue the pursuit in the predicted direction. Repointing algorithms therefore make assumptions about known objects, deemed to be animated by classic kinematics. Conversely, faced with extraordinary kinematics, the tracking is difficult given the directivity of the beams which can "lose" a very maneuvering target. Conversely, a non-directional observation means, capable of capturing 360 ° radiation without pointing an antenna or a beam in the predicted direction of the target, would make it possible to overcome this constraint and could be very complementary to the monitoring means. classical especially with regard to unpredictable phenomena.

In particular, passive radars offer such possibilities. Indeed, they work according to a principle of multistatic detection which consists in detecting the reflections of the electromagnetic waves emitted by radio transmitters (FM radio, T NT) on the objects which cross the airspace, without emitting any wave directed towards them. Here, therefore without the need for pointing. Such radars exist in the military domain (see Figure 6.2.8) and operate more in the low-medium altitude domain below 10 km. Similarly, scientific observation of meteor re-entries (IMCCE's FRIPON network for example, Figure 6.3.2.1 to Figure 6.3.2.4) allows simultaneous passive (emission-free) optical and electromagnetic observations, benefiting from coverage overall territory, between 0 and 100 km altitude, insensitive to accelerations and maneuvers (no sensor transmitter beam pointing). Recording is permanent and automatic. We can therefore reasonably hope that such means of observation during deployment will not only allow the observation of meteors, but also that of other phenomena including UAP. CNES / GEIPAN had also tested cameras transferred and integrated from the FRIPON network.

We have started discussions on a joint project called Trillian, intended to improve detection and classification processing on the Fripon network, to detect and classify not only meteorites, but also LTE, ball lightning phenomena and UAP. This project needs to be refined, and provided with resources of image processing and applied AI experts.

Optimization of observation loops will therefore merit study between conventional aerial surveillance means and new surveillance means, a possible subject of dialogue between 3AF / SIGMA2 and the various bodies concerned.

An inventory of observation means is summarized in Table 2 - Summary of sensors. It



completes the list of conventional electromagnetic and optical observation means, by means of magnetic field and gravity field measurements which could possibly reveal other types of UAP interference with our environment, a totally speculative hypothesis to date. but which remains open.

We may add that the analysis on EME effects leads us to consider the interest for recording EM radiation transmitted by UAP in the MicroWave spectrum. This is suggest to use ELINT systems to record EM radiation coming from UAP with passive receivers (airborne, space borne or ground based).

An interesting initiative deserves to be noted from the point of view of scientific observation through the UFODATA³ project. It brought together a few scientists wishing to develop multisensor observation stations (cameras, spectral analysis, HF sensors, magnetometer, gravitometer, etc.) which could be placed in certain well-known places for UAP observations. This observation process is reminiscent of that of Hessdalen, one of the scientists involved, Massimo Teodorani, also participating in the UFODATA project. The project is only at an initial stage of fundraising, and then aims to deploy a prototype station that could later be extended to a network, allowing information sharing. SIGMA2 is first of all interested in the FRIPON network being deployed, or REFORM, an amateur network deployed, and will follow this new initiative with great interest, especially as the list of instruments that could be assembled⁴ on the station matches the final inventory of sensors drawn up by the Commission.

UFODATA therefore seems to be an initiative taken by scientists which goes in the direction of collecting physical data on UAP in order to carry out serious scientific studies.

3 <http://www.ufodata.net>

4 http://www.ufodata.net/resources/UFOAC_MT_Project_REVISED.pdf

6.1 Image analysis: search for possible montages

Example of the Yungai analysis case (Chile, 03/22/1967) with the IPACO software (Dr François Louange)

6.1.1 Original images



Figure 6.1.1.1 - Yungai case (1/4)



Figure 6.1.1.2 - Yungai case (2/4)



Figure 6.1.1.3 - Yungai case (3/4)



Figure 6.1.1.4 - Yungai case (4/4)

6.1.2 Geometric analysis

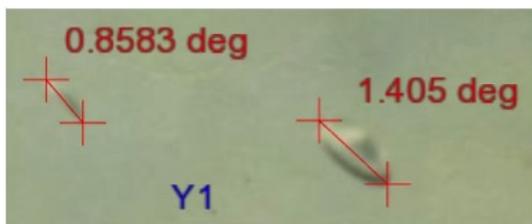


Figure 6.1.2.1 - Yungai case (1/4 geometry)

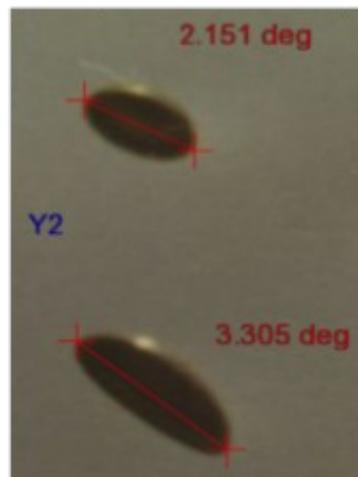


Figure 6.1.2.2 - Yungai case (2/4 geometry)

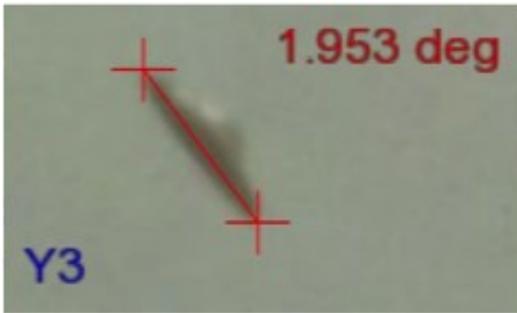


Figure 6.1.2.3 - Yungai case (3/4 geometry)

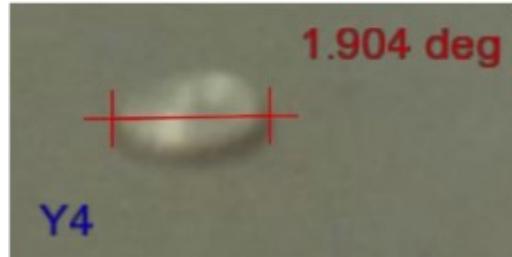


Figure 6.1.2.4 - Yungai case (4/4 geometry)

6.1.3 Image analysis

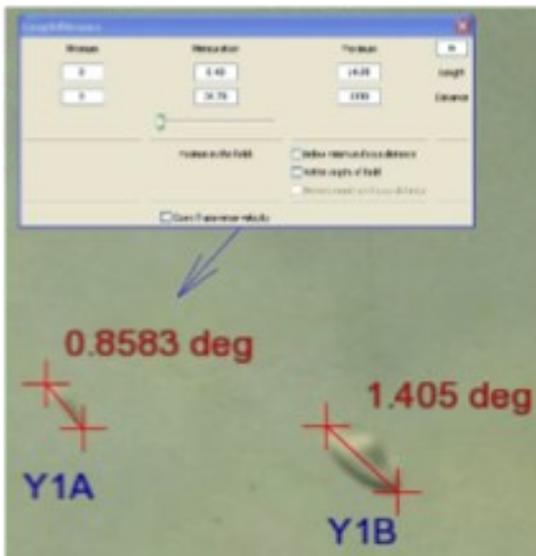


Figure 6.1.3.1 - Yungai case (image analysis)

| Object | Angular size | Size | Distance |
|--------|--------------|-------|----------|
| Y1A | 0.86 ° | 40 cm | 27 m |
| Y1B | 1.4 ° | 40 cm | 16 m |
| Y2A | 2.2 ° | 40 cm | 11 m |
| Y2B | 3.3 ° | 40 cm | 7 m |
| Y3 | 2.0 ° | 40 cm | 12 m |
| Y4 | 1.9 ° | 40 cm | 12 m |

Figure 6.1.3.2 - Yungai case (image analysis)

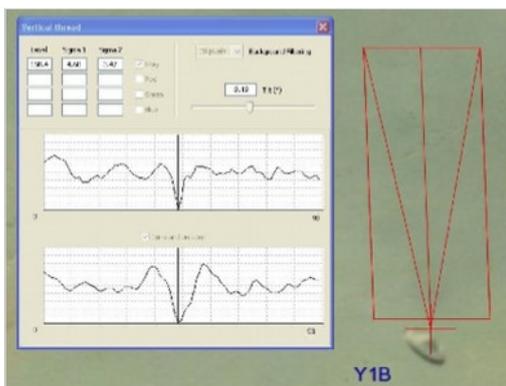


Figure 6.1.3.3 - Yungai case (search for tight thread)



Figure 6.1.3.4 - Yungai case (search for tight thread)

6.2 Air and space surveillance means



Figure 6.2.1 surveillance radar and air defense



Figure 6.2.2 : example of multifunction multifrequency radar to detect, track and guide stealth targets crossing the atmosphere (between 100 km altitude and denser layers below 10 km)



Figure 6.2.3 : example of early warning very long range radar



Figure 6.2.4 : example of a naval air defense Multifunction radar similar to the radar used in the US Nimitz case (2004) to track UAP

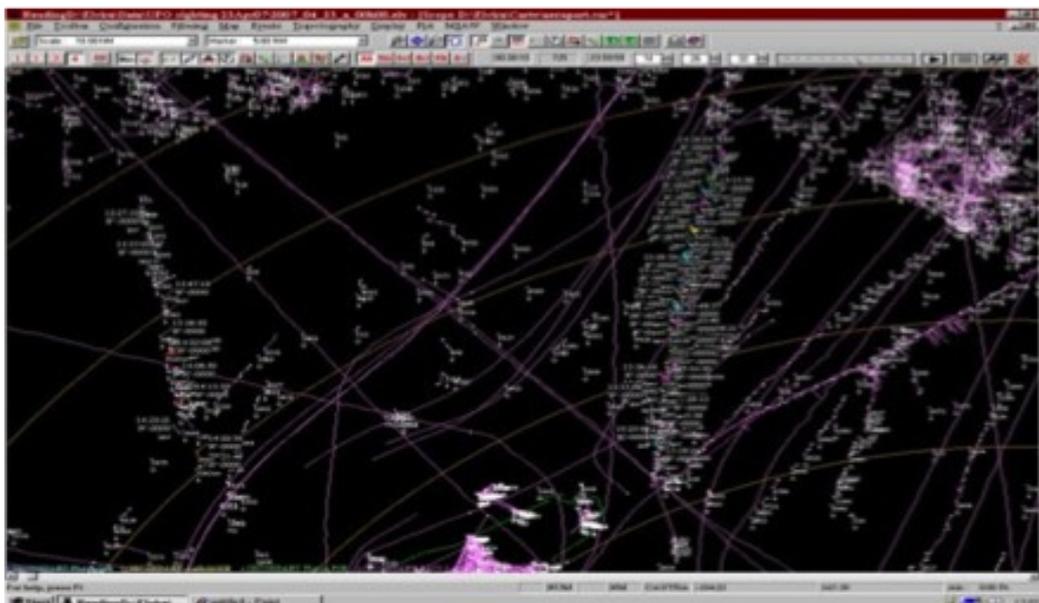


Figure 6.2.5 : example of visualization of a primary civilian radar situation (echoes are visible) - Jersey ATC radar

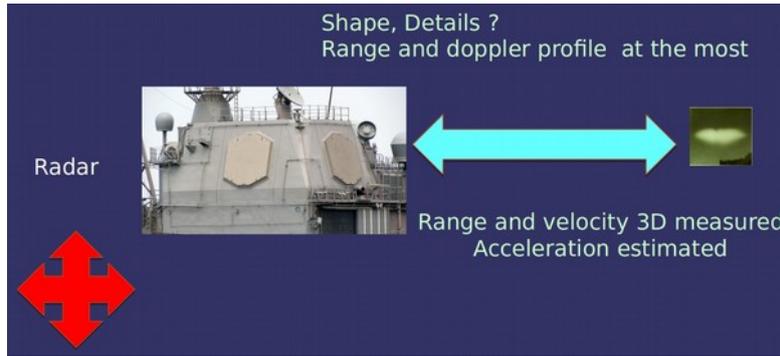


Figure 6.2.6 : the radar measures with its beam, the position of the object by angular measurements and the round trip time of the radar EM wave, which gives the distance. It thus gives the 3D position of the object and the speed measurement.

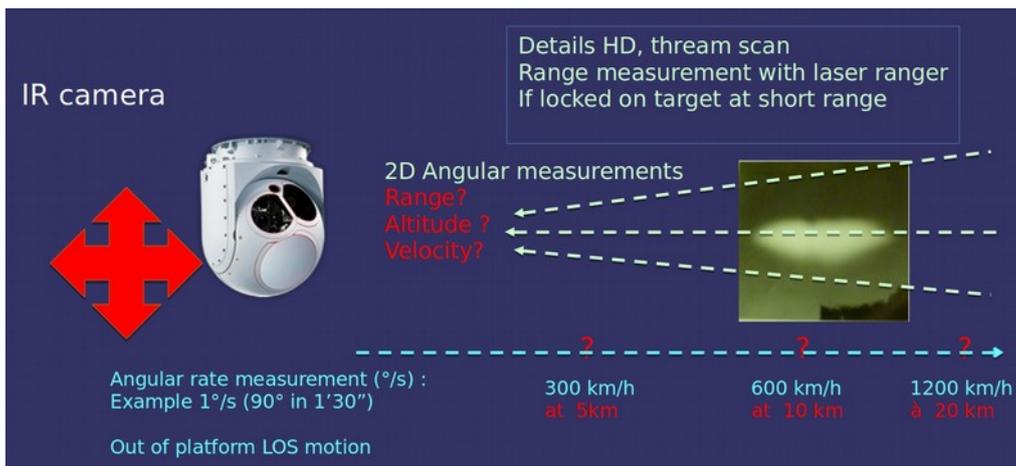


Figure 6.2.7 : the IR camera forms a 2D image day and night. It does not measure distance and does not, on its own, measure the distance, altitude or speed of the object being tracked. On the other hand, it gives information on the temperature of the object. The distance can be measured with a laser rangefinder, when it is coupled to the camera and the distance (<10 km) and the size of the object allow its use. Without radar or distance measurements conducted by another means, we cannot trace the distance and speed of the observed object.

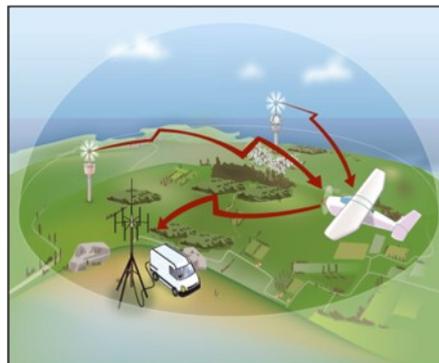


Figure 6.2.8 : principle of passive radar. The radar receiver receives the echo generated by the aircraft which interferes with ambient electromagnetic radiation (FM radio emissions etc.), which is measured and calibrated in advance.



Figure 6.2.9 - transmitting - receiving antennas



Figure 6.2.10 - Graves space surveillance bistatic radar - receiving antenna

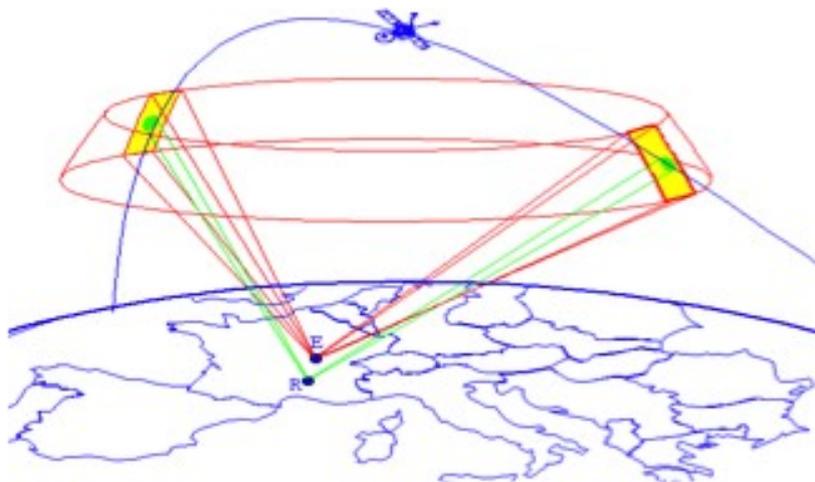


Figure 6.2.11 - emission diagram - reception of the bi-static radar surveillance of the Graves area

6.3 Detection, identification and control in French airspace

6.3.1 3 layers of detection / monitoring



Figure 6.3.1.1 - Missions of the CNOA (National Center for Air Operations) of the French Air Force: monitor the French airspace 24 hours a day, assess the threat and contribute to the Permanent Aviation Security Posture

Military and civilian radar stations

- Military: 16 high and medium altitude radars, 31 low and medium altitude radars (+ approach radars + AWACS)
- Civil: 4 stations

The information from the radar stations converges on four CDCs (Detection and Control Centers) spread over the metropolitan territory:

- CDC Mont de Marsan (BA 118)
- CDC Cinq-Mars-la-Pile (attached to BA 705 in Tours)
- CDC Drachenbronn (BA 901)
- CDC Mont Verdun (BA 942)

Information from the CDC converges on the CNOA (National Center for Air Operations) at Mont Verdun.

The information reaching the CNOA is radar tracks. The search for "abnormal" tracks can be carried out by the CNOA up to the level of plots provided by military radar stations or CDCs equipped with a radar, within the limits of the retention periods of the records.

6.3.2 Multistatic meteor scientific observation network (FRIPON network)

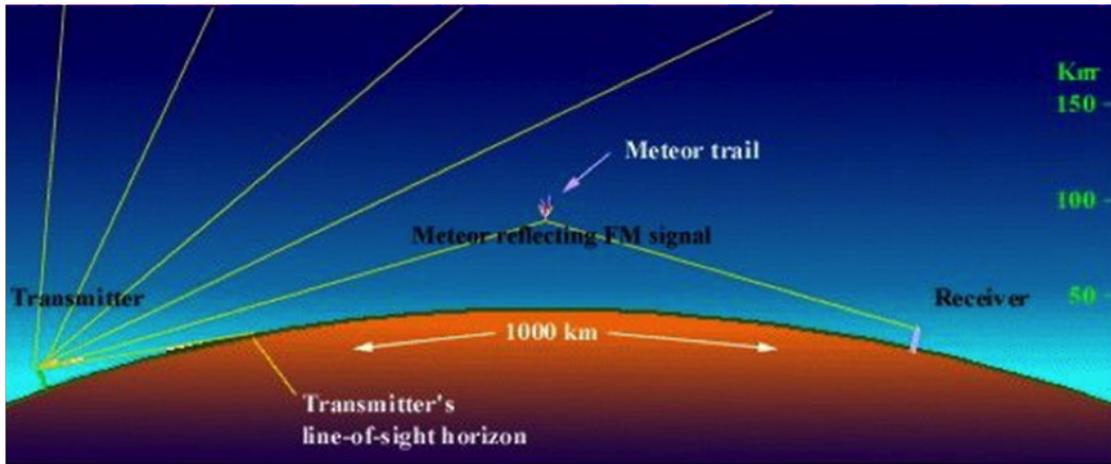


Figure 6.3.2.1– Bistatic radar to observe re-entry of meteoroids.

The HF transmitter illuminates the ionized tail of the meteorite which reflects the wave towards one or more receivers which allow the position and speed of the meteorite to be measured.



Figure 6.3.2.2 - HF receiving antenna of the meteor monitoring network

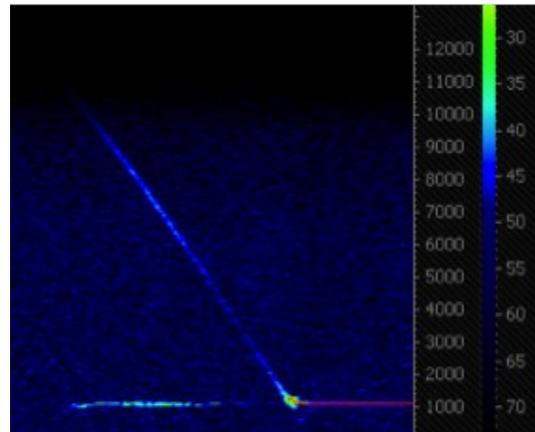


Figure 6.3.2.3 – Doppler track of the meteoroid reentry detected by the HF receiver

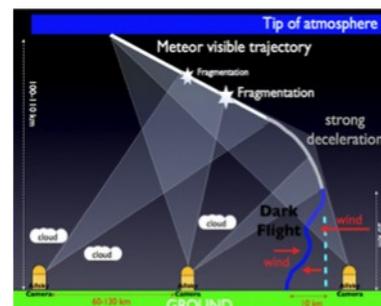


Figure 6.3.2.4 - Multiple Fisheye cameras (hemispherical wide-angle vision) of the FRIPON network allow global coverage of the territory.



6.4 Summary table of the types of sensors

| Sensors type | Permanent | Coverage Range/ altitude | Coverage Velocity/ acceleration | Tracking | Raw signal | Comments |
|---|---------------------|---|---|--------------------------------|-------------------------------------|--|
| Air Defense Radars Multifunction radar (MFR) | H24 | R 0 to X00 km x x 100 km) Altitude: 0 to 100 Kft (surveillance radars) For MFR radars, limits linked to maximum range and elevation angle | V < roughly Mach 3 Acceleration : <XX g (surveillance radars) Limits are higher for MFR tracking radars | Yes (active tracking for MFRs) | No | Tracks and plots recording. Signal is for maintenance |
| Early Warning radars and space surveillance | H24 | Range >>X 000 km Altitude : Max limited by detection Fence hundreds of km-horizon for low altitude limitation | V < 10 km/s | Yes (multifunctions) | No | Tracks and plots recording. Signal is for maintenance |
| Test range tracking radar | No | Range >X 00 km | V < 10 km/s | Yes | No | During tests or on request |
| Passive radars | H24 | Range: X 0km Low to medium altitude | Low to high velocity-low sensitivity to acceleration | Yes Software | No | Tracks and plots recording. Signal is for maintenance |
| Civil ATC primary radar | H24 | Horizon Range on transponder | | No | Yes (for old radars) | Old primary radars replace by synthetic |
| Civil ATC radar (secondary) | H24 | Over the horizon | | | | Transponder |
| Visible or Thermal camera | H24 (depending MTO) | X 0 km to X 00 km Depending on MTO and LOS elevation | No limitation | Yes | Depends on processing | Limitations due to MTO |
| Optical and HF meteoroids surveillance network | H24 | X0 km to 100 km Optical visible and HF (depends on MTO for optics) | No limitation-tracking of meteoroids up to 50 km/s | Yes multistatic | Yes (depending on storage duration) | Spectral analysis possible |
| IR and optical satellite | H24 | Range X 000 km depending on object and MTO - contrast | No limitation but false alarms on slow objects | Yes | Yes depends on processing | Depends on satellite-orbit and scenery |
| Gravitometer | H24 | NA | NA | NA | Yes | Measure of earth Field variation |
| Magnetometer | H24 | NA | NA | NA | Yes | Measure of Field variation |

Figure 6.4.1 - Synthesis of sensors



7 Conclusion

At this stage of the work, a progress report can only cautiously confirm a few guidelines and useful avenues to follow in order to deepen the study in the light of external research and our own work. However, we notice a strong inflection, as much in the international context, with in particular the change of communication of the USA on the subject UAP, and its possible repercussions, as in the modest analyzes carried out by the CT SIGMA2.

This requires first of all to briefly review the conclusions of our work in 2016, before discussing the transition to the current situation.

7.1 Reminder of the 2015 conclusions on the international situation

Regarding the subject's environment and existing data, it is obvious that the UAP subject is a subject of scientific and technical research, based on the observation of unexplained phenomena for several centuries, with an acceleration of observations during the 20th century which motivated the launch of investigative programs among the great powers: USA, Canada, Russia and countries of the exact Warsaw Pact, UK, France and more recently countries of South America and Asia as well. Our research made it possible to establish an overview of the work and cases identified around the planet and also to confirm the absence of visible international scientific cooperation. Some attempts for scientific cooperation were made with the UN, first in 1967 by an American commission of inquiry which had attempted direct contact with the Russian Academy of Sciences then via the UN COPUOS, and finally in 1978 by the proposal for decision 33/426 brought by the island of Grenada. This decision 33/426 was taken on December 18, 1978 during the 87th session of the General Assembly on the proposal of the island of Grenada but its international scope was neutralized because it did not allow the creation of an international research agency, nor the grouping of experts in order to share data and knowledge on these UAP phenomena. It was ultimately reduced to an invitation from states to coordinate nationally research into UFOs and extraterrestrial life and to inform the Secretary General of such activities.

Many states finally published their archives in the 2000s or gave access to their data to non-governmental organizations (Australia, Brazil, Canada, Chile, Denmark, Spain, Finland, France, Great Britain, Mexico, Peru, Sweden, Ukraine,...), without forgetting the publication of the American archives relating to the Blue Book Project file (cases studied by the US Air Force prior to 1969) and to the report of the Condon Commission; but these initiatives and the use of data have remained strictly national and do not allow official exchanges of information between experts. This does not exclude possible bilateral cooperation on this subject, as was the case for the agreement between Canada and the USA following the JANAP 146 procedures, the letter of agreement of which was signed in 1954, with the object of communications on observations of unknown objects (planes, missiles, but also UFOs, etc.) in NORAD airspace. **Nor can it be ruled out that**



work will continue in the USA¹, UK and Russia without any publication. Overall, the conclusions from official bodies confirm the existence of unidentified aerial phenomena, a fraction of them remaining unexplained, in some cases motivating recommendations not only for reporting but also for behavior to pilots (mentioned in UK MOD² reports), all concluding on the absence of risks from the point of view of security and defense, which seems to be the hyphen and the conclusions shared, independently, between the nations. The incentive for scientific research and the review of these data remains national in scope today, in some countries.

7.2 Downturn observed between 2016 and 2021

As we mentioned in our 2015 conclusions, we assumed that research was continuing in the USA, for example. However, the archival publications by the CIA, recalled above, testified to a global follow-up of events on this subject well beyond 1969.

Statements made via TTSA in late 2017 raised questions that SIGMA2 summed up in a note published in January 2018:

Change of communication policy on the NAPs by the USA?

Intention to share data on UAP observations?

What about the origin of these phenomena and the official American position on the ETH hypothesis?

The subject posed is that of incursions into the American airspace an affirmed subject of safety which remains a sensitive subject since the attacks of September 11, 2001 in the United States, even more in the international strategic landscape, but with regard to what?

Are these completely unknown phenomena, are they foreign incursions? Is the goal pursued to bring to light the data and realities on the UAP and to assert a lead in this field? Is it a question of reinforcing defense fundings on certain themes? Is it to consider information sharing (database) and wider cooperation on UAP, which would be new in the current climate.

On June 3, 2021, the NY Times published an article³ after reading the UAPTF report to Congress, titled: "U.S. Finds No Evidence of Alien Technology in Flying Objects, but Can't Rule It Out, Either."

Cases of UAP or unidentified objects are cited, 120 cases over the past two years. No

1 End of January 2016, CIA published a blog, depicting investigations on UFO cases in the USA since the 50's, also on cases occurring in the former Eastern countries during the same period, and finally a survey of all cases happening around the world till the end of the 90's.

2 see executive summary of the report « Unidentified Aerial Phenomena in the UK Air Defense region »
uap_exec_summary_dec00.pdf

3 <https://www.nytimes.com/2021/06/03/us/politics/ufos-sighting-alien-spacecraft-pentagon>



evidence is given of technologies of "extra-terrestrial" origin, ie confirming the Extra-Terrestrial Hypothesis (ETT); but we cannot rule out this "HET" hypothesis because of the abnormal behavior of these objects. No further mention is made at this stage, acknowledging that classified, therefore undisclosed, data exists in appendices to the report.

The questions about incursions by Chinese or Russian devices are still being asked. But at the same time, the observation is made of a kinematic behavior (brutal speeds and accelerations) inexplicable by known technologies, as well as the change of air-sea environment without interaction with the environment (absence of aerodynamic and acoustic effects. , ...).

We can therefore conclude, after three years of questioning US communication, to a new fact. **The UAP TF report a priori doubly contradicts the conclusions of the Condon report of 1969. Airspace security is a matter of concern due to unexplained incursions whose characteristics are beyond the technologies mastered by the United States. The origin of phenomena does not refer to natural phenomena.**

As a response to American questions, the People's Republic of China (PRC) responds to the Pentagon's report on UAP, with a statement⁴ relating a similar observation of regular incursions into Chinese airspace, acknowledging that this poses a security problem. . The same observation is made of extraordinary kinematics for these "abnormal" atmospheric phenomena.

The work carried out by a similar UAP Task Force, bringing together the academic research community with the armed forces of the PRC, refers to studies of UAP event analysis of "weak signals" type data assisted by Artificial intelligence data analytics technics. It is also an important factor of change. The observation is therefore shared.

What about Russia? As of this writing of this 2021 progress report, Russia has not yet formally reacted to the US report, which by the way has yet to be released. Only an article from the NY Times of June 3, 2021 mentions it, the report being expected for disclosure on June 25, 2021. We await with interest the American report but also the Russian position on this subject.

However, if we refer to the Russian research work on the subject UAP called anomalous phenomena reported in various publications, these brought out conclusions similar to the conclusions summarized by the NY Times:

Unknown phenomena animated by extraordinary cutscenes.

Change of environment without interaction with the air or aquatic environment.

The question of natural origin (atmospheric plasmas in particular) or artificial origin was raised, the Academy of Sciences leaning at the time on the origin of plasmas. However, military research showed unusual effects, both kinematic and electromagnetic.

The HET hypothesis was not preferred. Risk in air or sea space did not appear to be a

⁴ <https://thedebrief.org/china-confirms-it-has-its-own-ufo-task-force/>



primary concern after the research. The question of American incursions during the Cold War had obviously been considered, both in the air and under the sea.

7.3 What is new in 2021?

If we set aside the American declarations, what are our findings following the analysis of cases and publications in 2021, knowing that our conclusions of 2015 indicated two trends:

- Research on the links between various observables compared to different cases.
- Research of cases and databases, even meetings between experts.

The work of the SIGMA2 Commission has progressed on several axes such as the inventory and the case study, the follow-up of international activities, the work on physics, the inventory of advanced machine technologies... Many contacts have been made. Interesting documents have been identified, including work carried out abroad, but cases with indisputable physical data recorded are rare. The use of old cases, in particular EME from data of international but also French origin, allowed interesting comparisons.

At the French national level, the French databases that GEIPAN publishes are very useful for classifying cases of UAP. Cooperation with GEIPAN continues on the following principles: either through the contribution of certain SIGMA2 experts to the GEIPAN panel of experts, or through additional analysis by SIGMA2 on the cases of the GEIPAN database already investigated, for which the GEIPAN can help with the selection. At the same time, SIGMA2 can also contribute to the analysis of the international context. Other cooperation with French institutions could also be considered, depending on the needs, and the advisability of old, unexploited cases.

SIGMA2 also continued discussions with the IMCCE⁵ for the improvement of the FRIPON network around a common project in order to collect new data, on TLE⁶ (of interest to LPC2E⁷), on ball lightning (of interest to the Research laboratory on Lightning) and finally the UAP. SIGMA2 tries to bring together experts through the 3AF network to encourage "doctoral" students to join IMCCE and contribute to this work to improve FRIPON and to the study of these phenomena.

In parallel, SIGMA2 continued international contacts to try to create a technical and scientific network in order to objectively and scientifically analyze the available data, but also to make recommendations to improve the collection of useful physical data. Beyond borders, cooperation work was carried out with the Chilean CEFAA (case analysis) and with the American NARCAP, study exchanges took place with the American SCU, and a meeting took place with the CEFAE Argentine. Others could emerge.

5 IMCCE : Institut de mécanique céleste et de calcul des éphémérides

6 Transient Luminous Event

7 LPC2E : Laboratoire de Physique et de Chimie de l'Environnement et de l'Espace



However, as has been explained, new technologies and means of observation are gradually being deployed (camera networks) and give hope for new data collection, and even cooperation.

If unexplained cases with physical data are already identified, no global explanation has yet been able to be provided by SIGMA2 or by other study groups, apart from the identification of certain physical theories, which still remain to be demonstrated. .

However, as we announced in the previous report, SIGMA2 attempted to make a preliminary crosscheck between the electromagnetic observables of different phenomena. We compared the radiation emitted by plasmas (bluish radiation from atmospheric nitrogen plasmas) with recordings of electromagnetic signals at 3 GHz (US records). We were also able to compare electromagnetic disturbances on electronic equipment (on the ground or in flight), with effects induced by microwaves on the natural environment (soil, vegetation) or on humans. These overlaps raise many questions about their origin.

Regarding the kinematic behavior of UAP, sudden accelerations, passage from a stationary position to very high speeds (already mentioned in 2015), we conclude that they cannot be explained by plasmas of natural origin, whose speed and the accelerations are a priori limited in particular to the speed of sound. The speed of hypersonic movement and its accelerations can be explained if they accompany either a hypersonic mobile, performing brutal accelerations (according to an unknown technology), or by the projection of energy at a distance (like plasma lasers), but whose technological advances do not allow, a priori, the formation of plasmas at distances of several tens or hundreds of km. These findings are only partial and preliminary, but constitute a common thread that could intersect with other research, for example on materials and their interactions with high frequency EM radiation.

Far from demonstrating the inconsistency of the cases identified or giving peremptory explanations, this militates in favor of further studies, of intensifying the collection of in situ data, on condition of having an organization capable of storing and to analyze such computer data without which it is illusory to claim to carry out serious analyzes of cases.

The establishment of a documentary database and computer skills tool has been carried out: this is one of the key points for building the documentary base but also for the use of the technical data collected on the cases. Both documentary research and archiving will then have to be intensified.

However, if the study of UAP is or is becoming a subject of international dimension, it has however hardly motivated scientists until now, priority being given in the space field to the search for extraterrestrial life in deep space (exobiology) as well as to the study of the risks in near space, induced by space debris and the re-entry of meteorites, or the environmental or atmospheric risks which are indeed topics of interest for the Pacific Use Committee of the UN External Space (COPUOS).



It is necessary to involve physicists in order to confront the analyzed data and the physical hypotheses. The skills of CT SIGMA2 are still evolving with the contribution of researchers (plasma, quantum physics, biochemistry, etc.) who have joined it.

Data sharing is an important topic and we still regret the lack of physical data, as in 2015, even though cases have been investigated. We can hope for two factors of progress:

- on the one hand, the progressive contribution of scientists interested in the study of UAP and associated physics, starting with their interaction with the local environment. This requires data collection. These studies could cross-reference quantum physics, the link with gravitation ...
- on the other hand, the evolution of American communication, which could have a leverage effect on the awareness of phenomena and the sharing of data (old and archived but also new), unlike the previous situation, local, national searches without sharing information. This remains to be proven.

The serious study of UAP, the manifestations of which are numerous in our near terrestrial environment and remain unexplained, should motivate the scientific community and not only "ufology".

Assuming increased scientific interest and a willingness to share data, holding an international scientific workshop on type D UAP cases would be desirable. It would allow an exchange of views between scientists, in a limited number, on serious cases identified and studied with physical data, as well as on their interpretation or on observation techniques. This could allow the construction of a real scientific network likely to arouse the interest of a few physicists in the published data and those to come. 3AF and SIGMA2 could contribute to such a workshop in the spirit of the Pocantico UFO evidence seminar organized by Peter Sturrock in 1998.

SIGMA2 reached conclusions in the 2015 report, similar to those of the US UAPTF report regarding the unusual kinematics of the objects observed, such as those of the Army of the People's Republic of China.

This observation on kinematics has since been reinforced by other characteristics such as electromagnetic emissions at certain frequencies, of artificial origin, which we are discussing. Some have been noted in the past by the Americans as well as by the Russians, in their respective reports. But we have not yet noted any recall of these effects, nor knowledge of any intention to share the data. However, the shared observation remains a first step.

What would be the information communicated by the USA on the UAP? Which databases? Would there also be a similar communication from Russia on these phenomena, but also from China? From Israel? Other countries ? Would there be a



ripple effect? Reactions to the US UAPTF report have started.

To conclude by returning to the questions at the beginning: where are we on knowledge?

We may be past the stage of prejudice or disbelief.

Are we talking about facts, hypotheses, laws or theories?

Skepticism could give way to scientific curiosity in the face of an unknown now supported by established facts and inventoried hypotheses.

Do known laws explain everything? It seems that some cases are beyond known science and may prompt research into extensions of known laws or lead to other discoveries, confirming alternative theories, now referred to as speculative.

To the question do the UAP exist? We leave it to the reader to judge, but the answer is yes, in multiple and even changing forms during observations.

We said in 2015 that we did not exclude the search for explanations towards objects of artificial origin either, in view of extremely surprising cases by the observed behavior, whose propulsive modes and flight mechanics would far exceed our technologies on which an inventory has been made.

This inventory was continued on the technologies of drones, hypersonic missiles, plasma lasers and propulsion. These technologies do not explain the observations.

Likewise, natural phenomena cannot explain everything, especially hypersonic displacements with instantaneous acceleration and change of direction. These analyzes confirm us in the observation, for many observations of UAP, of a physics which we do not know, of possible artificial cause in certain cases, and therefore under this assumption, of unknown technologies.

Progress will come from the collection and sharing of data and from the interest of scientists in tackling the study of these phenomena by confronting them with the laws and theories under study.



APPENDICES



Annex A 2.2 - Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between the USA and USSR (Accidents Measures agreement)



<http://www.state.gov/t/isn/4692.htm>

Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between The United States of America and The Union of Soviet Socialist Republics (Accidents Measures Agreement)

BUREAU OF INTERNATIONAL SECURITY AND NONPROLIFERATION

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Signed at Washington September 30, 1971

Entered into force September 30, 1971

[Narrative](#)

[Treaty Text](#)

Narrative

The very existence of nuclear-weapon systems, even under the most sophisticated command-and-control procedures, obviously is a source of constant concern. Despite the most elaborate precautions, it is conceivable that technical malfunction or human failure, a misinterpreted incident or unauthorized action, could trigger a nuclear disaster or nuclear war. In the course of the Strategic Arms Limitation Talks (SALT), the United States and the Soviet Union reached two agreements that manifest increasing recognition of the need to reduce such risks, and that complement the central goal of the negotiations.

In early sessions, discussions parallel to the main SALT negotiations showed a degree of mutual concern regarding the problem of accidental war that indicated encouraging prospects of accord. These preliminary explorations resulted in the establishment of two special working groups under the direction of the two SALT delegations. One group focused on arrangements for exchanging information to reduce uncertainties and prevent misunderstandings in the event of a nuclear incident. The other addressed a related topic – ways to improve the direct communications link between Washington and Moscow. By the summer of 1971, major substantive issues had been resolved, and draft international agreements were referred by the SALT delegations to their governments. Both agreements were signed in Washington on September 30, 1971, and came into force on that date.

The Agreement on Measures To Reduce the Risk of Outbreak of Nuclear War between the United States of America and the Union of Soviet Socialist Republics covers three main areas:

- A pledge by each party to take measures each considers necessary to maintain and improve its organizational and technical safeguards against accidental or unauthorized use of nuclear weapons;
- Arrangements for immediate notification should a risk of nuclear war arise from such incidents, from detection of unidentified objects on early warning systems, or from any accidental, unauthorized, or other unexplained incident involving a possible detonation of a nuclear weapon; and



- Advance notification of any planned missile launches beyond the territory of the launching party and in the direction of the other party.

The agreement provides that for urgent communication "in situations requiring prompt clarification" the "Hot Line" will be used. The duration of the agreement is not limited, and the parties undertake to consult on questions that may arise and to discuss possible amendments aimed at further reduction of risks.

Treaty Text

Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between The United States of America and The Union of Soviet Socialist Republics

Signed at Washington September 30, 1971

Entered into force September 30, 1971

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties:

Taking into account the devastating consequences that nuclear war would have for all mankind, and recognizing the need to exert every effort to avert the risk of outbreak of such a war, including measures to guard against accidental or unauthorized use of nuclear weapons,

Believing that agreement on measures for reducing the risk of outbreak of nuclear war serves the interests of strengthening international peace and security, and is in no way contrary to the interests of any other country,

Bearing in mind that continued efforts are also needed in the future to seek ways of reducing the risk of outbreak of nuclear war,

Have agreed as follows:

Article 1

Each Party undertakes to maintain and to improve, as it deems necessary, its existing organizational and technical arrangements to guard against the accidental or unauthorized use of nuclear weapons under its control.

Article 2

The Parties undertake to notify each other immediately in the event of an accidental, unauthorized or any other unexplained incident involving a possible detonation of a nuclear weapon which could create a risk of outbreak of nuclear war. In the event of such an incident, the Party whose nuclear weapon is involved will immediately make every effort to take necessary measures to render harmless or destroy such weapon without its causing damage.



Article 3

The Parties undertake to notify each other immediately in the event of detection by missile warning systems of unidentified objects, or in the event of signs of interference with these systems or with related communications facilities, if such occurrences could create a risk of outbreak of nuclear war between the two countries.

Article 4

Each Party undertakes to notify the other Party in advance of any planned missile launches if such launches will extend beyond its national territory in the direction of the other Party.

Article 5

Each Party, in other situations involving unexplained nuclear incidents, undertakes to act in such a manner as to reduce the possibility of its actions being misinterpreted by the other Party. In any such situation, each Party may inform the other Party or request information when in its view, this is warranted by the interests of averting the risk of outbreak of nuclear war.

Article 6

For transmission of urgent information, notifications and requests for information in situations requiring prompt clarification, the Parties shall make primary use of the Direct Communications Link between the Governments of the United States of America and the Union of Soviet Socialist Republics.

For transmission of other information, notification and requests for information, the Parties, at their own discretion, may use any communications facilities, including diplomatic channels, depending on the degree of urgency.

Article 7

The Parties undertake to hold consultations, as mutually agreed, to consider questions relating to implementation of the provisions of this Agreement, as well as to discuss possible amendments thereto aimed at further implementation of the purposes of this Agreement.

Article 8

This Agreement shall be of unlimited duration.



Article 9

This Agreement shall enter into force upon signature.

DONE at Washington on September 30, 1971, in two copies, each in the English and Russian languages, both texts being equally authentic.

FOR THE UNITED STATES OF AMERICA:

WILLIAM P. ROGERS

FOR THE UNION OF SOVIET SOCIALIST REPUBLICS:

A. GROMYKO



**Annex A 3.6.2 - UFO What are they F Ziegel
1967 CIA-RDP79B00752A000300090001-6**



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UFOs--WHAT ARE THEY?
(F.Yu. Zigel')

Source: Smena (Change); No 7, February 1967, pages 27-29

(Prefatory Note. The publishing house of Hayka (Science) is preparing for publication a collection of scientific articles Naselenyy Kosmos (The Inhabited Cosmos)(chief editor, B. P. Konstantinov, Vice President Academy of Sciences USSR) in which along with consideration of such problems as the distribution of life in space, the habitability of the planets, communications with extraterrestrial civilizations, the mastery of the cosmos by mankind, space law, and other subjects, it is intended to give attention to the problem of unidentified flying objects (UFO). In the present article the editor-compiler of the collection Naselenyy Kosmos, Docent F. Yu. Zigel' discusses various UFO observations and attempts at explanation of them.)

Figure 1. This photograph was made in a park in New York of the object which you see in the center of the photograph a few seconds before it vanished. It is unidentified. According to sighters it was grayish-orange in color and, in addition emitted a yellow light. While the object was suspended in the air the man who took this picture, a professional photographer, was able to take this photograph.

The history of science covers thousands of year. During this period human consciousness has many times experienced deep shock as a result of a fundamental discontinuity in ideas. How many centuries were required for the now-evident idea of the sphericity of the Earth to win general acceptance! What scandalous absurdity did Copernicus endure from his contemporaries because of his hypothesis that the Earth moves. And the thoughts of Giordano Bruno about the limitless of space, and the geometry of Lobachevskiy, and Einstein's theory of relativity, the quanta nature of radiation and the fantasies of cybernetics? This is not all but no further examples are necessary since readers themselves can easily continue the list

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of great discoveries which shocked the world-view of mankind.

Make an effort and imagine that all this very long history of science has suddenly been compressed in time and, so to speak, passed through human consciousness in the course of 10-15 years. But this example is not an abstraction but a reality. This is what will happen to us who live through the next decade in which the volume of scientific information, achieved in the process of cognition, will double. Our minds should be prepared for a fundamental break in many well-established notions.

Need we say that the lion's share of the coming discoveries will probably have to do with space, with that hidden, illimitless area which mankind has only begun to master? Let us put aside prejudice and so-called "healthy thought" which in the well-justified words of G. I. Naan, Academician of the Estonian Academy of Sciences "is the embodiment of the experience and prejudices of one's own time. It is a very unreliable guide when we are dealing with a completely new situation." It is just such a situation which has developed in connection with the problem of unidentified flying objects (UFO), often called "flying saucers."

First of all, does the problem actually exist? Are there really indisputable facts pointing to the existence and reality of UFOs?

More than two decades ago, in May 1946, evidence first appeared concerning strange disc-shaped objects, called saucers, which were seen both from planes and from the surface of the earth. Observers noted that many UFOs displayed enormous speeds and accelerations unbearable by terrestrial organisms. To the category of UFOs were assigned also puzzling fires in the night sky and mysterious illuminated spheres of various colors. Observers also reported flying saucers which changed intensity in color. It was noted also that in some cases the UFOs caused local magnetic fluctuations; in their presence the needle of a compass fluctuated wildly.

In the book of the American astronomy D. Menzel "Le-tayushchikh tarelkakh (On Flying Saucers) (Publ House of Foreign Literature, 1962) there is a detailed descriptions of many UFO sightings and from the factual point of view one can easily inform himself about this matter from this book. Nevertheless we will present several undeniable facts in order that the reader may understand clearly about what we are talking.

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Curious are the observations of Menzel himself who twice was able to see this puzzling phenomenon. On the first occasion during a trip by auto Menzel noted over Sacramento two strange hazy saucers with faint pale-blue illumination. The saucers rapidly disappeared and reappeared "Unfortunately, I was forced to acknowledge," writes D. Menzel, "that I could not exactly explain this phenomenon." The second time Menzel and several astronomers at the Sacramento Peak Observatory "now suddenly in the sky there appeared a clear-yellow fiery sphere. It was at an altitude of about 100-130 km." Its identify has remained unknown.

Here is one of the first reports, made in August 1947. Two American pilots saw "a large dark cigar-shaped body, the shape of which was clearly outlined against the background of the night sky...It moved toward us and the plane barely avoided colliding with it by a sharp change of course. The dark object passed by. Attempts to pursue it were unsuccessful and after 4 minutes the mysterious object vanished. Other American pilots in July 1948 encountered a wingless "airplane" of cigar-shaped form. "This object," one of them reports, "flew straight at us, and we sharply veered to the left..Then the "pilot" of it, as though having suddenly noticed us and wishing to escape detection, pulled up the nose of his craft and vanished into a cloud, emitting backwards a tremendous shaft of alme such that our DC-3 shook from this powerful exhaust."

Several times American pilots attempted to attack UFOs but these invariably put on tremendous speed and, maneuvering strenuously, escaped pursuit. In some cases the pursuit ended with the crash of the pursuing plane as happed with Capt T. Mantel on 7 January 1948. Before the crash Mantel hastily reported by radio: "I am coming up to it...This thing is metallic in appearance and of enormous dimensions."

The famous American astronomer Claude Tombo (who in 1930 discovered the planet Pluto) late on the evening of 20 August 1949 together with his family observe the flight across the sky of strange rectangles illuminated with a pale greenish-yellow light. In Tombo's words "in all the several thousand hours of my life which I have passed in observing the night sky, I have never seen anything stranger or more surprising."

In 1965 and 1966 the number of UFO observations again increased sharply. Here are some examples of recent reports.

In January 1965 observers at the Antarctic research stations of Chile and Argentina noticed in the air a mysterious lighted object, the color of which changed from red to yellow than back to yellow, blue, white, and, finally orange. These

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color changes, extending over several minutes, were accompanied by radio interference, though no magnetic storm was in process at the time.

In the same year UFO reports were received from England, France, Portugal and other countries. In the summer of 1965 above the airport of Canberra there appeared a soaring object which duty personnel at the field in the control tower saw perfectly clearly. It hung over the airport for about 40 minutes and disappeared only when a plane was sent up to identify it. Near Canberra, where is located the Tinbinbillskiy space tracking station, a mysterious object was noted not long before the station began receiving signals from Mariner 4. But with the appearance of the object unusual difficulties arose in the reception of the signals. It has been noted also that UFOs are most often observed in areas near the poles, the cosmic space over which is free from radiation belts.

For two decades UFOs have been observed not only visually but also on radar screens. In 1965, according to a United Press report, radar sets in Oklahoma recorded on the evening of 1 August four unidentified objects flying at great height. They passed over into the atmosphere over the states of Kansas and Colorado.

In Moscow in June 1965 an international colloquium was held on the microstructure of the atmosphere at which there was discussion of the nature of "angel-echo"--strange objects seen on radar screens. These are regularly observed by Soviet scientists working at the Central Aerological Observatory near Moscow. According to the report of Cand Phys-Math Sciences A. Gorelik, UFOs have been recorded on radar screens not only in the USSR but also at stations in the US, Australia, India, and Japan. It has been established that the mysterious flying objects cannot be insects, plant seeds, flights of birds, which sometimes show up on radar. They frequently moved against the wind and were observed in places where there are no birds or insects. The nature of these objects remains unknown to this day.

The reader is probably already wearied by the listing of facts and is waiting for generalizations, explanations, and conclusions. Let us attempt to provide them.

In the last two decades there have been many thousands of factually irrefutable reported sightings of UFOs. Reports have come twenty countries and the "UFO phenomenon" must today be considered a worldwide one. Evidently this circumstance was one of the reasons why recently, for example in the US, as

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well as in several other countries, the riddle of UFOs has become a scientific problem and highly-qualified specialists (astronomers, physicists, mathematicians, sociologists, and others) have been called upon to solve it.

The American professor J. Valley, who took part in the International Mathematical Congress in 1966 in Moscow, recently published three detailed scientific monographs on UFOs. These comprise a complete investigation of this interesting problem and although the author does not come down in favor of any particular explanatory hypothesis, the idea of a foreign-planetary origin of UFOs appears to him worthy of attention. The well-known American astrophysicist and director of the Dearborn Observatory, Prof. J. Haynek(?) writes in a preface to one of Valley's books that he personally, as an astronomer, "has long been convinced that UFOs cannot be waved aside as senseless... The UFO phenomenon is a global one and is attracting the attention of many intelligent persons. At private conversations many scientists told me of their interest in this problem and desire that it be thoroughly studied... The reports are not only strikingly similar to one another; they continue to come from perfectly respectable individuals and this requires the conduct of scientific investigations."

So, let us proceed to several explanations for UFOs.

First Explanation.

All reports about "flying saucers" and other UFOs are complete nonsense, fabrications and concoctions of careless individuals.

This point of view is a very convenient one because it requires no intellectual effort and nips the problem in the bud. However there is some truth in it notwithstanding.

In the clamor which was raised after 1947 around "flying saucers" were heard the voices of mystics and simple adventurers seeking to profit from a passing sensation. It is sufficient to recall the notorious Adamski who maintained that he had succeeded in travelling in one of the "flying saucers"--to Venus! Unscrupulous individuals by a simple photographic trick transformed a discarded cap into a secret "visitor from space." Rumors were spread to the effect that "pilots" from the "saucers" had been seen to land on the earth.. But none of this has anything to do with the matter.

Unfortunately, at almost all the turning points in the history of science new facts and ideas have been denied, as a rule, and declared to be nonsense. For example, before 1803

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the fall of stones from the sky was denied by such great scientists as Lavoissier. According to the pronouncement of French academicians (1772) "the falling of stones from the sky is physically impossible," and this phenomenon "can in no way be reasonably explained." The objections of those who demonstrated the reality of meteorites were to be explained by anti-scientific delirium and stupidity, "unworthy even of refutation."

Second Explanation.

UFOs exist but actually they are not what they seem. An UFO is only an optical illusion connected with anomalous diffusion of light in the earth's atmosphere like a rainbow, or halo, caused by the sun or patches of light over water.

This point of view, sincerely put forward by D. Menzel in his book On Flying Saucers, has been widely accepted among scientists in the Soviet Union and abroad. But we must point out that the reading of Menzel's book involuntarily results in a feeling of deep disappointment since the author provides no convincing and scientific discussion of the phenomena. Therefore when Menzel's book is represented as a solid scientific work, as a circumstantial optical theory of explanation of UFOs, the opinion must be rejected as erroneous. The mystery of UFOs cannot be explained by means of atmospheric optics; the nature of these phenomena is clearly more complex than that.

Third Explanation.

UFOs are new secret flying craft of one of the terrestrial powers.

At first this point of view was very commonly held and militaristic circles in the USA hastened to spread rumors to the effect that secret Soviet craft were flying over the country. This absurd explanation, based on natural causes, later collapsed and no longer has any advocates.

Figures 2 & 3. Last summer passengers on an air liner flying between London and Manchester looking out the plane window saw a strange shape very close to the plane. One of the passengers was able to record the object on his movie camera. The film showed how against the background of the blue sky the unknown object changed its shape after a few seconds and then seemed to dissolve in

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(Picture caption cont'd)

the air. In the opinion of British specialists the possibility of an optical illusion is practically excluded.

Fourth Explanation.

The UFO is an unknown natural phenomenon. The material world which surrounds us is endlessly diverse and complex. There is no doubt but what the non-understood phenomena of nature are immeasurably more numerous than those which have been studied and understood. Perhaps UFOs represent something new and unprecedented just as, let us say, radioactivity was to us at the end of the last century?

This position is unquestionably worthy of attention. It is a stimulus to the study of UFOs, and this is its greatest value today. Recently there was a report of a hypothesis to the effect that an UFO is plasma consisting of ionized particles of air and charged dust particles. The plasma hypothesis, clearly would explain the fluctuations of the magnetic needle of a compass upon the appearance of an UFO, and also the fact that persons who have seen UFOs have noted also the irritation of their eyes as though under the effect of ultraviolet light. But this new hypothesis can hardly be a full explanation of UFOs. You see, there are cases of UFO observations in clear weather also, when there were no electrical particles and plasma in the atmosphere. The shapes of UFOs, their strange movements, their many-colored illumination are in no way similar to the behavior of natural clusters of plasma.

Figures 4. & 5. These photographs were taken near Namur (Belgium) on 4 June 1955. The man who took them noted a grayish-colored object glistening in the sun and approaching at great speed but then suddenly slowing down. At that moment the first picture (Figure 4) was taken. When the object had stopped a cloud of steam appeared around it. Then it raised itself above this cloudy patch, speeded up and quickly disappeared completely. Experts have concluded that the mysterious object was at an altitude of not less than 1,500 meters and that it had a diameter of at least 12 meters.

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Fifth Explanations, Bordering on the Fantastic.

UFOs are flying craft from other planets which are surveying the Earth.

Obviously, the hypothesis of a foreign-planet artificial origin of UFOs is an extreme point of view and at first glance completely improbable. Therefore we have placed it last, as a sort of antipodes to the first explanation--unsubstantiated denial. However, since the problem of UFOs has still not been solved, various, including fantastic, points of view are possible.

"We are far from the outright rejection of the interplanetary hypothesis," so writes even such a convinced opponent of it as D. Menzel, "but before accepting it, we wish to consider other more natural speculations."

Protagonists of this point of view call attention to the enormous speed and acceleration of the UFOs, not achievable by contemporary terrestrial flying craft and beyond the ability of terrestrial organisms to endure. The fact that UFOs never land is taken as possible evidence of the availability of some extraterrestrial bases for UFOs. It is curious that the number of UFO observations increases regularly with the approach of Mars to the Earth. And this fact is considered an argument in favor of the foreign-planetary hypothesis.

Protagonists of the foreign-planet origin of UFOs have worked out detailed "theories" concerning the range of UFOs, the utilization by them of the energy of the Earth's magnetic field or the energy of ions in the upper layer of the atmosphere. But all such discussions still seem extremely speculative. And even the "foreign-planet" hypothesis itself, of course, required more solid confirmation.

The conclusion is clear: there exists almost everywhere a definite type of phenomenon, known under the name of the UFO phenomenon. The nature of this phenomenon has still not been unravelled and not one of the existing hypotheses can pretend to be the final answer to the problem. In such a situation the only correct course is clear--to subject the mysterious UFO phenomenon to thorough and careful scientific study.

From nature should be wrested still another of her secrets. You see, the epoch of the "applied" study of the sky has actually arrived.

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Annex A 4.2.5.1.1.2 - AIAA 1971 UFO ENCOUNTER 1



Astronautics & Aeronautics July 1971

UFO ENCOUNTER 1

Sample Case Selected by the UFO Subcommittee of the AIAA

In its "Appraisal of the UFO Problem" A/A Nov. 1970, pp. 49-51, the Subcommittee pledged to give the members of this society an opportunity to form their own opinions with respect to the type of observations which form the core of the UFO controversy.

The selected case, which occurred on July 17, 1957, is treated in the Condon Report (Condon, E. U., 1969, *Scientific Study of Unidentified Flying Objects*, Bantam Books, N.Y., pp.56-58,136-139, 260-266, 750, 877-894). During the study by the University of Colorado group, the case files were not located due to an error in date. In addition, radar and weather analyses were made for September 19, 1957, rather than July 17, 1957. The conclusions drawn by members of the Condon Committee, based on available information are as follows:

1. *If the report is accurate, it describes an unusual, intriguing, and puzzling phenomenon, which, in the absence of additional information, must be listed as unidentified. (Condon, p.57).*
2. *In view of... the fact that additional information on this incident is not available, no tenable conclusions can be reached. From a propagation [Based on a wrong date.] standpoint, this sighting must be tentatively classified as an unknown. (Thayer, p.139).*
3. *If a report of this incident, written either by the B-47*

crew or by Wing Intelligence personnel, was submitted in 1957, it apparently is no longer in existence. Moving pictures of radar scope displays and other data said to have been recorded during the incident apparently never existed. Evaluation of the experience must, therefore, rest entirely on the recollection of crew members ten years after the event. These descriptions are not adequate to allow identification of the phenomenon encountered. (Craig, p.265).

4. *After review the unanimous conclusion was that the object was not a plasma or an electrical luminosity by the atmosphere. (Altschuler, p.750).*

Subsequently, James McDonald has been able to locate the case files, to correct the date of the flight and to draw additional information from the files as well as from personal interviews with the crew. At the request of the UFO Subcommittee, he describes the case in the following article. It is left to the reader to draw his own conclusions.

The aircraft Commander, Lt. Colonel Lewis D. Chase, USAF (Ret.), has confirmed the accuracy of this report in a letter to the Subcommittee.

This sample case may serve to illuminate the difficulties in deciding whether or not the UFO problem presents a scientific problem.

Air Force Observations of an Unidentified Object in the South-Central U.S., July 17, 1957

Summary

An Air Force RB-47, equipped with electronic countermeasures (ECM) gear and manned by six officers, was followed by an unidentified object for a distance of well over 700 mi. and for a time period of 1.5 hr., as it flew from Mississippi, through Louisiana and Texas and into Oklahoma. The object was, at various times, seen visually by the cockpit crew as an intensely luminous light, followed by ground-radar and detected on ECM monitoring gear aboard the RB-47. Of special interest in this case are several instances of simultaneous appearances and disappearances on all three of those physically distinct "channels," and

rapidity of maneuvers beyond the prior experience of the aircrew.

Introduction

In the early morning hours of July 17, 1957, an RB-47 was flying out of Forbes Air Force Base, Topeka, Kansas, on a composite mission that included gunnery exercises over the Texas-Gulf area, navigation exercises over the open Gulf, and finally ECM exercises scheduled for the return trip across the south-central United States. The RB-47 was carrying a six-man crew, of whom three were electronic warfare officers manning ECM gear in the aft portion of the aircraft. Their names are as follows: Lewis D. Chase, pilot; James H. McCoid, co-pilot; Thomas H. Hanley, navigator; John J. Provenzano, No.1 monitor; Frank B. McClure, No.2 monitor; Walter A. Tuchscherer, No.3 monitor. I shall draw upon my interview with the crew as well as case files which I finally located. The files consist of a three-

page TWX filed from the 745th ACWRON, Duncanville, Texas, at 1557Z on July 17, 1957, and a four-page case summary prepared by E. T. Piwetz, Wing Intelligence Officer, 55th Reconnaissance Wing, Forbes AFB, and transmitted to ADC Hq., Ent AFB, Colorado, in compliance with a request of August 15, from Col. F. T. Jeep, Director of Intelligence, ADC. That summary, plus a 12-page Airborne Observer's Data Sheet, was forwarded on November 17 from ADC to Blue Book, and was evidently the first notification Project Blue Book received concerning this case.

The 12-page Data Sheet (AISOP #2) was prepared by Major Chase on September 10, and contains a number of points of relevance not covered in other parts of the case file.

There is very relevant information in the case file as to precise times, locations, and other circumstances, and the case file does have the great



virtue of representing a summary account prepared while all of the details were fresh in the minds of the crew.

Before describing the first ECM contact, it is necessary to explain briefly the nature of the ECM gear involved in this case. (Details are no longer classified, although all of the basic case-file documents were initially SECRET.) This RB-47 had three passive direction-finding (DF) radar-monitors for use in securing coordinate information and pulse characteristics on enemy ground-based radar. The #2 monitor, manned by McClure, was an ALA-6 DF-receiver with back-to-back antennas in a housing on the belly of the RB-47 near the tail spun at 150 or 300 rpm as it scanned an azimuth. (Note that this implies ability to scan at 10/sec past a fixed ground radar in the distance.) Its frequency range was 1000-7500 MHz. Inside the aircraft, the signals from the ALA-6 were processed in an APR-9 radar receiver and an ALA-5 pulse-analyzer. All subsequent references to the #2 monitor imply that system.

Number 1 Monitor

The #1 monitor, manned by Provenzano, was an APD-4 DF system, with a pair of antennas permanently mounted on either wing tip. It was working at a higher frequency. The #3 monitor, with a frequency range from 30-1000 MHz, was manned by Tuchscherer. It was not affected and will not be described here. VHF communications were likewise not affected.

For emphasis, it needs to be stressed that the DF receivers are *not* radars and do not emit a signal for reflection off a distant target. They only listen passively to incoming radar signals and analyze signatures and other characteristics. When receiving a distant radar set's signal, the scope displays a pip or strobe at an azimuthal position corresponding to the relative bearing in the aircraft coordinate system. For the case of a fixed ground radar, approached from one side, the strobe is initially seen in the upper part of the scope and moves *down-scope*, a point to be carefully noted in interpreting the following discussion.

Having completed the navigational exercises over the Gulf, Chase headed across the Mississippi coastline, flying at an altitude of 34,500 ft, at about Mach 0.75 (258 kt IAS=500 mph TAS). The weather was perfect and practically cloudless

under the influence of a large high-pressure area extending throughout the troposphere. There were no showers or thunderstorms anywhere along the flight route. Shortly after the coast near Gulfport was crossed at a point marked A on the map in page 68, McClure detected on the #2 monitor a signal painting at their 5 o'clock position (aft of the starboard beam). It looked to him as if he were receiving a legitimate ground-radar signal. Upon noting that the strobe was moving *up-scope*, McClure tentatively decided that it must be a ground radar off to their northwest painting with 180 deg ambiguity for some electronic reason. But when the strobe, after sweeping *up-scope* on the starboard side, crossed the flight path of the RB-47 and proceeded to move *down-scope* on the port side McClure said he gave up the hypothesis of 180 deg ambiguity as incapable of explaining such behavior.

Fortunately, he had examined the signal characteristics on his ALA-5 pulse-analyzer, before the signal left his scope on the port side aft. In discussing it with me, his recollection was that the frequency was near 2800 mcs, and he recalled that what was particularly odd was that it had a pulse-width and pulse repetition frequency (PRF) much like that of a typical S-band, ground-based, search radar. He even recalled that there was a simulated scan rate that was normal. Perhaps because of the strong similarities to ground-based sets such as the CPS-6B, widely used at that time, McClure did not, at that juncture, call this signal to the attention of anyone else in the aircraft. The #1 monitor was not working the frequency in question, it later developed. The #3 monitor was incapable of working the frequency in question, McClure and the others indicated to me.

I next quote information transcribed from the summary report prepared by the Wing Intelligence Officer, COMSTRATRECONWG 55, Forbes Air Force Base, concerning this part of the incident that involved this aircraft (call sign "Lacy 17"):

ECM reconnaissance operator #2 of Lacy 17, RB-47H aircraft, intercepted at approximately Meridian, Mississippi, a signal with the following characteristics: frequency 2995 mc to 3000 mc; pulse width of 2.0 microseconds; pulse repetition frequency of 600 cps; sweep rate of 4 rpm; vertical polarity. Signal moved rapidly up the D/F scope

indicating a rapidly moving signal source; i.e., an airborne source. Signal was abandoned after observation...

Initial Visual Contact

If nothing further had occurred on that flight to suggest that some unusual object was in the vicinity of the RB-47, McClure's observations undoubtedly would have gone unmentioned and would have been quickly forgotten even by him. He was puzzled, but at that point still inclined to think that it was some electronic difficulty.

The flight plan called for a turn to the west in the vicinity of Meridian and Jackson, Mississippi (Point B), with subsequent planned exercises wherein the EWOS did simulated ECM runs against known ground radar units. The contemporary records confirm what Chase and McCoid described to me far more vividly and in more detail concerning the unusual events that soon ensued.

They turned into a true heading of 265 deg, still at Mach 0.75 at 34,500 ft. At 1010Z (0410 CST), Major Chase, in the forward seat, spotted what he first thought were the landing lights of another jet coming in fast from near his 11 o'clock position at, or perhaps a bit above, the RB-47's altitude. He called McCoid's attention to it, noted absence of any navigational lights, and as the single intense bluish-white light continued to close rapidly, he used the intercom to alert the rest of the crew to be ready for sudden evasive maneuvers.

But before he could attempt evasion, he and McCoid saw the brilliant light almost instantaneously change direction and flash across their flight path from port to starboard at an angular velocity that Chase told me he had never seen matched in all of his 20 years of flying, before or after that incident. The luminous source had moved with great rapidity from their 11 o'clock to about their 2 o'clock position and then blinked out.

The Airborne Observer's Data Sheet filled out by Chase as part of the post-interrogation gives the RB-47 position at the time of that 1010Z first visual contact as 32-00N, 91-28W, which puts it near Winnsboro in east-central Louisiana (Point C).

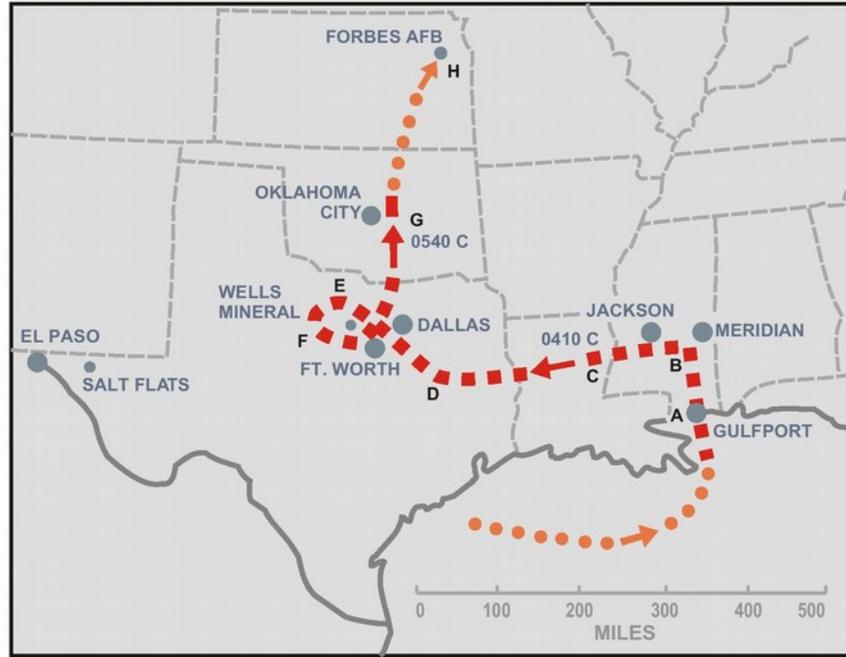
The descriptions obtained in the 1969 interviews with these officers are closely supported by the original intelligence report:

July 1971

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MAP OF THE JULY 17, 1957, UFO EPISODE



KEY

■ ■ ■ PATH OF RB-47H DURING PERIOD OF CONTACT WITH UFO ● ● ● OTHER PORTIONS OF RB-47H FLIGHT

A--FIRST ECM CONTACT OVER GULFPORT AREA
 B--RB-47H TURNS TO WEST NEAR MERIDIAN
 C--FIRST VISUAL SIGHTING BY COCKPIT CREW
 D--RB-47H TURNS NORTHWESTWARD TO PURSUE AT FULL POWER

E--AREA NEAR WHICH AIRCRAFT OVERSHOOTS UFO
 F--OBJECT APPEARS TO RAPIDLY DROP 5000 FT, THEN BLINKS OUT AS RB-47H ATTEMPTS TO DIVE ON IT
 G--LAST ECM CONTACT NEAR OKLAHOMA CITY, 1.5 HR AFTER FIRST VISUAL CONTACT
 H--RB-47H LANDS AT HOME BASE

At 1010Z aircraft cmdr first observed a very intense white light with light blue tint at 11 o'clock from his aircraft, crossing in front to about 2:30 o'clock position, co-pilot also observed passage of light to 2:30 o'clock where it apparently disappeared.

Chase did not observe any magnetic compass anomalies during the flight.

Actions over Louisiana-Texas Area

Immediately after the luminous source blinked out, Chase and McCoid began talking about it on the interphone, with the already alerted crew listening in. McClure, recalling the unusual signal he had received on his ALA-6 back near Gulfport, now mentioned for the first time that peculiar incident and concurrently set his #2 monitor to scan at about 3000 mcs, to see what might show up. He found he was getting a strong 3000 mcs signal from about their 2 o'clock position, just the relative bearing at which the unknown luminous source had blinked out moments earlier.

Provenzano told me that immediately after that they checked out the #2 monitor on other known ground-radar stations, to be sure that it was not malfunctioning; it appeared to be in perfect working order.

He then tuned his own #1 monitor to 3000 mcs and also got a signal from the same bearing. There remained, of course, the possibility that, just by chance, this signal was from a real radar down on the ground and off in that relative direction. But as the minutes went by and the RB-47 continued westward at about 500 mph, the relative bearing of the 3000 mcs source out in the dark did not move down-scope on the monitors as should have occurred with any ground radar, but instead kept up with the RB-47, holding a fixed relative bearing.

I found these and ensuing portions of the entire episode still vivid in the minds of all the men, although their recollections for various details varied somewhat, depending on the particular activities in which they were then engaged.

Chase varied speed, going to maximum allowed power, but

nothing seemed to change the relative bearing of the 3000-mcs source. They crossed Louisiana and headed into eastern Texas, with the object still maintaining station with them. Eventually they got into the radar-coverage area of the 745th ACWRON, Duncanville, Texas, and Chase dropped his earlier reluctance about calling attention to these peculiar matters and contacted that station (code name "Utah"). The crew was becoming uneasy about the incident by this time, several of them remarked to me. That phase of the incident is tersely described in the following quotes from the report of the Wing Intelligence Officer:

Aircraft cmdr notified crew and ECM operator Nr 2 searched for signal described above, found same approximately 1030Z at a relative bearing of 070 degrees; 1035Z, relative bearing of 068 degrees; 1038Z, relative bearing 040 degrees.

Note that the above time would indicate that McClure did not immediately think of making his ALA-6 check, but rather that some 20 min went by before that was thought of. Note also that by 1038Z the



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Secretary

VERNON J. ZURICK
Environmental Research Laboratories of the
National Oceanic and Atmospheric Administration
Boulder, Colorado

unknown source of the 3000 mcs radar-like signal was moving up-scope relative to the 500 mph RB-47. The Wing Intelligence Officer continued:

At 1039Z aircraft comdr sighted huge light which he estimated to be 5000 [ft] below aircraft at about 2 o'clock. Aircraft altitude was 34,500 ft, weather perfectly clear. Although aircraft comdr could not determine shape or size of object, he had a definite impression light emanated from top of object.

At about 1040Z ECM operator #2 reported he then had two signals at relative bearings of 040 and 070 deg. Aircraft comdr and co-pilot saw these two objects at the same time with same red color. Aircraft comdr received permission to ignore flight plan and pursue object. He notified ADC site Utah and requested all assistance possible. At 1042Z ECM #2 had one object at 020 deg relative bearing.

In my interviews with the aircrew, I found differences between the recollections of the various men as to some of these points. McCoid recalled that the luminous source occasionally moved abruptly from starboard to port side and back again. Chase recalled that they had contacted Utah (his recollection was that it was Carswell GCI, however)

prior to some of the above events and that Utah was ground-painting the target during the time it moved up-scope and reappeared visually. As will be seen below, the contemporary account makes fairly clear that Utah was not painting the unknown until a bit later, after it had turned northwestward and passed between Dallas and Ft. Worth. Chase explained to me that he got FAA clearance to follow it in that off-course turn (Point D) and indicated that FAA got all jets out of the way to permit him to maintain pursuit. The Intelligence summary continues:

At 1042Z ECM #2 had one object at 020 deg relative bearing. Aircraft comdr increased speed to Mach 0.83, turned to pursue, and object pulled ahead. At 1042.5Z ECM #2 again had two signals at relative bearings of 040 and 070 deg. At 1044Z he had a single signal at 050 deg relative bearing. At 1048Z ECM #3 was recording interphone and command position conversations.

ADC site requested aircraft to go IFF Mode III for positive identification and then requested position of object. Crew reported position of object as 10 n. mi. northwest of Ft. Worth, Texas, and ADC site Utah immediately confirmed presence of objects on their scopes.

At approximately 1050Z object

appeared to stop, and aircraft overshoot. Utah reported they lost object from scopes at this time, and ECM #2 also lost signal.

Chase, in reply to my questions, indicated that it was his recollection that there was simultaneity between the moment when he began to sense that he was getting closure at approximately the RB-47 speed, and the moment when Utah indicated that their target had stopped on their scopes. He said he veered a bit to avoid colliding with the object, not then being sure what its altitude was relative to the RB-47, and then found that he was coming over the top of it as he proceeded to close. At the instant that it blinked out visually and disappeared simultaneously from the #2 monitor and from the radar scopes at Site Utah, it was at a depression angle relative to his position of something like 45 deg.

Chase put the RB-47 into a port turn in the vicinity of Mineral Wells, Texas (Point E), and he and McCoid looked over their shoulders to try to spot the luminous source again. All of the men recalled the near simultaneity with which the object blinked on again visually, appeared on the #2 scope, and was again skin-painted by ground radar at Site Utah. The 1957 report describes these events as follows:

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Aircraft began turning, ECM #2 picked up signal at 160 deg relative bearing, Utah regained scope contact, and aircraft comdr regained visual contact. At 1052Z ECM#2 had signal at 200 deg relative bearing, moving up his D/F scope. Aircraft began closing on object until the estimated range was 5 n. mi. At this time object appeared to drop to approximately 15,000 ft altitude, and aircraft comdr lost visual contact. Utah also lost object from scopes.

At 1055Z in the area of Mineral Wells, Texas, crew notified Utah they must depart for home station because of fuel supply. Crew queried Utah whether a CIRVIS Report had been submitted, and Utah replied the report had been transmitted. At 1057Z ECM#2 had signal at 300 deg relative bearing, but Utah had no scope contact. At 1058Z aircraft comdr regained visual contact of object approximately 20 n. mi. northwest of Ft. Worth, Texas, estimated altitude 20,000 ft at 2 o'clock from aircraft.

Case added further details on this portion of the events, stating that he requested and secured permission from Utah to dive on the object when it was at lower altitude. He did not recall the sudden descent that is specified in the contemporary account, and there are a number of other minor points in the Intelligence Report that were not recollected by any of the crew. He told me that when he dove from 35,000 ft to approximately 20,000 ft the object blinked out, disappeared from the Utah ground-radar scopes, and disappeared from the #2 monitor, all at the same time. McClure recalled that simultaneous disappearance, too. It should be mentioned that the occasional appearance of a second visual and radar-emitting source was not recalled by any of the officers when I interviewed them in 1969.

Actions over Texas-Oklahoma Area

McCoid recalled that, at about this stage of the activities, he was becoming a bit worried about excess fuel consumption resulting from use of maximum allowed power, plus a marked departure from the initial flight plan. He advised Chase that fuel limitations would necessitate a return to the home base at Forbes AFB, so they soon headed north from the Ft. Worth area (Point F).

McClure and Chase recalled that the ALA-6 system again picked up a

3000 mcs signal on their tail, once they were northbound from Ft. Worth, but there was some variance in their recollections as to whether the ground radar concurrently painted the object. McCoid was unable to fill in any of those details. Fortunately the 1957 Intelligence Report summarized further events in this part of the flight, as they moved northward into Oklahoma:

At 1120Z aircraft took up heading for home station. This placed area of object off the tail of aircraft. ECM#2 continued to [get] D/F signal of object between 180 and 190 deg relative bearing until 1140Z, when aircraft was approximately abeam Oklahoma City, Oklahoma. At this time, signal faded rather abruptly. 55 SRW DOI [55th Strategic Reconnaissance Wing, Director of Intelligence] has no doubt the electronic D/F's coincided exactly with visual observations by aircraft comdr numerous times, thus indicating positively the object being the signal source.

It was Chase's recollection that the object was with them only into southern Oklahoma; Hanley recalled that it was with them all the way to Oklahoma City area (Point G); the others remembered only that it was there for some indefinite distance on the northbound leg between Ft. Worth and Topeka, their home base.

Blue Book

The records indicate that Project Blue Book received summary information on this incident from ADC on Oct. 25, 1957 (over two months after occurrence of the event). A "Brief Summary" ends with the following paragraph:

In joint review with the CAA of the data from the incident, it was definitely established by the CAA that object observed in the vicinity of Dallas and Ft. Worth was an airliner.

This refers to a near-collision of two DC-6 American Airliners near Salt Flats, Texas, 50 mi. from El Paso at 14,000 ft at 3:30 a.m. of this day. (See the map on page 68.) The case is now carried in the official Blue Book files as "Identified as American Airlines Flight 655."

MacDonald Dies

On June 13, James E. MacDonald was found dead in the desert near Tuscon. He was 51 years old.



Annex A 4.2.5.1.2 - Blue Book 19471969



by ancestry

https://www.fold3.com/image/9079681

CLASSIFICATION **UNCLASSIFIED**

| | | | |
|--|--|---|-----------------------------|
| COUNTRY OF ACTIVITY REPORTING USA | | REPORT NO. D5-1-59 | (Leave blank) |
| AIR INTELLIGENCE INFORMATION REPORT | | | |
| COUNTRY OR AREA REPORT CONCERNS USA - CANADA | | DATE OF INFORMATION 26 Mar 59 Zulu | SRI STATUS (If applicable) |
| ACTIVITY SUBMITTING REPORT Det 5, 1006th AISS Cairor Field, Spokane, Washington | | DATE OF COLLECTION 31 Mar 59 | |
| PREPARING INDIVIDUAL URBAN A. FERRO, JR., CAPT, USAF | | DATE OF REPORT 2 Apr 59 | SRI NO. CANCELED/COMPLETE |
| NAME OF DESCRIPTION OF SOURCE B-52 Crew, 325th Bomb Squadron Fairchild AFB, Washington | | EVALUATING A-1 | SRI NO. CANCELED/INCOMPLETE |
| REFERENCES (SAIR Subject, previous reports, etc., as applicable) | | ADDITIONAL INFORMATION ON (Date) ACTIVE | |
| APR 200-2, APR 200-2A, 1006th AISS Supplement 1 to APR 200-2 | | | |
| SUBJECT (Descriptive title. Use individual reports for separate subjects) | | | |
| Unidentified Flying Object | | | |
| SUMMARY (Give summary which highlights the salient factors of narrative report. Begin narrative text on AF Form 112a unless report can be fully stated on AF Form 112. List inclusions, including number of copies) | | | |
| <p>I. SUMMARY: This report contains information about an Unidentified Flying Object (UFO) observation on 26 March 1959 Zulu. The observation was made by a B-52 aircraft commander and his crew while flying on a HEADSTART II type mission. The B-52 aircraft was flying at 32,000 ft on a southerly heading when contrails were sighted slightly above and to the west of the B-52. The contrails proceeded northward and out of sight. Within a short period of time (approximately four (4) minutes), the tail gunner picked up an object on his scope. The object was also detected by the Electronics Warfare Officer (EWO) and two (2) radar frequencies were determined as being utilized by the UFO. The UFO was maintained on the MB-9 scope for approximately one (1) hour at ranges of 8,000 to 15,000 yards. A ground GCI station was notified upon initial contact with the UFO and an F-89 Interceptor was launched at the time UFO penetrated Northern ADIZ. Soon after tail gunner picked up F-89 on scope, the UFO moved off to the rear of the scope and disappeared.</p> <p>II. DISTRIBUTION: USAF only.</p> <p>III. INTERVIEWERS: CAPTAIN ARNOLD F. VON MARBOD, AC937080 FIRST LIEUTENANT DELLE L. FERRIS, 32187A</p> <p style="text-align: right;"><i>Urban A. Ferro Jr.</i> URBAN A. FERRO, JR. Captain, USAF Preparing Officer</p> <p style="text-align: center;">APPROVED: <i>John W. Eador</i> JOHN W. EADOR Colonel, USAF Commander</p> <p>INCL</p> <p><i>John W. Eador</i> AFR 200-2A-212 23 Apr 59</p> | | | |
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| AF FORM 112 15 SEP 54 | | REPLACES AF FORM 112 15 SEP 54 | |
| CLASSIFIED | | CLASSIFICATION | |
| Doc. # 59-062 | | 315475 | |



SOURCE INFORMATION

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Publication Number: T1206
Publication Title: Project Blue Book, 1947-1969
Publisher: NARA
Short Description: NARA T1206. Records and case files relating to investigations of sightings of unidentified flying objects (UFOs).
Year: 1959
Month: March
Month Season Number: 03
Location: Northern Montana
Incident Number: [Blank]
Original data from:  [The National Archives \(http://www.archives.gov\)](http://www.archives.gov)



Annex A 4.2.5.1.2 - Fold3 Page 8 Project Blue Book 19471969



by ancestry

https://www.fold3.com/image/9079682

CLASSIFICATION (SECURITY INFORMATION when filled in)

UNCLASSIFIED SUPPLEMENT TO AF FORM 112

| | | |
|--|-----------------------|-------------------|
| ORIGINATING AGENCY Det 5, 1006th AIGS Geiger Field, Spokane, Wash. | REPORT NO. D5-1-59 | PAGE 2 OF 3 PAGES |
|--|-----------------------|-------------------|

UNIDENTIFIED FLYING OBJECT

I. DESCRIPTION OF SOURCE: The crew of the B-52, call sign, "OUTCOME 15".

II. RELIABILITY OF SOURCE: All the crew members of "OUTCOME 15" appeared to be highly observant, well trained in their duties and very intelligent in their specific fields. They made no suppositions and for the most part answered questions based only on the findings of their electronics gear where applicable.

III. UNIDENTIFIED FLYING OBJECT

1. The following named crew members of "OUTCOME 15" were interviewed at FAIRCHILD AIR FORCE BASE (A737H-11737H), WASHINGTON, on 31 March 1959.

| | | |
|-------------------------|------------|--------------------|
| CAPT JACKSON, JOHN W. | AO015489 | Aircraft Commander |
| CAPT BECK, RAY H. | AO006389 | Co-pilot |
| MAJ PAGE, WALDO M. | 22602A | Navigator |
| CAPT FERLIAN, ROBERT J. | 45131A | Radar |
| 1/LT HILLARD, ROBERT J. | 51284A | EWO |
| TRT COMBS, JOE (SMI) | AF18335234 | Tail Gunner |

2. "OUTCOME 15" was participating in a HEADSTART II MISSION and after flying north to 5520N-10420W, turned to a southerly heading. Position reports were made to SASKATOON RADIO (5200N-10645W).

3. At 023626Z "OUTCOME 15" was flying at 32,000 ft, position 5100N-10800W, under VFR conditions. An object, trailing intermittent, thin and non-persistent contrails and believed to be an aircraft, was sighted in the two (2) o'clock position flying in a northerly direction. In contrast, "OUTCOME 15" was laying readily visible and persistent contrails even though it appeared that the object was at a higher altitude. The contrail patterns left by the object gave no clue to the number of engines. The path of the object was in the after-glow of the sunset and no lights were discernible. The tail gunner observed, that the object continued in a northerly direction with slight variations in its flight path until it was in a direct rear-line flight, and then the object disappeared.

4. At 024126Z the tail gunner made the first electronic contact with an object on the scope of a MB-9. At this time "OUTCOME 15" was flying at a true airspeed of 375 kts and the object was following at 8,000 yards.

5. "OUTCOME 15" called "CANADIAN CLUB" CONTROL CENTER (A731N-11110W) at 02445Z and reported that an object was trailing them. "CANADIAN CLUB" stated that they would launch an interceptor if the object was still with them when they penetrated the NORTHERN ADIZ to the states. As "OUTCOME 15" passed SWIFT CURRENT RADIO (5030N-10800W), SWIFT CURRENT RADIO was queried whether or not a fighter was in the area. The reply was affirmative, however, the fighter was east of SWIFT CURRENT.

6. The EWO detected the object on the nose-tail warning system (AN/AJ35A) soon after notification by the tail gunner, and at 0306Z detected the object on the AN-APR-9. The object was determined to have radar operating on 9135 megacycles. The object's radar never locked on "OUTCOME 15" but just kept sweeping with approximately one (1) second sweep frequency. The frequency tended to oscillate from one (1) sweep to the next but still maintained the 9135 megacycles. The EWO maintained contact with object for approximately twenty (20) minutes. The EWO then dialed to search other bands and when he returned to 9135 megacycles, the object was gone.

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FORM 112a - REPLACES AF FORM 112-PART B, 1-55, WHICH HAS BEEN OBSOLETE
Document Log # 590013-4

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SOURCE INFORMATION

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Publication Title: Project Blue Book, 1947-1969
Publisher: NARA
Short Description: NARA T1206. Records and case files relating to investigations of sightings of unidentified flying objects (UFOs).
Year: 1959
Month: March
Month Season Number: 03
Location: Northern Montana
Incident Number: [Blank]
Original data from:  [The National Archives \(http://www.archives.gov\)](http://www.archives.gov)



Annex A 4.2.5.1.4 - Malmstrom 1967



Reading sheet on Malmstrom AFB cases

Malmstrom AFB 04/1966

#6703: 1966/4/0 0:0 20 111:9:0W 47:30:0N 3211 NAM USA MNT 10 9
sources MALMSTROM AFB,MT:SPRING:UFOS SEEN:ALARMS:10 MISSILES
INOPERATIVE:

Good p302 Ref# 26 FAWCETT+GREENWOOD: UFO COVERUP. Page No. 29 MIL. BASE
Nuclear & sites UFO Hatch

Malsmtrom March 1967

16/03/1967 au 30/03/1967

490th strategic missile squadron Malmstrom Base, Montana

Observation of a glowing red object “missiles starting shutting down one after one” According to at least six former or retired U.S. Air Force officers, UFOs apparently disrupted the functioning of all 10 Minuteman I missiles at the Echo Flight Launch Control Center on March 16, and essentially repeated the feat a short time later, at Oscar Flight LCC, where at least six to eight missiles were simultaneously shut down. (Statements provided to me by former Minuteman Missile Targeting Officer Robert Jamison, suggest a March 24 date for the Oscar incident. However, the leading Malmstrom case researcher, Jim Klotz, correctly notes that no documentation is yet available to assign a date to it.) The large-scale missile disruptions at Malmstrom, each lasting a day or more, understandably resulted in great concern, extending from the local Air Force commanders to the highest levels of the Strategic Air Command. Not only had a significant number of our nuclear missiles been temporarily compromised, but UFO involvement in the shutdowns was a known fact even at the time, according to Jamison.

Not that any of this was publicly acknowledged by the Air Force.

Decades later, in response to a FOIA request submitted by Klotz, SAC did declassify a hundred or so pages of the 341st Missile Wing’s unit history, which referenced the Echo Flight missile malfunctions. However, the official history claimed that although UFOs had been reported in the area at the time of the shutdowns, those reports had later proved to be erroneous. However, the unit historian, David Gamble, later told Klotz that while compiling material for the official history, he had learned of the reports of UFO activity within Malmstrom’s missile fields.

Source: Soviet Nukes and UFO <http://www.eoghan.me.uk/tips/msmt/index.html>

Captain USAF Salas , testimony at Press Club, Washington DC May 2001, book Faded Giants 2005,

Remarkable Reports from the missile field by Robert L. Hastings
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#7196: 1967/3/30 0:0 20 111:10:0W 47:29:0N 3331 NAM USA MNT 7 9
MALMSTROM AFB,MT:RDR-VIS/UFO:10 MISSILES KAPUT/FRITZ:SAME/GREAT
FALLS/1966 Ref# 120 GOOD,Timothy: ABOVE TOP SECRET. Page No. 301 MIL. BASE

Sources Blue Book:?

Malsmstrom Nov 1975

07/11/1975

Malmstrom Strategic Air base, Montana



K7 Minuteman silos, missiles computer registred

A Sabotage Alert Team described seeing a brightly glowing orange, football field-sized disc that illuminated the Minuteman ICBM missile site. As F-106 jet interceptors approached, the UFO took off straight up, NORAD radar tracking it to an altitude of 200,000 feet [38 miles or 60 km.]. An object... emitted a light which illuminated the site driveway. The orange-gold object overhead also has small lights on it.”

source

(24 NORAD Region Senior Director Log November 1975.)

Source: Soviet Nukes and UFO <http://www.eoghan.me.uk/tips/msmt/index.html>).

Voir autres sources dont NORAD

Malmstrom end of October/ beginning of November 1975

Events on 5 SAC bases (Loring AFB, Maine, Wurtsmith AFB, Michigan, **Malmstrom AFB**, Montana, **Minot AFB**, North Dakota, and Canadian Forces Station Falconbridge, Ontario, Canada

during a two-week period in late October and early November 1975, is well known and fully documented by declassified USAF and NORAD documents. A couple of sample quotes provide the alert status of these incidents:

“Several recent sightings of unidentified aircraft/helicopters flying/hovering over Priority A restricted areas during the hours of darkness have prompted the implementation of security Option 3 at our northern tier bases. Since 27 Oct. 75, sightings have occurred at Loring AFB, Wurtsmith AFB, and most recently, at Malmstrom AFB. All attempts to identify these aircraft have met with negative results.”

Sources:

(CINCSAC Offutt AFB message, “Subject: Defense Against Helicopter Assault,” November 10, 1975.)

Source: Soviet Nukes and UFO <http://www.eoghan.me.uk/tips/msmt/index.html>).

Autres? FOIAA source?

See Canadian files



Annex A 4.2.5.1.5 - Minot Case 732 AIRPANC Minot US 241068



Case 732

US/M/S1/UI/AS/AGR/EM/GW

October 24, 1968 0300L

Minot AFB and Minuteman Missiles base, North Dakota, USA

Among the UAP cases coming from official sources (USAF in this case) the Minot Case is probably one of the most interesting and puzzling UAP report for several reasons : The sighting has a total duration of 2h15, it took place on and above a Nuclear Minuteman missiles base, the phenomenon was reported by 20 witnesses (14 on ground and 6 in a USAF B-52 bomber), the UAP was tracked both by ground and airborne radars, when the UAP has maneuvered close to the B-52 the radio communications were momentarily broke off, and finally the UAP has landed on ground while in the same time the alarm of one missile silo was activated and doors found open by security guards.

At 3h00 (Local time), a B-52 was practicing a training flight at about 39 miles Northwest of Minot Air Force base when an unknown echo appeared on its radar scope at 3 miles from the left of the aircraft. This target was moving initially at a speed of 3,000 mph and rapidly close on the B-52 and remained at about 1 mile from the aircraft during 20 miles. During that time, UHF transmission from the B-52 to the ground control were interrupted and as soon as the echo disappeared the aircraft UHF transmitter became operational. Radar scope photos were obtained, and clearly show the radar echo. The size of the echo was larger than that of a KC-135 refueling aircraft.

At the same time on ground, at Minuteman nuclear missiles base of Minot, the member of a missile maintenance team driving his car reported seeing a bright red-orange object stationary at about 1,000 feet above while a low muffled jet engine sound was heard. He stopped his car, then started again and the object began to move as it was following him before accelerating and stopping at 6-8 miles away. A few time later he lost the object from sight. Fourteen other maintenance technicians, airmen and alert team members sighted the same object in various places in the base. All the ground witnesses described the object as follows: big size, bigger than a plane, and red-orange in color. At the beginning of the sighting, only one object was seen, joined for a short period by another similar object.

The B-52 which continued its training flight when it was vectored toward the location of the visual sighting ten miles northwest of the base. While arriving at two miles from the sighting location the B-52 instructor pilot visually sighted an object ahead and below which seemed to remain stationary and close to the ground.

At 04h49 (local time), inner and outer alarms at “Oscar 7” missile silo sounded at Wing Security Control. “Oscar 7” is ten miles north and 11 and a half miles east of “November 7” where were the ground witnesses. A security alert team was dispatched and found the padlock to the chainlink fence open and the fence gate standing open. This set off the outer alarm. Inside the complex, a horizontal door had been unsecured and left open. No tracks, prints or impressions were found. (From USAF Project Blue Book 16 mm microfilms from Maxwell AFB)



In a report written in 2000, (32 years later), Bradford Runyon the instructor pilot who was in cockpit right seat has given some more details. “While flying in the right seat as instructor co-pilot of a B-52H, I requested permission to descend from FL 200 (flight level 20,000 feet) to land at Minot AFB. At this time I was requested to check on something in the area and given a heading to follow. When I asked what I was asking for, I was told I would know if I found it. Minutes later we had an object on our radar scopes approaching from the right rear of our plane at such a high rate of speed that they thought a collision was imminent. The object stopped off our right tail momentarily, then moved to the left side of our plane. We lost radio contact with the base, and I decided to land the plane. The UFO stayed with us until within 10 miles of the base where it set down on the ground and our radios came back on. We were instructed to go back and overfly the object which we did at 2,000 feet altitude, again losing radio contact with the base when we flew over the object. At a briefing the following day, I was told that a 20 tons concrete lid had been removed from a Minuteman missile silo and both outer and inner alarms had been activated. Our aircraft film showed a radar return about five times as large as a KC-135 tanker and a closure rate of about 3,000 mph. Ground crews saw the object joined with us, and recently a retired CIA investigator sent to investigate the incident told me that Blue Book lied, and that it was a “UFO”. The body was several hundred feet long and glowed dark orange in color. The crescent moon-shaped part was connected to the body with a space between. Blue, green and possibly orange lights appeared to be inside the crescent shaped part as we passed over the object and to the right of the picture.

Comments: The conclusion of the USAF preliminary investigation report stated that some of the ground witnesses could have seen the B-52 during its pass at low altitude. But in the same report they presented four occurrences that cannot be correlated or explained at this level:

1. What caused the aircraft radar echo ?
2. Aircraft loss of UHF transmission ?
3. The cause or source of visual aircraft sighting of a brightly lighted object and a simultaneous ground sighting in approximately the same location ?
4. The OSCAR 7 alarms could be attributed to circumstantial effort of prankster, however no evidence of trespassers was found ?

The USAF report stated also that the B-52 crew was the most experienced of the Air Force Base because they were in charge of estimating the other crew on the base.

(Sources: USAF Project Blue Book report, 16 mm microfilms from Maxwell AFB / Preliminary Study of Sixty Four Pilot Sighting Reports Involving Alleged Electro-Magnetic Effects on Aircraft Systems, Dr Richard F. Haines and Dominique Weinstein, NARCAP Technical Report n°3, 2001)



Annex A 4.2.5.2 1 - Petrozavodsk Phenomenon

The Petrozavodsk Phenomenon

<http://www.ufoexperts.net/petrozavodskufo.html>



Rare lost image of part of the event.

The Petrozavodsk phenomenon was a series of celestial events of disputed nature on September 20, 1977. The sightings were reported over a vast territory from Copenhagen and Helsinki on the west to Vladivostok on the east. The phenomenon is named after the city of Petrozavodsk in Russia.

A vast body of visual observations, radiolocation reports, physical measurements and accompanying meteorological data, concluded that "based on the available data it is unfeasible to satisfactorily understand the observed phenomenon". The Petrozavodsk phenomenon contributed to the creation of **Setka** AN, a Soviet research program for anomalous atmospheric phenomena.

Most sightings occurred between 01:00 and 01:20 a.m. UTC, when at least 48 unidentified objects reportedly appeared in the atmosphere. Several sightings occurred before, at 1 a.m. local time over Medvezhyegorsk, at 2:30 a.m. over Loukhi and at 3 a.m. over Kovdor and Palanga (Lithuania). From approximately 3 a.m. to 3:25 an unidentified luminous object has been observed by the supervising personnel of the Leningrad maritime trade port. At 3:30 a flying object, surrounded by a luminous coat, was reportedly seen by the crew of the Soviet fishing vessel Primorsk, which was departing from the Primorsk harbour. The object appeared to move noiselessly from the east and near Primorsk to abruptly changed the direction to north.

In Helsinki, Finland, the sightings of a glowing ball were reported by newspapers *Ilta-Sanomat* on September 20 and *Kansan Uutiset* the next day. The ball was observed by many residents, including taxi drivers, police functionaries and Helsinki Airport personnel. An unidentified object was also observed near Turku by two men. At the distance of 300 m they spotted a spinning object similar to a lifebuoy, 10 m in diameter. *Ilta-Sanomat* reported a sighting of a glowing object in Denmark, over Copenhagen by the pilots of a Finnish airline aircraft flying from Rome.



The glowing objects, that emitted light rays, were also observed in various places of the Soviet Union, mostly in the northwest. The appearance of an unidentified object over Helsinki reportedly caused a heavy radiotrafic on Soviet territory. In the European part of the Soviet Union "bright, luminous bodies surrounded by extended shells and emitting light rays or jets of quaint shapes" were reported. The "shells" reportedly "transformed and diffused within 10 to 15 minutes", while "a more longlived, stable glow was observed, mostly in the northeastern part of the sky". The eyewitnesses included paramedics, on-duty militsiya functionaries, seamen and the longshoremen at Petrozavodsk's port, military, local airport staff and an amateur astronomer. The phenomenon was also observed by the members of the IZMIRAN geophysical expedition near Lekhta. In Saint Petersburg, then Leningrad, the sighting of an unidentified object was reported by three nightshift employees of Pulkovo Airport, including air traffic controller B. Blagirev. According to Blagirev, he spotted a fireball-like object slightly larger than Venus at 3:55 a.m. on the north-north-east at an azimuth of 10°. The object was surrounded by a spacious, rhythmically glowing coat with intricate structure and "the observed phenomenon had nothing similar to aurora". The object moved ascendantly to the observer, to south-south-west, then it changed the direction to north-north-west and eventually disappeared. All three airport employees failed to identify what they saw. Further reports in the Soviet Union came from Primorsk (two eyewitnesses), Petrodvorets (one eyewitness), Lomonosov (three eyewitnesses), Podporozhye (three eyewitnesses), Polovina (one eyewitness), Leppäsyriä (one eyewitness), Kem (several eyewitnesses), Põltsamaa, Liiva, Priozersk, Kestenga, Valday and other places. Many reports were accompanied by drawings from eyewitnesses. By 30 December 1978 the Soviet researchers collected a total of 85 reports on Petrozavodsk phenomenon.

In the settlement of Kurkijoki a luminous object was seen by engineer A. Novozhilov, who compared it to an airship. He reported the sighting to the candidate of technical sciences Konstantin Polevitsky, who recorded it. Initially Novozhilov saw what he thought to be a meteor. After some time the object had stopped and then moved towards Novozhilov, quickly increasing in size and acquiring the well-outlined shape of an airship. The object was faceted and tipped with brightly shining spots on front and back. The edges were glowing with white light, which was slightly fainter than spots. The facets resembled the windows lightened from inside and were evenly glowing with a white light that was fainter than that of the edges. The object reportedly moved at the altitude of 300–500 m, being 100 m long and 12–15 m in diameter. Still approaching Novozhilov, the object, moving from west to east, had released a brightly shining ball from the rear, which flew north. The ball was flying horizontally and then descended behind a forest. The landing reportedly caused the appearance of a bright glow. At 4:15 a.m. Novozhilov took three unsuccessful photos of the sighting with a 0,1 sec exposure. The object was "much larger than moon" and moved with the speed of a helicopter. The observation lasted 10–15 minutes in complete silence.

Another detailed account on one unidentified object was given by Soviet writer and philosopher Yuri Linnik. He observed the object on his dacha near Namoyevo at about 3 a.m. through the amateur telescope with a 80x magnification. That lens-like object, surrounded by a dim, translucent ring, had a color of a "dark amethyst, intensively



lightened from inside". The edges of the lens-like object had 16 spots (described by Linnik as "nozzles") which emitted pulsating red rays at an angle of 10°–15°. The angular size of the object was estimated at 20 arcminutes. The object passed near stars Gamma Geminorum, Eta Geminorum, Capella, 172 Camelopardalis, 50 Cassiopeiae, Gamma Cephei, Psi Draconis, 16 Draconis, Psi Herculis, Kappa Coronae Borealis and Delta Coronae Borealis. The object stopped near Gamma Cephei at an azimuth of 220°. Near Kappa Coronae Borealis, at an azimuth of 340°–350° the object changed its direction to 30°–35° west. It finally disappeared on the north at an azimuth of 340°. The duration of the flight was 15 minutes.

Apart from ground observations, there were also reports from several aircraft. The crew of Tu-154 spotted a luminous spherical object at the altitude of 12 km. A bright, luminous object was also observed for a half an hour by Georgian writer Guram Pandzhikidze and other passengers of an aircraft returning from Singapore to Moscow at the altitude of 11 km, at about 4:30 or 5 a.m. Pandzhikidze reported the sighting on 2 October to the director of Karelian Hydrometeorological Observatory Yuri Gromov, who verified the report's copy.

Pravda report on the Petrozavodsk object, The headline is titled "Unidentified nature phenomenon".

At the time Petrozavodsk was the capital and a major industrial hub of the Karelian Autonomous Soviet Socialist Republic, with a population of 203,000 as of 1974. The earliest published report of the Petrozavodsk phenomenon was written by a TASS correspondent Nikolai Milov, who described the unidentified object over Petrozavodsk as "a huge star", that "flared up in the dark sky" at about 4 a.m. local time, "impulsively sending shafts of light to the Earth". Milov's report was published in the mainstream Soviet press (Pravda, Izvestiya, Selskaya Zhizn, Sotsialisticheskaya Industriya). A local newspaper Leninskaya Pravda also reported the Petrozavodsk object. The preliminary data analysis by the Academy of Sciences of the USSR found the eyewitness' reports to be mutually consistent and complementary. Some eyewitness' accounts were attested by Yuri Gromov. According to Milov, "the star" was spreading out over Petrozavodsk in the form of a jellyfish, "showering the city with a multitude of very fine rays which created an image of pouring rain". Milov further reported that "after some time the luminescent rays ceased" and "the jellyfish turned into a bright semicircle", which resumed its movement towards Onega Lake.

The object, surrounded by a translucent coat, was initially spotted at about 4 a.m. in the northeastern part of the sky below Ursa Major at an azimuth of about 40°. The initial brightness of the object was "apparently comparable to that of Venus". The object moved ascendantly towards Ursa Major. The course angle as determined by former pilot and eyewitness V. Barkhatov was 240°. As the object ascended, it was expanding and pulsating, but the decrease in brightness was not noted. The object moved slowly for about 3 minutes. Shortly before the object stopped it dispersed a bright "cloud". The "cloud" was round or oval in shape. Its maximum angular size was larger than that of Ursa Major, about 30° in diameter. The altitude of the object during the formation of the "cloud" was estimated at 7,5±0,4 km (based on eyewitnesses' observations) or at 6.0±0.5 km, based on parallax. The linear diameter of the object's core was estimated



either at 119 or at about 60 meters. The diameter of the object's jellyfish-like cupola was estimated by Felix Ziegel at about 105 m, based on drawing of eyewitness Andrei Akimov. The object itself was red in color and emitted a bluish white glow. The lighting of the area was compared to that from a full moon. According to eyewitness V. Trubachev, "the ground was lightened like in the white night". The glowing "cloud" then developed a dark spot around the central core. The spot was quickly expanding while the glow was fading away. The object hovered over Petrozavodsk for five minutes and then moved away. Before hovering the object moved slowly, with the angular velocity of a passenger aircraft. After the hovering its speed had increased. One eyewitness noted that the object's underside resembled the Segner wheel. The entire phenomenon lasted 10–15 minutes. The Petrozavodsk object was also seen in adjacent places, such as Pryazha. In 1978 *Tekhnika i Nauka* published the colored reconstruction of various stages of the object.

Clinician psychologist Y. Andreyeva evaluated the mental condition of nine eyewitnesses of the Petrozavodsk phenomenon. She concluded that "one can be confident of complete mental sanity of the eyewitnesses and the veracity of their answers and testimonies". Nonetheless, several reports noted some impact of the phenomenon on humans and environment. According to A. Grakov, who observed a glowing yellow ball the size of a moon, the air above the lake in Petrozavodsk glowed with white light after the ball had disappeared. The glow was more intense than that from Petrozavodsk's lights. According to Yuri Linnik, after 20 September 1977 there was an increased biological activity in the areas where the phenomenon was observed. Noting that that increase might not be related to the Petrozavodsk phenomenon, Linnik nonetheless reported the blooming of roses in his garden and the second bloom of "about 10 species of herbaceous plants". Linnik called it "extraordinary for Karelia's latitude" because "after the autumn equinox the vegetation of herbs almost ceases". He further emphasized the intense bloom of the water in Ukshozero, caused by *Ankistrodesmus*, shortly after 20 September. Some impact on technical devices was also noted when the engineers in the Petrozavodsk area had reportedly observed "huge failures" in computing devices, which then regained normal performance.

The unidentified objects over the airports of Helsinki, Pulkovo and Peski were not detected by the airport radars. Although, according to UPI, the object was detected by the Helsinki airport radar, the airport's traffic controller Ari Hämäläinen claimed it was not. The objects were not spotted by the Soviet air defense system either. Later, however, the glowing objects were reportedly detected by the weather radar of Karelian Hydrometeorological Observatory in Petrozavodsk on 30 September at 17:40, 20 October at 23:30 and 20 November at 02:14–02:17.

A note of the Soviet Academy of Sciences, informing about the dispatch of an expert group to Karelia to study the phenomenon, 1978. The initial analysis of the phenomenon was made by the research fellow of Sternberg Astronomical Institute Lev Gindilis using various testimonies and meteorological data. He wrote that the passage of one object at a reasonably high altitude, which allows simultaneous observations from all reported locations, is plausible at the flight altitude of c. 100 km or more. Gindilis noted that in that case "the minimal linear dimensions of the bright spherical object should be about



1 kilometer, while the diameter of the coat – several tens of kilometers". Considering the launch of Kosmos-955 as the possible cause, Gindilis outlined several obstacles, such as the westward motion of the unidentified object (while Kosmos-955 was launched to north-east), the observed angular sizes of it combined with the expected distance and prolonged hanging over Leppäsyriä. A Sortavala newspaper *Krasnoye Znamya* published a report from local hydrometeorological station, which further confirmed that the Petrozavodsk object moved from northeast to southwest. The suggestion about Kosmos-955 was also criticized by Felix Ziegel, who noted that the space vehicles are launched eastwards, in the direction of Earth's rotation.

On 2 January, 1978 the Vice President of the Soviet Academy of Sciences Vladimir Kotelnikov signed a note to the Karelian Department of the Academy, informing about the dispatch of an expert group to study the phenomenon in situ. There, relying on eyewitnesses' testimonies, the employee of Petrozavodsk University Y. Mezentsev conducted theodolite measurements to determine the approximate location of the unidentified object over Petrozavodsk.

One copy of the report was received by the French research group GEPAN. The copy was subsequently forwarded to CUFOS in Evanston, Illinois in the United States. J. Allen Hynek presented another copy to NASA scientist Richard Haines, who then translated the copy to English. The Soviet report was met with a mixed reception abroad. Haines, Hynek and others publicly claimed that the report was the key evidence for the existence of unidentified flying objects.



Annex A 4.2.5.2.2.1 - case Usovo Ukrain from SETKA



reading sheet

Cas Usovo Base Ukrain`

Source <http://www.ufoinfo.com/news/setka.shtml> Setka: A Secret Soviet UFO Research Program
DAWN OF THE SECRET PROGRAM By Paul Stonehill & Philip Mantle

Contenu

October, 1982

Reports received from Russia indicate that Soviet Colonel Boris Sokolov investigated the case, and on October 5, 1982, he was sent to Ukraine. Sokolov knew quite a lot about UFOs, as he was involved in the information collection and analysis per the Instruction. The reason he was summoned to the Soviet Ukraine was an urgent report from an ICBM base, sent to the Chief of General Staff. On October 4th, a UFO was observed in the area; it remained there for about four hours. But the control panel indicated that an order came in to prepare launch of the base missiles. Lights actually lit up on the panel, and launch codes enabled the missiles; there were many officers present that witnessed the incident that could have started a nuclear war. Apparently Boris Sokolov's team came to the conclusion that it was the UFO that bears responsibility for arming Soviet missiles. In the year 2000 Sokolov changed his views, perhaps under direct pressure, and came out against UFO hypothesis in this and other cases.

This case became famous in the West years later. A transcript from ABC News Prime Time Live dated October 5, 1995 describes the segment about the KGB files. David Ensor, a well-known correspondent for the network, conducted a five-month investigation of the Soviet UFO files. Dozens of Russian scientists, military and government officials had been interviewed. Ensor found out about forty major incidents, including one that prompted fears of starting an accidental nuclear war. Ensor's team also found out about the Instruction. They viewed awesome footage of a huge triangular UFO filmed by a Soviet propaganda film crew (most likely, it was the so-called Riga UFO, 1961 incident). Other reports confirmed by eyewitnesses proved to be important. The incident that almost unleashed a nuclear war took place in 1982, on October 4. The event in question took place in the Soviet Ukraine. That day a huge UFO of perfect geometrical shape and 900 meters in diameter hovered over a nearby ballistic missile base. Numerous eyewitnesses confirmed the sighting to David Ensor. So did Lt. Colonel Vladimir Plantonev (we are not certain if this name was spelled correctly by ABC news), a missile engineer. According to him the UFO was a noiseless, disc-shaped craft; it had no portholes, its surface completely even. It made turns, like an airplane would. The missile silo at the base contained a nuclear warhead pointed at the United States. It was dismantled in the early 1990's. But in 1982 it was fully functional. Plantonev was in the bunker that fateful day in 1982. The room contained dual control



panels for the missile, each of them hooked to Moscow. As the UFO hovered overhead, signal lights on both the control panels suddenly turned on, for a short period of time. The lights indicated that the missiles were preparing for launch. Moscow could have initiated such launch, by its transmission of special orders. But no order came from Moscow, and no one at the base pushed any buttons. For 15 long seconds the base simply lost control of its nuclear weapons. Moscow was very much alarmed, and sent an investigation team to verify the incident. A member of the commission, Colonel Igor Chernovshev (we are not certain if this name was spelled correctly by ABC news), corroborated the 1982 incident to David Ensor.

Paul Stonehill and Philip Mantle

Co-authors of *Mysterious Sky - Soviet UFO Phenomenon* (2006) now available via [Amazon.com](https://www.amazon.com) & [Amazon.co.uk](https://www.amazon.co.uk).

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Annex A 4.5.5.2.5 - DOC 0005517792 cas URSS Alma Ata



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UNCLAS 3V/PMU/SU SPACE
 *** BEGIN MESSAGE 29 ***
 SERIAL-LD2004002591 UDX=X(55792)
 CLASS=UNCLAS 3V/PMU/SU SPACE
 UNCLAS 3V/PMU/SU SPACE
 SERIAL: LD2004002591
 PASS: COPY TO [REDACTED]
 COUNTRY: USSR
 SUBJ: ALMA-ATA PATROLMEN REPORT UFO SIGHTING
 SOURCE: MOSCOW TASS IN ENGLISH 1603 GMT 19 APR 91
 TEXT:

//((BY TASS CORRESPONDENT VASILY DANSHIN))
 ((TEXT)) ALMA-ATA APRIL 19 TASS -- MILITIAMEN SIGHTED AN UNIDENTIFIED FLYING OBJECT WHILE ON PATROL IN ALMA-ATA, CAPITAL OF THE SOVIET CENTRAL ASIAN REPUBLIC OF KAZAKHSTAN, THE NEWSPAPER VECHERNYA ALMA-ATA REPORTS TODAY.
 LATE IN THE AFTERNOON, WHILE APPROACHING THE KOK-TYUBE MOUNTAIN -- A RECREATION AREA FAVOURED BY LOCAL INHABITANTS -- THE PATROLMEN NOTICED A KIND OF FIRE AT THE TOP OF THE MOUNTAIN. THEY WATCHED THE FLAMES GO UP AND DOWN THEN AN ARRAY OF RED RAYS BURST OUT OF THE CENTRE.
 OTHER MILITIAMEN ALSO NOTICED THE STRANGE OBJECT. THE DRIVER OF THE PATROL CAR SAID HE AND HIS COMRADES DROVE UP TO THE "FLAMING OBJECT", AND WHEN THEY WERE A MERE 200 METERS AWAY FROM THE HOVERING UFO, A FEW RAYS SWEEP ACROSS THE CAR AND IT STOPPED DEAD. WHEN THE MILITIAMEN MOVED TOWARDS THE UFO, IT DIMMED ITS "SEARCHLIGHTS" AND DISAPPEARED.
 UPON RETURNING TO THE POLICE STATION, THE PATROLMEN NOTICED THAT NONE COULD RECALL THE WAY BACK FROM THE MOUNTAIN -- ALL MEMORY OF THE PASSAGE HAD BEEN COMPLETELY OBLITERATED.
 RADIO TALKS CONCERNING THE UNIDENTIFIED FLYING OBJECT WERE RECORDED ON TAPE. THERE ARE IMPARTIAL WITNESSES TO THE EVENT.
 (ENDALL) 191603 [REDACTED] 11904.026/[REDACTED] 20/00312 APR

BT
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Approved for Release
 Date:

MAY 2000

UNCLAS 3V/PMU/SU SPACE

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Annex A 4.2.5.4.2 - AIRPANC extract

**Extrait document AIRPANC****Case 1055**

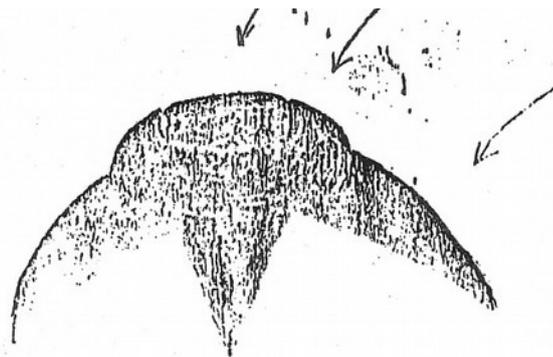
IR/M/S1/UI/AS/EM/GR/GW/MA

September 19, 1976**0130L****75 km north of Tehran, Iran (36°25 N / 51°30 E)**

At about 0:30 am, an Iranian Air Force high ranking officer received four telephone calls from citizens living in the Shemiran area of Tehran saying that they had seen strange objects in the sky. Some reported a kind of bird-like object while others reported a helicopter with a light on. There were no helicopter airborne at that time. After he told the citizens it was only stars and had talked to Mehrabad Tower, he decided to look for himself. He noticed an object in the sky similar to a star, bigger and brighter. He decided to scramble an F-4 from Shahrokhi AFB to investigate. At 01:30 on the 19th the F-4 took off and proceeded to a point about 40 NM (nautical miles) north of Tehran. Due to its brilliance, the object was easily visible from 70 miles away. As the F-4 approached a range of 25 NM, it lost all instrumentation and communications (UHF and intercom). The pilot broke off the intercept and headed back to Shahrokhi. When the F-4 turned away from the object and apparently was no longer a threat to it, the aircraft regained all instrumentation and communications. At 01:40 a second F-4 was launched. The backseater acquired a radar lock on at 27 NM, 12 o'clock high position, with the VC (rate of closure) at 150 NM per hour. As the range decreased to 25 NM the object moved away at a speed that was visible on the radar scope and stayed at 25 NM. The size of the radar return was comparable to that of a 707 tanker. The visual size of the object was difficult to discern because of its intense brilliance. The light that it gave off was that of flashing strobe lights arranged in a rectangular pattern and alternating blue, green, red and orange in color. The sequence of the lights was so fast that all the colors could be seen at once. The object and the pursuing F-4 continued on a course to the south of Tehran when another brightly lighted object, estimated to be one-half to one-third the apparent size of the moon, came out of the original object. This second object headed straight toward the F-4 at a very fast rate of speed. The pilot attempted to fire an AIM-9 missile at the object but at that instant his weapons control panel went off and he lost all communications (UHF and interphone). At this point the pilot initiated a turn and negative G dive to get away. As he turned the object fell in trail at what appeared to be about 3-4 NM. As he continued in his turn away from the primary, the second object went to the inside of his turn then returned to the primary object for a perfect rejoin. Shortly after the second object joined up with the primary object another object appeared to come out of the other side of the primary object going straight down at a great rate of speed. The F-4 crew had regained communications and the weapons control panel and watched the object approached the ground anticipating a large explosion. This object appeared to come to rest gently on the earth and cast a very bright light over an area of about 2-3 kilometers. The crew descended from their altitude of 25,000 ft to 15,000 ft and continued to observe and mark the object's position. They had some difficulty in adjusting their night visibility for landing, so after orbiting Mehrabad a few times they went out for a straight in landing. There was a lot of interference on the UHF and each time they passed through a mag. bearing of 150 degrees from Mehrabad they lost their communications (UHF and interphone) and the



INS fluctuated from 30 degrees to 50 degrees during 360° orbit by F-4 pilot's dark adaptation was regained (est. duration of INS fluctuation of 10-15 sec, while at radial of 150° from Mehrabad). The one civil airliner that was approaching Mehrabad during this same time experienced communications failure in the same vicinity (Kilo Zulu) but did not report seeing anything. While the F-4 was a long final approach the crew noticed another cylinder-shaped object (about the size of a T-bird at 10 miles) with bright steady lights on each end and a flasher in the middle. When queried the tower stated there was no other known traffic in the area. During the time that the object passed over the F-4 the tower did not have a visual on it but picked up after the pilot told them to look between the mountains and the refinery. During daylight the F-4 crew was taken out to the area in a helicopter where the object apparently had landed. Nothing was noticed at the spot where they thought the object landed (a dry lake bed) but as they circled off to the west of the area they picked up a very noticeable beeper signal. At the point where the return was the loudest was a small house with a garden. They landed and asked the people within if they had noticed anything strange last night. The people talked about a loud noise and a very bright light like lightning. The aircraft and area where the object is believed to have landed are being checked for possible radiation. (*Sources: US government documents (confidential DIA report declassified on August 31, 1977) / Uninvited guests, Richard Hall, 1988 : The UFO cover up, L. Fawcett and B. Greenwood, 1984 / NARCAP Technical Report n°3, « A preliminary Study of 64 pilot sighting reports involving alleged Electro-Magnetic effects on aircraft systems. » by Dr Richard F. Haines and Dominique F. Weinstein*)



Case 1055: September 19, 1976, Iran: “object similar to a star”



Annex A 5.14.1.1 - Extract from the ONERA letter on MHD



An extract from letter 3AF N ° 32 (July-August 2018) which relates to research at ONERA, concerning work on MHD, is given in addition to this summary in the appendix. The application to atmospheric reentry (reduction of the effects of hypersonic shocks, reduction of drag), but also to the reduction of the effects of shocks in the combustion chambers of super ramjet are explained there.

The question of propulsion by MHD is also briefly discussed. What should be remembered is that the MHD can be envisaged to improve the aerothermodynamic conditions of hypersonic flights making it possible to reduce the effects of high temperatures and shocks, or even to optimize a “conventional” propellant and allow its increase in its performance. lifetime. MHD propulsion is a technology even beyond the applications described requiring a very large generation of energy to create an "MHD" thrust replacing any other form of thrust (superstatorreactor, rocket motor propulsion, etc.).

Extract from letter 3AF N ° 32 on research at ONERA

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de l'Aéronautique et de l'Espace

NUMÉRO SPÉCIAL LA PROSPECTIVE À L'ONERA

ONERA
THE FRENCH AEROSPACE LAB



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Quel avenir pour la propulsion électrique ?



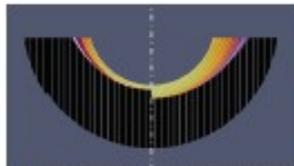
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LA MAGNÉTOHYDRODYNAMIQUE

par Roland Berton, maître de recherche, Julien Labaune, Denis Packan et Dominique Scherrer

Les activités récentes de l'ONERA sur la magnétohydrodynamique ont pour origine la constitution en 2008 d'un Groupe de Travail d'Études Prospectives (GTEP) du Centre de Prospective et de Veille Aérospatiales, dans le but d'évaluer les différentes applications possibles de cette branche de la physique dans le domaine aérospatial, d'identifier les applications les plus prometteuses et d'en susciter l'étude avec des outils modernes. Suite aux conclusions de ce groupe de travail, la rentrée atmosphérique a été considérée comme une application justifiant une évaluation au moyen d'une plateforme numérique spécifique en préalable à une éventuelle validation expérimentale. En parallèle, plusieurs activités internes ayant pour objet l'étude du foudrolement des avions (Projet de Recherche Fédérateur Foudre) ou des décharges électriques en écoulement (Projet de Recherche Fédérateur Saha) ont permis le développement d'outils numériques puissants permettant le calcul de plasmas en écoulement.

PRINCIPES THÉORIQUES

La MagnétoHydroDynamique (MHD) a pour objet l'étude de l'écoulement d'un fluide conducteur de l'électricité dans un champ magnétique \mathbf{B} et un champ électrique \mathbf{E} . Sous l'influence de ces champs, une particule chargée (ion ou électron, de charge unitaire q) se déplaçant à la vitesse \mathbf{v} est soumise à la force de Lorentz égale à $q(\mathbf{E} + \mathbf{v} \wedge \mathbf{B})$, donnant lieu à l'établissement de courants électriques au sein du fluide. En l'absence de collisions, le champ magnétique seul tend à donner à la particule une trajectoire hélicoïdale autour de la direction de \mathbf{B} : le mouvement de rotation autour des lignes de champ est appelé mouvement cyclotronique. Mais, de manière générale, la relation entre la densité de courant électrique \mathbf{j} et le champ électromagnétique est donnée par la loi d'Ohm, exprimant l'équilibre local entre les forces de Lorentz et les forces engendrées par les collisions : $\mathbf{j} = \sigma(\mathbf{E} + \mathbf{V} \wedge \mathbf{B})$ où σ est la conductivité électrique et \mathbf{V} la vitesse moyenne du fluide. On constate que le seul mouvement du fluide conducteur dans un champ \mathbf{B} crée un courant $\sigma(\mathbf{V} \wedge \mathbf{B})$, s'apparentant au courant de Foucault dans les solides. On note que la vitesse à considérer dans l'expression de la force de Lorentz s'exerçant sur une particule chargée n'est pas la vitesse moyenne du fluide, mais la vitesse de la particule, ce qui implique que le courant électrique influence le champ induit qui est à son origine : ce phénomène, appelé effet Hall, joue un rôle prépondérant dans certaines applications, en particulier celles concernant des plasmas faiblement ionisés. Son importance peut être quantifiée par le paramètre de Hall (pour les électrons et pour les ions) défini comme le rapport de la pulsation cyclotronique des particules chargées et de la fréquence de collision avec les neutres. En pratique, l'effet Hall se traduit par le fait que la conductivité électrique à considérer dans la loi d'Ohm n'est pas

scalaire mais tensorielle.

La somme des forces de Lorentz s'appliquant à toutes les particules chargées se traduit pour le fluide par une force volumique, la force de Laplace, de densité volumique \mathbf{F} égale à $\mathbf{j} \wedge \mathbf{B}$, s'exerçant perpendiculairement au courant électrique et au champ magnétique. De même, le travail de ces forces se traduit pour le fluide par une source d'énergie totale de densité volumique égale à $\mathbf{j} \cdot \mathbf{E}$. On montre facilement que $\mathbf{j} \cdot \mathbf{E} = \mathbf{F} \cdot \mathbf{V} + \mathbf{j} \cdot \sigma^{-1} \cdot \mathbf{j}$. Le terme $\mathbf{F} \cdot \mathbf{V}$ est égal à la variation d'énergie cinétique du fluide. Le terme $\mathbf{j} \cdot \sigma^{-1} \cdot \mathbf{j}$, toujours positif, est égal à la variation d'énergie interne du fluide : il représente l'effet Joule. On note que les sources de quantité de mouvement $\mathbf{j} \wedge \mathbf{B}$ et d'énergie totale $\mathbf{j} \cdot \mathbf{E}$ sont proportionnelles à la densité de courant : l'interaction MHD est donc conditionnée à l'existence d'un courant électrique au sein de l'écoulement. Il est donc impératif que le fluide soit conducteur de l'électricité : cette contrainte constitue une limitation importante aux applications terrestres de la MHD.

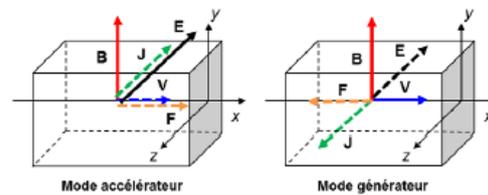


Figure 1 – Modes de conversion MHD (en négligeant l'effet Hall, et pour des champs \mathbf{E} et \mathbf{B} perpendiculaires). Les vecteurs en trait plein représentent les grandeurs "imposées" et les vecteurs en pointillés les grandeurs "produites" par l'interaction MHD.

Les applications technologiques de la MHD visent toutes à réaliser une conversion entre différentes formes d'énergie. On distingue généralement deux modes de conversion : le mode accélérateur (ou moteur) et le mode générateur (voir Figure 1). Le mode accélérateur réalise une conversion d'énergie électrique (cédée par l'extérieur) en énergie cinétique et en énergie interne (reçues par le fluide) : il vise à mettre en mouvement ou accélérer un fluide et on l'utilise principalement pour des applications de propulsion, de brassage ou de pompage. Le courant électrique est engendré essentiellement par un champ électrique \mathbf{E} appliqué de l'extérieur par des électrodes disposées à cet effet. L'orientation du courant électrique et celle du champ magnétique appliqué sont choisies de façon à ce que la force de Laplace s'exerce dans la direction voulue. Le mode générateur réalise à l'inverse une conversion d'énergie cinétique du fluide en énergie électrique (cédée à l'extérieur) et en énergie interne. Dans ce mode, la force de Laplace s'oppose à l'écoulement ($\mathbf{F} \cdot \mathbf{V} < 0$) et le ralentit. On l'utilise soit pour produire de l'énergie électrique soit pour freiner un véhicule. Le courant électrique est cette

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| Fluide conducteur | Masse volumique (kg/m ³) | Conductivité électrique (S/m) | Vitesse (m/s) | Induction magnétique (T) | Dimension caractéristique (m) | Paramètre d'interaction | Nombre de Reynolds magnétique |
|--------------------------------|---|-------------------------------|--------------------|--------------------------|-------------------------------|-------------------------|-------------------------------|
| Métal liquide (acier) | 7×10^3 | 2×10^6 | 1 | 5×10^{-2} | 1 | 0,7 | 0,1 |
| Métal liquide (sodium) | 9×10^2 | 4×10^6 | 6 | 10^{-1} | 1 | 7 | 0,3 |
| Plasma (soleil) | 2×10^{-3} | 10 | 10^3 | 2×10^{-1} | 10^6 | 2×10^5 | 10^5 |
| Plasma (rentrée atmosphérique) | 2×10^{-4} à 2×10^{-3} | 200 | 7×10^3 | 5×10^{-1} | 0,1 à 1 | 0,4 à 40 | 10^{-5} à 10^{-4} |
| Electrolyte (eau salée) | 10^3 | 1 | 1 | 5 | 1 | 3×10^{-2} | 10^{-6} |
| Electrolyte (microfluide) | 10^3 | 10 | 2×10^{-3} | 5×10^{-1} | 2×10^{-4} | 2×10^{-4} | 10^{-10} |

Tableau 1 – Caractéristiques de quelques milieux donnant lieu à une interaction MHD

fois engendré essentiellement par le champ électrique induit $\mathbf{V} \wedge \mathbf{B}$ dans la direction perpendiculaire à \mathbf{V} et \mathbf{B} (en l'absence d'effet Hall).

Les équations complètes de la magnétohydrodynamique regroupent les équations de bilan de la mécanique des fluides (masses, quantité de mouvement et énergie) et les équations de Maxwell simplifiées (courants de déplacement négligés, quasi-neutralité) décrivant le champ électromagnétique [1]. Ces deux systèmes d'équations sont étroitement couplés. Pour le fluide, l'effet du champ électromagnétique se traduit par des termes sources volumiques de quantité de mouvement et d'énergie totale, respectivement $\mathbf{j} \wedge \mathbf{B}$ et $\mathbf{j} \cdot \mathbf{E}$. Pour l'électromagnétisme, l'effet de l'écoulement s'exprime de façon directe par la vitesse dans la loi d'Ohm et de façon indirecte par la température qui conditionne le taux d'ionisation et donc la conductivité électrique. L'importance de l'interaction MHD peut être quantifiée par deux nombres sans dimension. Le premier, appelé paramètre d'interaction, quantifie l'action du champ magnétique sur l'écoulement : il est égal au rapport entre la force de Laplace et la force d'inertie. Le second, appelé nombre de Reynolds magnétique par analogie avec la mécanique des fluides, quantifie l'effet de l'écoulement sur le champ magnétique : on le définit comme le rapport entre le terme convectif et le terme diffusif dans l'équation d'évolution du champ magnétique. Pour de très faibles valeurs du nombre de Reynolds magnétique (domaine de la MHD "résistive"), comme c'est le cas par exemple dans les plasmas faiblement ionisés, le champ magnétique n'est pratiquement pas altéré par l'écoulement. Au contraire, pour des valeurs très élevées du nombre de Reynolds magnétique (domaine de la MHD "idéale", typiquement plasma solaire), le champ magnétique est dit "gelé" dans l'écoulement. Ces deux nombres fondamentaux

permettent de classer les différents fluides MHD (tableau 1) et de simplifier les équations en négligeant certains termes d'ordre supérieur.

La résolution des deux systèmes d'équations couplés (Navier-Stokes et Maxwell) est généralement réalisée par une plateforme numérique réalisant un couplage fort entre un code de mécanique des fluides et un code électromagnétique. La plateforme développée par l'ONERA permet la simulation numérique d'effets MHD dans des géométries et configurations tridimensionnelles complexes sur le calculateur de l'ONERA comptant près de 20000 cœurs. Elle est basée sur le code CEDRE pour la mécanique des fluides et, actuellement, Code_Saturne pour l'électromagnétisme. Ces deux codes sont couplés de manière forte par le coupleur CWIPI. Plusieurs modules ont été développés pour tenir compte, dans des cas complexes, d'effets de déséquilibre chimique, d'un chauffage des électrons par le champ électrique (résolution de l'équation de Boltzmann) et des réactions plasma qui en découlent, ainsi que de la conductivité tensorielle.

APPLICATION À LA RENTRÉE ATMOSPHÉRIQUE

Dans le domaine aérospatial, une application potentielle de la MHD est la rentrée atmosphérique. Pour cette application, la température de l'air est suffisamment élevée en aval du choc engendré par le véhicule pour permettre son ionisation partielle spontanée et le rendre ainsi conducteur de l'électricité. L'interaction MHD, correspondant ici au mode générateur, vise à ralentir l'écoulement dans un repère lié au véhicule. Cette action sur l'écoulement peut être mise à profit soit pour augmenter la traînée du véhicule, soit pour réduire les flux thermiques pariétaux, soit encore pour modifier sa trajectoire. La Figure 2 représente la configuration de

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l'interaction MHD pour le cas d'une sphère, fréquemment étudié. Sous l'effet du champ magnétique, orienté perpendiculairement à l'écoulement, s'établit un courant azimutal j à l'origine d'une force $j \wedge B$ dans le sens opposé à celle de l'écoulement. Pour cette configuration, il faut noter que l'effet Hall, quand il est significatif, est à l'origine de courants secondaires dans la direction perpendiculaire au courant azimutal et au champ magnétique. Selon la nature (isolante ou conductrice) de la paroi, ces courants secondaires peuvent toutefois être contrecarrés.

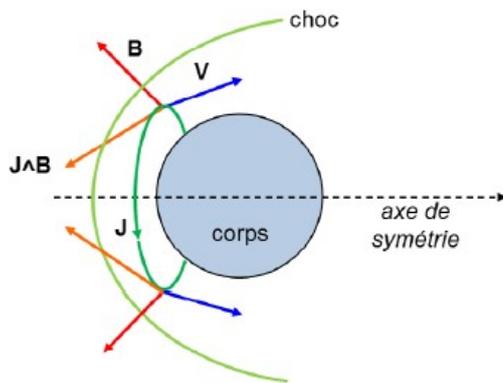


Figure 2 - Interaction MHD pour la rentrée atmosphérique

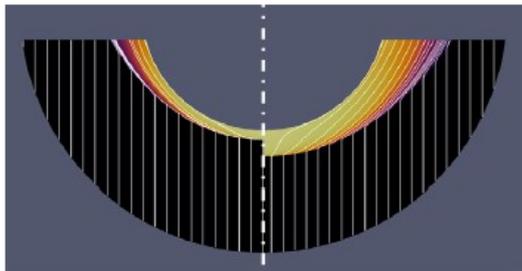


Figure 3 - Simulation de la rentrée atmosphérique d'une sphère
Champ de vitesse et lignes de courant avec MHD (partie droite)
et sans MHD (partie gauche)

La Figure 3 présente les résultats de simulation obtenus en utilisant la plateforme de calcul ONERA pour évaluer l'effet de freinage. La partie gauche de l'image est composée du champ de vitesse en plages de couleurs et des lignes de courant (de l'écoulement) en blanc pour une sphère plongée dans un écoulement à Mach 20 sans effet MHD. La partie droite correspond au calcul dans les mêmes conditions en ajoutant un aimant au centre de l'objet et donc les forces MHD résultantes. Celles-ci s'opposent à l'écoulement et conduisent à un éloignement du choc. La modification de la traînée sera la conséquence d'une part de cette altération et d'autre part des forces

électromagnétiques appliquées à l'aimant. De manière imagée, il est possible de comparer ce dispositif aux freins électromagnétiques utilisés sur les camions ou les trains.

Parallèlement à ces simulations numériques, un modèle analytique a été développé à l'ONERA [2]. Ce modèle, qui constitue une extension des relations de choc de Rankine-Hugoniot à la MHD résistive, montre que le saut de vitesse transverse à travers le choc n'est pas nul, contrairement au cas aérodynamique (sans champ magnétique). Complété par des hypothèses sur la couche de choc, ce modèle permet par ailleurs de calculer la distance du choc en fonction du paramètre d'interaction. Le premier intérêt de ce type de modèle est d'aider à mieux comprendre la physique complexe de l'interaction MHD. Par ailleurs, son faible coût permet de l'utiliser lors de calculs de trajectoire du véhicule, nécessitant de très nombreux appels au calcul des efforts exercés sur le véhicule, ce qui est difficilement envisageable avec les simulations numériques 3D couplées.

AUTRES CHAMPS D'APPLICATION DE LA MHD

Dans le secteur aérospatial, la propulsion spatiale est un domaine d'application où des solutions MHD sont déjà utilisées et même commercialisées. Citons par exemple le propulseur à effet Hall et les propulseurs PPT (Pulsed Plasma Thruster). D'autres types de propulseurs sont développés afin d'atteindre des poussées plus élevées, tels que les propulseurs MPD (Magnetoplasmadynamic).

Dans le domaine de la propulsion hypersonique, l'utilisation de la MHD a été envisagée en Russie dans les années 2000 (projet AJAX) pour améliorer le rendement propulsif d'un superstatoréacteur en réalisant un pontage MHD d'énergie entre l'entrée et la sortie de la chambre de combustion. Plus précisément, un générateur MHD est disposé entre la prise d'air et la chambre de combustion, et un accélérateur MHD entre la sortie de la chambre de combustion et la tuyère. Le générateur MHD ralentit l'écoulement supersonique et lui prélève de l'énergie sous forme électrique, laquelle est ensuite restituée au fluide par l'accélérateur MHD. Par rapport à un superstatoréacteur conventionnel, le pontage d'énergie permet d'avoir une vitesse et/ou une température réduite en entrée de chambre, et donc de faciliter la combustion et réduire les charges thermiques. Aux vitesses de vol modérées (jusqu'à environ Mach 7), ce système pourrait ainsi repousser la transition entre combustion subsonique et combustion supersonique ; aux vitesses de vol les plus élevées (Mach 10 et plus), il pourrait permettre de prolonger le domaine d'emploi du superstatoréacteur. Théoriquement séduisant, ce concept se heurte à d'importantes difficultés ayant trait à :



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- la réalisation d'un champ magnétique intense avec une masse et un encombrement minimum ;
- l'obtention d'une conductivité électrique suffisante dans l'écoulement, nécessitant un ensemencement de l'air par une vapeur de métal alcalin tel que le césium, le potassium ou le sodium, et éventuellement un pré-ionisateur de type faisceau d'électrons pour obtenir une ionisation hors équilibre ;
- la tenue des électrodes ;
- la maîtrise des phénomènes parasites (instabilités, effet Hall, effet Joule, etc).

La MHD a également été envisagée dès les années 1960 en France par l'ONERA ainsi qu'aux Etats-Unis et en URSS pour accélérer l'écoulement dans une soufflerie hypersonique mais les recherches se sont heurtées à ces mêmes difficultés.

En-dehors du secteur aérospatial, les champs d'applications possibles de la MHD sont nombreux [3]. On peut citer en particulier :

1) La production d'énergie électrique. Dans les générateurs de Faraday à tuyère, le passage entre les électrodes du plasma chaud produit par une combustion génère une tension qui engendre un courant électrique (dit de Faraday) dans le fluide et dans le circuit extérieur reliant les électrodes. Dans les générateurs de Hall, on utilise le courant axial (dit de Hall). Cette filière, étudiée à l'EDF dans les années 1970, a été écartée pour l'instant à cause de la trop grande usure des électrodes (matériaux réfractaires) pendant les centaines d'heures requises.

2) La propulsion marine. La MHD a été envisagée pour mouvoir des embarcations de taille réduite ou des sous-marins, l'avantage étant le côté silencieux à cause de l'absence d'hélice. L'inconvénient réside dans la faible conductivité de l'eau salée, mais un prototype, le "Yamato" a néanmoins été construit et testé au Japon dans les années 1980.

3) Les pompes électromagnétiques. Elles sont utilisées depuis plusieurs décennies pour pomper le sodium fondu dans les centrales nucléaires. Des études récentes montrent l'intérêt d'utiliser du lithium liquide à la place du sodium.

4) La microfluidique. Dans cette application, le principe MHD est utilisé pour pomper des électrolytes à l'échelle de quelques dizaines de microns. Le procédé MHD permet une grande souplesse de régulation du sens de circulation et du débit de fluide.

5) La métallurgie. Le brassage et le formage métallurgiques utilisent les forces magnétiques pour mélanger, homogénéiser et modeler les métaux fondus. De nombreuses études ont été consacrées à ces problèmes depuis les années 1980.

6) La MHD stellaire. Ce domaine d'application de la MHD est lié à la vie des étoiles, dont la plupart, comme le Soleil, sont magnétiques, c'est-à-dire possèdent un fort champ magnétique interne. Les éruptions solaires sont dues à la libération d'énergie magnétique.

7) L'effet dynamo (solaire, terrestre). Il s'agit d'un processus qui permet l'entretien du champ magnétique à l'intérieur d'une masse de plasma ou de métal liquide en mouvement. La dynamo solaire a une période d'inversion moyenne de 11 ans qui module l'activité de notre étoile de plasma, et son amplitude est directement corrélée au climat terrestre.

8) La fusion thermonucléaire. Le confinement du plasma par un champ magnétique, réalisé dans les Tokamak en vue de la fusion thermonucléaire, donne lieu à des phénomènes MHD, de par les mouvements produits et les instabilités engendrées. Le plasma enfermé dans un tore est soumis à un champ magnétique toroïdal.

Ont également participé aux activités récentes de l'ONERA sur la MHD : Richard Benay, Gérard Bobillot, Frédéric Damongeot, Antoine Guigon, Michel Parlier, Laurent Serre, Roger Valle.

Bibliographie

- [1] G.W. Sherman, A. Sutton, " *Engineering Magnetohydrodynamics* ". McGraw-Hill, 1965.
- [2] R. Berton, " *Analytical model of a resistive MHD shock without Hall effect* , " J. Fluid Mech., vol. 842, pp. 273-322, 2018.
- [3] R. Berton, " *La magnétohydrodynamique* " : Masson, 1990. ■



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