



Above & Right: French Air Force Rafales were the first fighter-bombers to strike Libyan targets near Benghazi on March 19. Armée de l'air & Luca La Cavera

As unrest spread across the Arab world, protests against the 42-year rule of Muammar Gaddafi intensified across Libya, starting in January and leading up to protests and a confrontation with police on February 15 in Benghazi. Unrest expanded across the country and protesters took control of Benghazi, Tobruk, Misrata and other cities and by late February the fall of the Gaddafi regime seemed inevitable. Gaddafi sent his mercenaries, police and the armed forces out to attack protesters. The United Nations Security Council's on February 26, 2011, imposed Resolution 1970 which established an arms embargo against Libya and a freeze of Libya's international assets

for the protection of the Libyan people. Gaddafi's armed forces pushed east toward Benghazi and conducted a successful counter-offensive spearheaded by armour, artillery and heavy use of air power. Media imagery has confirmed the employment of Su-22, Su-24 and MiG-23 strike aircraft and Mi-8, Mi-17 and Mi-24 helicopter gunships against rebel forces. In response to the violence by Gaddafi forces, on March 17, 2011 the United Nations Security Council passed resolution 1973 which banned: "all flights in the airspace of the Libyan Arab Jamahiriya in order to help protect civilians," and also authorized "all means necessary" short of foreign military occupation, to protect its citizens from attack.

Previous no-fly zones were enforced over Bosnian Serb airspace over the former Yugoslavia (Operation Noble Anvil) and a decade long operation over Iraq (Operation Southern Watch). While both operations met with some success, they did not stop all air operations and were long and costly efforts. **Lon Nordeen and David Isby**

Odyssey Dawn to Unified Protector

On March 19, 2011, aircraft spotters in Malta were out in force to catch the arrival of a Lufthansa Airbus A380 on a training flight – the first visit of an A380 to the central Mediterranean island state. But a set of parallel contrails high overhead turned out

to be the most memorable sight of the day.

Those with zoom lenses trained their cameras on the high-flyers to reveal four stubby little delta-winged aircraft, heavily laden with under wing stores and canards just visible, set well back from the nose. Rafales! The accompanying four-engine jet with a boom under its tail could only be a French Air Force C-135FR.

For more than a month the world had watched as a popular uprising in Libya spread to city after city. But the Gaddafi regime reacted with massive and indiscriminate force, and the uprising faltered. The pro-Gaddafi forces regained ground until they appeared outside Benghazi, the eastern city which was the centre of the uprising and



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AIR International's team of correspondents report on air operations over Libya

the rebels' main stronghold.

In the meantime, discussions had been going on seemingly endlessly about imposing a no-fly zone over Libya to prevent Gaddafi from using his air force against the uprising. The idea was being promoted by Britain and France, but the United States appeared distinctly unenthusiastic at first. And then there was the question of whether Russia and China would veto a UN Security Council resolution to impose a no-fly zone. But the situation was growing more desperate by the day for the Libyan uprising. If the rebellion failed, those involved in it could expect fearsome reprisals.

The Security Council adopted resolution 1973 on the night of March 17. There were ten votes

in favour, none against, and five abstentions (including Russia and China). The resolution went beyond the imposition of a no-fly zone: it also authorised the use of "all necessary measures... to protect civilians and civilian populated areas under threat of attack", while excluding the occupation of Libyan territory by foreign forces.

Odyssey Dawn Gets Under Way

By the time the resolution was passed, NATO E-3 AWACS aircraft had already been monitoring Libyan airspace for several days. Action to implement the resolution began on March 19 when French Air Force Rafales and Mirage 2000s, supported

by C-135FR tankers, flew patrols over Benghazi. They also destroyed ground vehicles belonging to the pro-Gaddafi forces. It was some of these aircraft whose contrails were observed over Malta that afternoon.

The coalition was widened with the addition of two Arab nations: Qatar sent six Mirage 2000s to Souda, while the United Arab Emirates stationed six F-16s and six Mirage 2000s at Decimomannu. Furthermore, Greece and Sweden committed four F-16s and eight JAS 39 Gripen respectively. A total of 350 aircraft, including transports, tankers and surveillance assets, were reported to be involved in the operation by March 24. The Libyan campaign represented the operational debut of the Typhoon and the Gripen.

There is no questioning the impact of the air campaign. TV footage from Tripoli showed night-time scenes with occasional explosions lighting up the city skyline while anti-aircraft guns fired tracer into the darkness. Libya's air defences were neutralised in short order. By March 23, Air Vice Marshal Greg Bagwell of the RAF was able to report that the Libyan Air Force "no longer existed as a fighting force," and that coalition aircraft were able to operate with near impunity.

Who's in Charge?

In the meantime the coalition was undergoing a change of leadership. Initially Operation Odyssey Dawn was a US-led venture, but the United States made it clear from the start



Above: A Mirage 2000D fighter-bomber takes on fuel from a Canadian Forces CC-150 Polaris during a mission from BA126 Solenzara on Corsica. The aircraft are deployed from BA133 Nancy-Ochey in eastern France. Armée de l'air

Right: A US Navy EA-18G Growler of Electronic Attack Squadron 132 (VAQ-132) 'Scorpions' refuels from a CC-150 Polaris. Six EA-18Gs re-deployed from Al Asad AB, Iraq to Aviano AB, Italy in support of Operation Odyssey Dawn. Luca La Cavera

Bottom: United Arab Emirates Air Force Mirage 2000-9EADs are also participating in the NATO-led Unified Protector operating from Decimomannu AB on Sardinia. Anthony Lovelock

that it wished to scale down its initial involvement and relinquish command of the campaign.

It was logical for NATO to assume command. But at first France opposed this, citing the need to keep the Arab members of the coalition on board. However, NATO command did not appear to trouble Qatar and the United Arab Emirates. Indeed the coalition gained a new Arab member – Jordan, which sent six F-16s to Aviano – on the very day NATO assumed command.

And some NATO members in the coalition were clearly uncomfortable about acting outside the collective direction of NATO. At one point Italy threatened to deny the use of its bases to the operation unless it was brought under NATO direction, while Norway said that its aircraft would not fly missions until the command issue was resolved.

The wrangles over command of the operation reflected disagreements over its nature and

scale. Turkey, in particular, sought to limit attacks against ground targets – partly out of concern about the possibility of casualties among the very civilians whom the operation was intended to protect. The coalition was doing its best to avoid civilian casualties, on one occasion aborting a mission when civilians were reported to be in the target's vicinity. But tragedy struck on March 30 when a loyalist convoy was attacked in a village near Brega. An ammunition truck was hit and the explosion destroyed two homes, killing 7 and wounding 25.

On March 28, it was finally agreed that NATO would assume responsibility for all air operations over Libya. According to some reports, this decision was preceded by sensitive negotiations to determine what constituted legitimate ground targets. The change of command came into effect at 6:00AM on March 31, and Operation Odyssey Dawn (the US codename for the campaign) became Operation Unified Protector.

In the following days the USAF withdrew its attack aircraft from the campaign, although it continued to provide support in the form of air-to-air refuelling and intelligence-gathering. Reportedly, this led to the operation suffering a shortfall in strike assets, particularly because not all national contingents in the campaign were flying air-to-ground sorties. As a result, the RAF sent an additional four Tornados to Gioia del Colle and reassigned four Typhoons from air-to-air to strike missions.

Charles Poliadano

Air power's Role

At the turn of the year if anyone had seriously suggested that at the end of March more than 350 combat aircraft from 12 nations would be conducting a strategic air campaign against Libya, under the banner of United Nations Security Council resolution, they would have got short shift. In the list of likely Middle East conflicts, war with Libya would not have seemed likely compared with an escalation in the crisis in Afghanistan, the nuclear stand-off with Iran or spill over from the Arab-Israeli conflict. But on March 19 that remarkable turn of events became reality with the start of combat operations against Libya by French Air Force (Armée de l'Air – AdLA) Dassault Rafale and Mirage 2000 jets.

First Strike

Fighting between rebel fighters in the east of the country and government troops escalated during the third week of March and it seemed as if Gaddafi's troops were only hours away from launching a ground assault

on the rebel strong hold of Benghazi. While diplomats at the United Nations in New York were putting the finishing touches to a Security Council resolution on March 17 authorizing the employment of "all necessary measures" to enforce a no-fly zone, protect civilians and impose an arms embargo, senior military planners from the UK, France and US Africa Command were meeting in Europe to try to stand-up a command structure for the imminent operation and bring combat forces to operational readiness. Time was short and there were no contingency plans to draw upon for this mission.

The headquarters of US Africa Command in Stuttgart, Germany, would have overall control of the mission. Real-time command and control of the air aspects would be given to senior US air commanders of the 17th Air Force from the combined air operations centre (CAOC) at Ramstein AB in Germany, a facility usually used by US European Command's air component.

Staff of US Africa Command's air component, under Major General Margaret Woodward, was augmented by liaison staff from the British, French and other air forces who prepared to choreograph the air campaign, generate a daily air tasking order and make initial bomb damage assessments.

As world leaders met in Paris on the morning of March 19 to finalise plans for the operation, Libyan tanks were attacking Benghazi. French President Nicholas Sarkozy ordered the Armée de l'Air to launch a mission to hit the tanks and blunt the assault. Early in the afternoon a French Air Force strike package of 12 Rafale and Mirage 2000s were in

ITALY

A VIEW FROM ITALY

Italy is on the front line in this war, and in spite of its friendship agreement with Gaddafi, decided to participate, at first putting seven airbases at Trapani, Sigonella, Decimomannu, Amendola, Gioia del Colle, Aviano, and Pantelleria at the disposal of the coalition. Italian Air Force assets directly assigned and committed to Operation Odyssey Dawn were four Tornado ECRs and four F-16A/ADFs from 37° Stormo, all based or deployed at Trapani.

At 20:00 on March 20, the Italian Air Force also started to launch its aircraft against Libyan regular forces: the first mission included four Tornado ECRs from 50° Stormo, tasked to provide Suppression of Enemy Air Defence (SEAD) with AGM-88 HARM missiles, supported by two Tornado IDS from 6° Stormo, equipped with 'buddy-buddy' in-flight refuelling pods.

On March 27, Italy placed four AV-8B+ Harriers from the GRUPAER (embarked on the carrier Garibaldi) at the disposal of NATO, while four F-2000As replaced the four F-16A/ADF previously assigned to the coalition operations. **Riccardo Niccoli**



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the air over Benghazi area and had knocked out some 14 government tanks and armoured vehicles. The urgency of the situation meant this mission was flown before a planned series of strikes to put the Libya air defence system out of action could be launched. The French jets were escorted by a Transall C-160G, which patrolled in the area to detect the activation of Libyan air defence radar systems with its onboard electronic intelligence (ELINT) gathering equipment.

In the wake of these strikes, nearly a dozen NATO and two Arab nations scrambled to get combat aircraft within striking distance of Libya to augment the initial operations by the US, UK and France. A week after the start of the conflict, 12 nations had deployed more than 350 military aircraft to participate in operations around Libya with further reinforcements still en route.

Air Strikes

Suppressing Libya's air defence network has been at the heart of allied air operations since the start of Operation Odyssey Dawn. While the bulk of the allied air and cruise missile efforts on the first couple of days was directed at neutralising the Libyan fixed air defence system, the pressing need to protect civilians in Benghazi and other cities from attacks by pro-Gaddafi ground forces has raised the importance of escorting allied close air support aircraft with suppression of enemy air defence (SEAD) assets because of the threat of mobile and low level air defence systems.

A week into the campaign and allied air operations had matured

considerably and a fairly consistent battle rhythm had been established. The strategic campaign against the Libya command and control infrastructure and air defence system has continued but at a much lower level of activity. Tomahawk Land Attack Missile (TLAM) shooting ships and submarines have carried the burden on this mission, firing between five and a dozen TLAMs on a nightly basis as new targets emerge or BDA analysis reveal that old targets need to be struck again.

Three or four packages of manned strike aircraft were also launched against selected fixed targets that required heavier warhead equipped weapons to destroy them on a nightly basis. Tornado GR4s launched night time missions from RAF Marham, Norfolk, against Libyan air defence and command and control sites. Flying 3,000 mile (4,800km) missions lasting six and a half hour missions from and to their Norfolk base, each

of Tornado GR4 carried two Storm Shadow air-launched cruise missiles.

On a 24/7 basis allied air forces stood up three 'defensive counter-air' CAPs off the eastern Libya coast ready to react to any hostile air activity that threatened the no fly zone. Fighters from several allied nations were rotated through these CAP stations ready to engage targets.

Four close air support (CAS)/ interdiction CAPs were also maintained along the coast, with one off Tripoli, two off Misrata and one off Benghazi. At any one time a pair of strike aircraft would be manning each CAP station ready to engage any emerging targets stage offensive operations. The cueing of targets fell to ground moving target indicator (GMTI) and synthetic aperture radar (SAR) equipped intelligence, surveillance, targeting and reconnaissance

(ISTAR) platforms. These include RAF Sentinel R1 ASTOR, USAF RQ-4 Global Hawk and E-8C Joint-STARS. Electronic intelligence (ELINT) and signals intelligence (SIGINT) platforms, including an RAF Nimrod R1, US Navy EP-3E Aries II, USAF RC-135 Rivet Joint and French Transall C-160 Gabriel, were also kept on station off the Libyan coast to provide complementary surveillance coverage. To sustain these operations on a daily basis up to 11 air-to-air refuelling tracks were set up and sustained off the Libyan coast by British, Canadian, French, Italian and US tankers.

By the end of the first week of the war on almost an hourly basis, the strike aircraft loitering off shore were called forward to engage Libyan targets, with US attack aircraft operating mainly at night and European strike aircraft during daylight hours.

For the pilots of these aircraft,





target identification on the confused Libyan battlefield is proving to be a major challenge. Unlike in Afghanistan where air strikes have to be controlled and authorized by joint terminal attack controllers (JTACs) or forward air controllers, in the Libyan theatre, RAF aircrew have delegated authority under the rules of engagement to decide to attack ground targets.

The allied air campaign under went a major evolution on March 31 when command transitioned from US Africa Command to NATO. Overall command of the NATO air component was taken over by the Allied Air Component Headquarters at Izmir in Turkey. This NATO headquarters has peacetime responsibility for all alliance air operations in the Mediterranean region, under its commander Lt Gen Ralph Jodice II, US Air Force. Real time command of air operations over Libya was transferred from the Ramstein CAOC to NATO's Combined Air Operations Centre 5 at Poggia Renatico airbase in northern Italy. **Tim Ripley**

Libyan Armed Forces Order of Battle

The IISS 2009 military balance lists the Libyan Army as including 25,000 volunteers plus 25,000 conscripts organized into 10 tank battalions, 10 mechanized brigades, 18 infantry battalions, 6 commando battalions, 22 artillery battalions, 4 surface-to-surface units and 7 air defence artillery battalions. This force



included some 2,000 tanks, most of Russian manufacture including T-72, T-62s and T-55s, 1,900 armoured vehicles, 2,400 artillery, and mobile surface-to-air (SAM) missile batteries with FROG-7 and SCUD rockets.

Army air defence was provided by mobile 2K12 Kvadrat (SA-6 *Gainful*), SK-33 Osa (SA-8 *Gecko*) Crotales, SA-7/9K31 Strella (SA-9 *Gaskin*), 9K35 Strella 10 (SA-13) SAMs and a variety of gun systems. The 32nd Khamis Brigade was thought to be the primary force protecting the regime. In early 2011 units considered supporting the regime included about 10,000 army, 3,000 revolutionary guards and 1,000 mercenaries from Chad and Nigeria.

The Libyan Air force included a personnel strength of more than 20,000 more than 40 squadrons with more than 350 aircraft. This includes French Mirage F1 fighters, Russian Su-22, Su-24, MiG-21, MiG-23 fighters, L-39 fighter-bombers and Mi-24 attack helicopters, which have been used in action against the rebels, plus a large transport and helicopter element. The capabilities of the Libyan air force seem to have been seriously impacted by reduced funding, and the current political challenges. Two Libyan

pilots defected to Malta with their Mirage F1s and a crew of an Su-22 is known to have bailed out rather than attack the rebels. A number of other Libyan jets have crashed either due to technical problems or been shot down. The media confirmed the loss of a MiG-23 near Benghazi on March 19.

The Libyan Air Defence Force includes a significant but aging mix of early warning, command and control radars, command and control sites, surface-to-air missiles and gun batteries and 10 squadrons of Mirage F1 and Russian MiG-23 interceptors. This force is credited with having the second largest collection of radars, weapons and interceptors in Africa (second only to its Egyptian neighbour). A 2010 report by US analyst Sean O'Connor credits the Libyan air defence network with five regional commands supported by 17 active early warning/EW sites which included a mix of Russian-supplied P-12/18 *Spoon Rest*, P-14 *Tall King*, P-35/37 *Tall King* and P-80 *Back Net* radars and the force was also thought to have received Italian LPD-80 radars. The report listed 31 strategic SAM sites in Libya with a mix of four long-range S-200 (SA-5 *Gammon*), eleven medium-range S-75 (SA-

2 *Guideline*) and sixteen S-25M *Neva* (SA-3 *Goa*). Many of these strategic SAM sites are located near each other to provide overlapping coverage, with the bulk located near the coast to protect Tripoli, Benghazi and major military air bases.

While separate from the air defence force, Army air defence mobile assets could provide protection for critical targets around Tripoli, military bases and airfields as well as armoured forces engaged in combat with the rebels. The 2K12 Kvadrat (SA-6 *Gainful*) SK-33 Osa (SA-8 *Gecko*) and Crotales mobile radar guided SAMs proved to be effective in previous air engagements due to their mobility. IR-guided 9K31 Strella (SA-9 *Gaskin*), 9K35 Strella 10 (SA-13) shoulder-fired SA-7 and similar SAMs and a variety of gun systems could also prove to be a nasty surprise to low-flying strike aircraft and slower gunships like the AC-130.

Lon Nordeen and David Isby

Operation Harmattan

Initial Armée de l'Air (AdIA – French Air Force) sorties included Dassault Rafale B/C combat aircraft from the EC.01.007 'Provence' squadron departing their base at BA113 St Dizier-Robinson, northeast France, to commence reconnaissance operations over Libya. During the same day, AdIA aircraft dropped their first ordnance destroying four Libyan Army armoured vehicles located to the southwest of Benghazi in eastern Libya. These vehicles were hit by





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Above: An AV-8B Harrier assigned to the 26th Marine Expeditionary Unit returns to the amphibious assault ship USS Kearsarge (LHD 3) on March 21 for fuel and ammunition resupply while conducting air strikes supporting Operation Odyssey Dawn. LCpl Michael Lockett/US Marine Corps

Top left: On March 23, 2011 a Spanish Air Force CN-235 VIGMA (Vigilancia Marítima, Maritime Surveillance) took off from Getafe AB near Madrid for Decimomannu AB on Sardinia. The aircraft is helping to enforce the arms embargo on Libya operating over the Gulf of Sirte and southern Mediterranean Sea. Anthony Lovelock

Below left: Spanish EF-18M Fighters refuelled at NAS Sigonella, Italy, on March 22 following a combat air patrol mission flown as part of Operation Odyssey Dawn. The aircraft are deployed to Decimomannu AB on Sardinia from Ala 12 at Torrejón AB near Madrid. SSgt Brendan Stephens/US Army

Sagem Armement Air-Sol Modulaire (AASM/Modular Air-to-Ground Weapon) precision bombs dropped by the Rafales, and GBU-12 Paveway II laser-guided bombs dropped by Mirage 2000D aircraft from the EC 03.003 'Ardenne' squadron from BA133 Nancy-Ochey, northern France. These aircraft later recovered to BA126 Solenzara, Corsica,

which has since become a major airfield supporting Harmattan.

The following day (March 20) saw AdIA aircraft perform eleven more sorties, with additional air strikes by the force on March 21, during which a Mirage 2000D hit a Libyan tank around 100km (62 miles) south of Benghazi. Up until March 22, Harmattan had mainly been an 'air force show', although this changed

with the Marine Nationale (French Navy) aircraft carrier *Charles de Gaulle*, commencing operations with its embarked air wing. This air wing comprised Rafale-M F3 and Dassault Super Étendard Modernisé (SEM) aircraft, performing reconnaissance and combat air patrols.

Air-to-ground operations significantly increased on March 24, following the attack of a Libyan

air base with a MBDA SCALP-GP air-to-ground cruise missile. Other air-to-ground attacks include the destruction of a Libyan Air Force Soko G-2 Galeb with an AASM as the aircraft landed at Misrata airport in western Libya. The G-2 was reportedly one of a further five aircraft that were struck by French warplanes at the airfield on March 26; along with two Mil Mi-35 *Hind-E* attack helicopters. Misrata airport is a dual-use facility that provides training to Libyan air force aircrew, along with civilian flights. In addition to the destruction of the G-2s at Misrata, Mirage 2000Ds used GBU-12s to hit Libyan Army artillery near Ajdabiyah, around 160km (100 miles) south of Benghazi, with operations against artillery in this area continuing the following day.

March 27 saw a combined strike package of AdIA and Aéronavale (French Naval Aviation) Rafales hit a 'command centre' located to the south of Tripoli, with an ammunition dump at Gharyan, 62 miles south of Tripoli attacked by navy Rafales and Étendards on March 28. The same day, Mirage F1CR reconnaissance aircraft from the ER 02.033 'Savoie' squadron based at BA112 Reims-Champagne, northern France, performed their first sorties. In fact, Gaddafi's military facilities continued to be the focus of operations on March 29, day eleven of Harmattan, with a military depot 30km (19 miles) south of Tripoli being hit, along with an anti-aircraft missile installation 100km (62 miles) to the southwest of the city.

SPAIN

OPERATION ARGOS

On March 18 the Council of Ministers of Spain approved the agreement submitted by the Ministries of Defence and Foreign Affairs for which it gave its approval to the participation of the Spanish armed forces in military operations against the regime of Colonel Muammar Gaddafi, in compliance with resolutions 1970 and 1973 of the United Nations Security Council.

The Spanish contribution is twofold: firstly to help ensure the air exclusion zone and secondly to ensure the embargo decided by the United Nations. In the first case, the Spanish Government initially authorized the deployment for in-flight operations for an extended period of a month depending on the situation, while for embargo operations it was approved a deployment for three months, also renewable.

As for the no-fly zone, the Government of Spain has earmarked a total of 5 aircraft under Operation Argos, in particular 4 EF-18M fighter bombers belonging to Ala 12, Torrejón de Ardoz, and a Boeing 707TT refuelling plane belonging to 47 Grupo, all under the Command of Ala 12 Lt Col Luis Villar and bound for Decimomannu AB, Sardinia. Both fighters and refuelling aircraft as well as the about 100 military personnel were deployed to Italy on March 19, Spain being one of the first countries to deploy its military resources to contribute to air operations, as recognized by the NATO Military Committee. This rapid deployment was largely due to the fact that Ala 12 squadrons were in a six-monthly period of stand-by status— ready to intervene immediately if necessary— within the 16th NATO Response Force (NRF).

The first combat air patrol performed by Spanish EF-18Ms was conducted two days after arrival in Sardinia. During these flights, each one lasting around four hours, the Spanish aircraft did not report any incidence or receive any order to intercept suspicious aircraft in the international operation to control the air exclusion zone. The Spanish Ministry of Defence also reported that there were no plans to expand the Spanish fighter jets air-to-air role to air-to-ground attack against Libyan military targets.

A day earlier, the Spanish President also announced that both Morón AB near Seville and Rota Naval Air Station in Cadiz had also been made available for carrying out the mandate of the UN.

Since then both bases are being widely used by the US Air Force to conduct the pre-positioning of its fighter, bombing and refuelling aircraft, also contributing to the large logistical effort carried out by the US transport planes since the start of operations over Libya. Of the two, Morón has been the busiest, with dozens of KC-135s and KC-10s stationed permanently at the base and flying on a daily basis. E-8C Joint STARS and EP-3 Orions are stationed at NAS Rota.

Since March 23, the Spanish Government has a CASA C-235 VIGMA and 12 crewmen, deployed to Decimomannu for maritime surveillance. The Spanish maritime patrol aircraft is participating in the NATO effort in compliance with the arms embargo on Libya. The aircraft flew its first mission on March 26, and reported no violation during its four-hour patrol. Roberto Yáñez and Alex Rodriguez



Strikes against Gaddafi's air defences continued on March 30, with an anti-aircraft missile battery 20km (12 miles) south of Sirte being hit by AdIA and Aeronavale Rafales, Mirage 2000s and SEMs. These air defences may have been co-located at Ghardabiya AB. As of the time of writing French aircraft were continuing to attack Gaddafi's forces, with Libyan armour located at Al Khums, to the west of Misrata being hit on April 1, with five armoured vehicles to the west of Sirte struck the following day.

The Rafale, SEM, Mirage 2000D and Mirage F1CR aircraft comprise one part of a wider French deployment of aircraft. Mirage 2000-5s from the EC 01.002 'Cigogne' squadron based at BA102 Dijon-Longvic, eastern France, have performed air defence, while C-135FR tankers from GRV 02.091 'Bretagne' squadron based at



Three B-2s travelled halfway around the world to deliver 45 GBU-31(V)/B joint direct attack munitions (JDAMs) each weighing 2,000lb (907kg). TSgt Shane Cuomo/US Air Force

GREECE

GUARD WATCH AT SOUDA



The Qatar Emiri Air Force has six Mirage 2000-5DDAs deployed to NAS Souda Bay on the island of Crete supporting Operation Unified Protector. Paul Farley/US Navy

As Operation Odyssey Dawn evolved in mid-March, the strategic location of the US Naval Support Activity base at Souda in Crete placed the facility at the forefront of coalition operations against Libya. Colloquially known as NAS Souda Bay, the base is in close proximity to the Middle East and the Gulf of Sirte the base holds considerable capability in the eastern Mediterranean. Thus with these factors in mind, the US and its allies immediately asked the Greek Government for permission to base fighter aircraft at Souda to help enforce the no-fly zone over Libya.

Six Royal Norwegian Air Force Block 15 F-16A MLU Fighting Falcons arrived from Bodo AB with a 120-strong detachment on March 20 having received the go-ahead from the Norwegian Defence Minister Greta Faremo. The Norwegian F-16s commenced flying on March 24 striking tanks, artillery and other military targets including hardened aircraft shelters in Northern Libya. The Norwegian F-16s carry IRIS-T air-air missiles, 500lb (227kg) GBU-38 JDAMs and an ALQ-131 pod for self-defence. Qatar one of two Arab countries involved in Odyssey Dawn also expressed a desire to operate its Mirage 2000-9 fighters from Souda. A diplomatic issue arose when the Cyprus government was late in accepting the flight plans for transit flights of the Qatari aircraft. Despite this, two Qatar Emiri Air Force Mirage 2000-9s from No.7 Squadron based at Doha landed at Larnaca, Cyprus during the morning of March 22 and departed for Souda in the late afternoon. The Qatari detachment was supported by a C-17A Globemaster one of two in service with the Qatar Emiri Air Force. A third Mirage 2000 arrived from Qatar via Incirlik in Turkey on March 25. Greece and Qatar do not have a Memorandum of

Understanding covering air combat training, consequently the Hellenic Air Force squadrons based at Souda were not involved in training with the Qatari detachment. This task was undertaken by the French Air Force which deployed three Mirage 2000-5Fs of EC 01.002 'Cigognes' from BA102 Dijon-Longvic to Souda on March 24 to fly joint missions over Libya. Both the French and Qatari pilots were given briefings on local air traffic control procedures at Souda Bay by Hellenic Air Force staff. A fourth French Mirage-2000-5F arrived at Souda on April 1. Two French and two Qatari Mirages flew the first mixed mission to enforce the no-fly zone over Libya enforcement mission from Souda for the first time on March 26. Subsequent missions involve mixed pairs flying night time combat air patrol missions. The French aircraft are armed with MICA IR/EM missiles, the Qataris with a combination of MICA and Magic missiles. Qatar currently has six Mirage 2000-9s and 200 personnel deployed to Souda Bay. Although the Hellenic Air Force has not flown any CAP or bombing missions since the operations started, the Greek government from the very beginning pledged a SAR helicopter and an AWACS aircraft. The SAR commitment is met by a Super Puma of 384 Squadron based at , which is on 15 minute readiness alert around the clock. The Hellenic Air Force is also providing a EMB-145 Erieye of 380 Squadron based in Elefsina to provide AWACS cover. The first such mission was flown on the night of April 1, when a single EMB-145 provided airspace control of Libyan airspace while flying a racetrack pattern over the Mediterranean Sea between southern Crete and the Libyan coast to the northwest of Benghazi. This marked the type's combat debut with the Hellenic Air Force. Kyriakos Paloulian

BA125 Istres-Le Tubé on France's Mediterranean coast provide refuelling. Command and control support comes from E-2C Hawkeye aircraft of the Aeronavale 4 Flotille based at BAN Lorient-Lann Bihoué on France's Atlantic coast, along with E-3F AWACS operated by the EDCA 01.036 and EDCA 02.036 squadrons at BA702 Avord in central France.

In addition to these assets, signals and communications intelligence gathering is thought to have been performed by C-160G Gabriel aircraft of the EEA 01.054 'Dunkerque' squadron based at BA126 Metz-Frescaty in northern France, although the French Ministry of Defence declines to comment publicly on the operation of these aircraft. Furthermore, France's Helios-2 imagery intelligence satellites, along with pictures gathered by the Rafale's Thales Reco-NG reconnaissance pods, have been essential for providing imagery to facilitate target planning for French air strikes, and possibly for other NATO nations.

Meanwhile, the 'vanilla' version of the Transall, the C-160R from BA123 Orléans-Bricy, has played an important role transporting munitions, such as the AASM, to the base in Corsica. Furthermore, the EH 01.067 'Pyrénées' Combat Search And Rescue (CSAR) squadron based at BA120 Cazaux on France's Atlantic coast, operating Eurocopter EC725R2 Caracal and Aerospatiale SA330BA Puma helicopters have deployed onto French Navy vessels in the Mediterranean to perform CSAR for any downed French air crew.

As the air campaign against Colonel Gaddafi's armed forces enters its fourth week, the AdIA



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SSgt Marc Lane/US Air Force

and the Aeronavale are continuing their tempo of air strikes against the Libyan military. **Tom Withington**

11,500-mile Missions to Libya

Before the United States scaled back its role in the air campaign over Libya and looked to NATO allies to take over, both the B-1B Lancer and B-2 Spirit bombers took part in the effort.

For its opening salvo in Operation Odyssey Dawn, the US Air Force unleashed three B-2 stealth bombers and sent them on what one reporter called a "stamina-sapping," 25-hour bombing mission. The B-2 is what the USAF calls a 'high demand, low density' asset, a kind of silver bullet reserved for the most crucial, high-value targets.

Leaving on March 20 from

Whiteman AFB in cow pastures near Knob Noster, Missouri, the B-2s travelled halfway around the world to deliver 45 GBU-31(V)/B joint direct attack munitions (JDAMs), or satellite-guided bombs each weighing 2,000 pounds (907kg). Each B-2 carries a two-person crew – both pilots, seated side-by-side, who take shifts to relieve fatigue on far-reaching sorties. The 509th Bomb Wing at Whiteman, the only B-2 unit and a successor to the wartime group that bombed Hiroshima, operates the United States' 19 B-2s, of which 16 are 'combat coded', meaning ready for duty. The B-2 is powered by four 19,000lb (kW) thrust General Electric F118-GE-100 non-afterburning turbofan engines with intake and exhaust located atop the aircraft to shield them from detection from below.

The sinister-looking, bat-like B-2s drew the task of destroying key targets in Moammar Gaddafi's air defence and command and control systems, a first step toward establishing a United Nations-mandated 'No Fly Zone' that would help prevent Gaddafi forces from massacring rebels. US officials insist that Gaddafi himself was not a target of the B-2 strike or of any other sorties being flown into Libya.

Critics carped that flying a B-2 sets back the US taxpayer \$10,000 per hour, not realizing that they had the number wrong and were, in effect, arguing against themselves. Where they got this widely published figure is unclear but the official figure according to information provided to the author is actually \$44,000.

The US press also reported widely

that the B-2 is the only US warplane equipped to deliver the GBU-37 "bunker buster," a 5,000-pound (2,250kg) bomb with a hardened nose that can bore through 20 to 30 feet of rock or reinforced concrete before detonating. That's true enough, but according to information provided to the author, the GBU-37 was never considered for Libya, where B-2 targets were airfields and air defences, not leadership headquarters.

A week into Odyssey Dawn on March 27, launched after two days' notice, two B-1B Lancers of the 28th Bomb Wing at Ellsworth AFB, South Dakota attacked targets in Libya on March 27. They departed their home base amid what a US Air Force press release called "dismal weather, including four inches of snow, glare ice, and freezing fog."



B-1Bs took off from the continental United States on combat sorties for the first time on March 19 to strike targets in Libya. The two bombers were assigned to the 28th Bomb Wing based at Ellsworth AFB, South Dakota. SSgt Marc Lane/US Air Force



Marathon Mission

It was the first time B-1Bs took off from the continental United States on combat sorties to strike overseas targets said Col Jeffrey Taliaferro, commander of 28th Bomb Wing based at Ellsworth AFB, South Dakota.

The B-1B carries two pilots and two combat systems officers (CSOs). Four, 30,000lb (133.4kN) thrust F101-GE-100 turbofan engines provide power for the bomber, which has 'swing wings' —variable geometry wings that can be swept forward for low-speed manoeuvring or backward for a high-speed dash.

Capt Donavon Davis is a B-1B pilot and was the mission lead on the flight from South Dakota to Libya—the longest mission any of the crewmembers had ever flown. This gave him "an adrenaline rush like you wouldn't believe," Davis said when crews appeared at a brief press conference in Rapid City where Ellsworth is located.

"In just under two days from our initial notification to launch, we were able to generate several aircraft, hundreds of weapons, and launch those aircraft," Taliaferro told reporters. He said the bombers flew for nearly an entire day to reach their targets and return, landing back at Ellsworth almost exactly 24 hours after taking off. Others on Davis's crew included co-pilot Maj Andrew Pernell and combat systems officer Capt Matt Tull.

Both the B-2 and B-1B operations illustrated the far-reaching prowess of US bombers. Still, it is difficult not to wonder if the B-1B flight was also a gesture to Capitol Hill, where lawmakers have long had their eyes on shutting down Ellsworth. Last year, the US Air Force announced a plan to gradually withdraw about half of its B-1Bs from service, beginning with six airframes in fiscal year 2012. The use of B-1Bs over Libya was unexpected; even by airmen stationed at Ellsworth and some believe their mission could have been flown by tactical warplanes.

Robert F Dorr

US Naval Aviation in Odyssey Dawn

It is not known if US President Barack Obama asked the proverbial question, "Where are the carriers?" when civil war broke out in Libya, but there was not one in the Mediterranean Sea. USS Enterprise (CVN 65), with Carrier Air Wing One (CVW-1) embarked, had just completed a transit of the Suez Canal bound for the North Arabian Sea and Persian Gulf after Egyptian President Hosni Mubarak stepped down. Enterprise lingered in the Red Sea as Operation Odyssey

Dawn began, but the coalition forces at hand seemed adequate for the no-fly zone job, and Enterprise proceeded to the North Arabian Sea to provide strike aircraft over Afghanistan.

Not that there was no US Navy flat-top in the Med. The amphibious assault ship USS Kearsarge (LHD 3), heading home from a deployment to Southwest Asia, was on hand, with Marine Medium Tiltrotor Squadron 266 (Reinforced) (VMM-266) embarked. VMM-166 'Thunder Eagles', equipped with Bell-Boeing MV-22B Osprey tilt-rotor transports, was the air combat element for the 26th Marine Expeditionary Unit and had a Bell AH-1W Super Cobra and Bell UH-1N 'Huey' detachment from a Marine Light Attack Helicopter Squadron (HMLA) and a Sikorsky CH-53E Super Stallion detachment from a Marine Heavy Helicopter Squadron (HMH). The Kearsarge also hosted a detachment of armed Sikorsky MH-60S Seahawk helicopters from Helicopter Sea Combat Squadron 22 (HSC-22). But it was a detachment of six

Boeing AV-8B Harrier II strike aircraft from the Tigers of Marine Attack Squadron 542 (VMA-542) assigned to VMM-266 that would see the most action of all of the US Navy units in the operation.

The established no-fly zone would turn into an area where coalition forces struck Libyan air-defence missile sites, radars, missile storage depots with Tactical Tomahawk cruise missiles. Missiles were fired on the first day, 19 March, and thereafter by the Ohio-class nuclear-powered guided-missile submarine USS Florida (SSGN 728), the first Ohio-class boat to engage in combat. Tomahawks also were launched by the Arleigh Burke-class destroyers USS Stout (DDG 55), and USS Barry (DDG 52), and the Los Angeles-class nuclear-powered attack submarines USS Providence (SSN 719) and USS Scranton (SSN 756). As of April 2, US Navy ships had launched a total of 221 Tomahawks (the Royal Navy's ships, including nuclear-powered attack submarine HMS Triumph, had fired an additional seven.) More than half of the total was fired on the first day's blitz.

The Tiger's Harriers were called in to strike Libyan army forces, such as tanks, armoured vehicles, and artillery that appeared to threaten rebel forces, with strafing and precision GBU-12 laser-guided bombs and Joint Direct Attack Munitions. On March 21, when an Air Force F-15E crashed in Libya because of mechanical problems, Harriers covered the successful rescue effort for the crew. One F-15E crew member was picked up within 35 minutes by Tactical Air Recovery of Personnel (TRAP) force of two VMM-266 MV-22Bs and two CH-53Es. The F-15E airman was safe onboard Kearsarge within 90 minutes of his mishap. The second airman was rescued by Libyan rebels and turned over to US custody.

The opportunity for the AV-8Bs on Kearsarge to shine was very timely in view of the Marine Corps' support of the troubled short takeoff/vertical landing version of the Joint Strike Fighter, the Lockheed Martin F-35B Lightning II. If the F-35B is cancelled after its two year probation, the eventual retirement of Harriers — the aircraft that make amphibious

CANADA

CANADA'S CONTRIBUTION

When the United Nations passed UN resolution 1973 to set up a no-fly zone over Libya on March 17, Prime Minister Stephen Harper announced the same day that the Canadian government would send six CF-18 Hornet fighter aircraft to contribute to the United Nations mission. On March 18, seven CF-18s (including a spare aircraft) from No.425 'Alouette' Tactical Fighter Squadron from 3 Wing CFB Bagotville, Quebec, flew to Prestwick, Scotland (for a fuel stop) before proceeding to their operating base at Trapani, Sicily. Supporting the deployment were CC-150 Polaris air-refuelling tanker aircraft from No.437 'Husky' Transport Squadron and a CC-177 Globemaster III from No.429 'Bison' Squadron both from 8 Wing CFB Trenton, Ontario. A CP-140 Aurora aircraft provided Search and Rescue coverage during the trans-Atlantic deployment.

The Canadian air component currently deployed to the Mediterranean is assigned to Task Force Libeccio comprises seven CF-18 Hornets and two CC-150 Polaris tankers based at Trapani AB, and two CP-140 Aurora maritime patrol aircraft based at NAS Sigonella, Sicily. One Aurora is from No.405 Long Range Patrol Squadron from 14 Wing CFB Greenwood, Nova Scotia, and the other from No.407 Long Range Patrol Squadron from 19 Wing CFB Comox in British Columbia. Under the Command of Col Alain Pelletier, Task Force Libeccio has about 250 personnel assigned, including aircrews, technicians and logistics personnel from 3 Wing, 8 Wing, 14 Wing and other locations across Canada. On March 21, operating out of Trapani, the Canadian element of seven CF-18s and two CC-150 Polaris tankers



Seven CF-18 Hornets from No.425 Tactical Fighter Squadron at 3 Wing CFB Bagotville, Quebec, are deployed to Trapani AB for Operation Unified Protector. All images Luca La Cavera
Right bottom: A CC-150 Polaris detached from No.437 Transport Squadron at 8 Wing CFB Trenton, Ontario, taxis on the main runway at Trapani AB, Sicily.
Right top: Laser-guided bombs are being used against targets in Libya by the Canadian CF-18 Hornets during Operation Unified Protector.



Armed with four AASM air-to-ground missiles, a French Aeronavale Rafale F3 waits to be launched from the aircraft carrier Charles de Gaulle bound for Libya. Aeronavale

OPERATION UNIFIED PROTECTOR



completed their first missions. The CF-18s successfully escorted other coalition aircraft on strike missions. All Canadian aircraft returned to base with no shots fired in anger.

The following day two CF-18s (and two CC-150s in support of the CF-18s and other Coalition aircraft) were tasked with an attack on a Libyan airfield, however due to a high risk of collateral damage the pilot's chose not to carry out the attack and returned to Trapani.

Twenty-four hours later, CF-18s accompanied by Polaris tankers conducted two air interdiction missions (one day and the other at night). Four CF-18s employed 500lb (227kg) laser-guided bombs in the destruction of ammunition depots near Misratah in Northern Libya. This was the first operational use of the CF-18 upgraded under the Incremental Modernization Program. Key components of which include the Lockheed Martin Sniper Advanced Targeting Pod (ATP), the Joint Helmet Mounted Cueing System (JHMCS), jam-resistant Link 16 radios, Raytheon's AN/ALR-67(V)3 radar warning receiver (RWR) and colour displays and integration of the AIM-120 AMRAAM missile. CF-18s released 500lb (227kg) precision-guided munitions on a radar site in the vicinity of Misrata on March 25 and

flew two missions to destroy an ammunition depot 60 miles (96km) south of the city on March 27 and 29. The second March 29 raid on the target was ordered because surveillance images showed some of the bunkers survived the first attack. As of midnight GMT on April 7 the Canadian CF-18s had flown 76 sorties, the CC-150s 33 and the CP-140s had flown 11.

The Canadian government has announced that an additional six CF-18s are standing by in Canada to deploy overseas if the Coalition makes a request for additional forces. **Francesco Militello Mirto and La Cavera Luca**



assault ships into strike platforms — would leave the United States with far fewer options to respond with sea-based air power. The proximity of Kearsarge to Libya increases the sortie generation rate of the embarked Harriers.

Operation Odyssey Dawn also marked the first opportunity for the Boeing EA-18G Growler electronic attack aircraft to fly against a hostile air-defence system. Electronic Attack Squadron 132 (VAQ-132) had been deployed to Al Asad, Iraq since November 2010 on the aircraft's first operational deployment, flying combat missions in support of Operation New Dawn. With the planning for Odyssey Dawn, VAQ-132's five EA-18Gs were staged to Aviano AB, Italy, and began flying jamming missions off Libya. It is not yet known if the EA-18Gs fired any AGM-88 High-Speed Anti-Radiation Missiles against Libyan targets.

Other US Navy aircraft involved in Odyssey Dawn included Lockheed P-3C Orion maritime patrol aircraft and EP-3E Aries II electronic reconnaissance aircraft to provide ISR support to the coalition efforts. On March 28, one Libyan Coast Guard 12m patrol craft, Vittoria, along with two smaller craft, fired on shipping in the port of Misrata. A P-3C assigned to Patrol Squadron Five (VP-5) fired two AGM-65F infrared-imaging Maverick missiles and rendered the vessel "ineffective," according to a Navy spokesman. This attack was the first time a US Navy P-3 had fired in anger at a maritime target.

Rick Burgess



OPERATION UNIFIED PROTECTOR



Above: A 48th Fighter Wing F-15E Strike Eagle, loaded with precision-guided munitions and AMRAAM missiles, prepares to taxi from a hardened aircraft shelter at Aviano AB, Italy. The 48th FW lost an F-15E in Libya on March 21 reportedly because of mechanical failure.

Below: The United Arab Emirates Air Force deployed six Block 60 F-16s to Decimomannu AB on Sardinia on March 27. F-16E 3048, armed with AIM-120 AMRAAM missiles, is seen landing at the Italian base. Anthony Lovelock

Early Success

In just over a week of combat operations, the air element of Operation Odyssey Dawn was able to claim some major successes. The threat to Benghazi appeared to have been lifted and rebels had been able to re-take their first major town, thanks in large part to allied air support.

Several new weapon systems were used successfully in combat, including the Tactical Tomahawk Block IV variant that can be re-programmed in flight. The EA-18G Growler proved the worth of dedicated SEAD aircraft. The Italian air force used its KC-130J Hercules tankers for the first time, while the deployment of UAE Air Force F-16E Block 60s is a notable combat debut.

A number of weapon systems also debuted in a conventional war scenario against armoured forces, even though they have been used against insurgents in Iraq and Afghanistan. These include the RAF

Sentinel R1, MBDA Dual Mode Seeker Brimstone air-to-surface missile and the US Air Force RQ-4 Global Hawk. The combination of GMTI/SAR and precision-guided munitions appears to be proving highly effective against Libyan armoured units. The ability of ISTAR platforms to find and identify targets from outside the threat envelopes of Libya air defences is proving particularly useful. The non-appearance of slow flying MQ-1 Predator unmanned aerial vehicles until April 7 was largely due to the still potent nature of Colonel Gaddafi's air defences. This later point seems to suggest that the day of the manned fast jet combat aircraft is not over. **Tim Ripley**

The End Game

The disagreements about command and targeting also reflected worries about 'mission creep' – about the coalition going beyond its mandate and taking sides in what could turn

out to be a protracted civil war. And indeed, as the rebel forces broke out of Benghazi and made their short-lived advance westwards in late March, the coalition appeared to be flying close air support for them. When NATO took over on March 31, it tried to restore clarity by saying that its operational focus would be on protecting civilians, in line with resolution 1973 of the UN Security Council.

This shift of emphasis may have been the reason behind an outburst by rebel general Abdul Fattah Younis, who accused NATO of failing to pursue its air campaign with vigour. In response, NATO denied that its efforts were slackening. It pointed out that Gaddafi's forces had changed tactics, placing heavy weaponry in built-up areas and switching to lighter, more mobile vehicles which were indistinguishable from those used by the rebels. This made targeting harder.

Indeed, on April 2 and 7 there were two friendly fire incidents in which coalition aircraft mistakenly

attacked rebel vehicles. The first such incident reportedly happened after celebratory fire from a rebel anti-aircraft weapon was interpreted by aircraft overhead as hostile fire.

On one hand, NATO's vigorous early pursuit of the air campaign opened it to charges of exceeding its mandate. On the other hand, following resolution 1973 to the letter led to criticism from the rebels that it was not doing enough.

The fundamental problem is that while the resolution casts NATO in the role of neutral overseer of the conflict – simply making sure that neither side targets civilians – the bald fact is that the air campaign was launched to stop the uprising against Gaddafi from being crushed. Quite simply, NATO is on the side of the rebels.

It is another bald fact that, unless the rebels' military cohesion improves dramatically, or unless the Gaddafi regime collapses of its own accord – which, up to the time of writing, it has stubbornly refused to do – NATO's involvement in Libya is set to be prolonged. For the hugely expensive air operation over Libya will have to be kept going so long as Gaddafi remains in power. NATO members are gamely saying that they are in for the long haul, but privately they must be concerned at the prospect of an open-ended commitment over Libya.

At the start of the campaign it was widely thought that, with a protective air umbrella in place, the rebellion would quickly regain strength and sweep Gaddafi from power. But this hope has faded, like those contrails in the sky above Malta on March 19. It remains to be seen how the conflict will develop, and what the end game will be. **Charles Polidano**

