

FIREFIGHTING USAF HERCULES

SALVATION FROM ABOVE



The western USA is well known for the major forest fires that regularly ravage communities and damage the environment.

Dr Kevin Wright visited the 146th Airlift Wing of the California Air National Guard to find out more about its airborne firefighting mission.

Channel Islands Air National Guard (ANG) Station, in Ventura County, California sits on the Pacific coast and is home to the California ANG's Lockheed Martin C-130J Hercules equipped 146th Airlift Wing (AW). The site, which is leased by the State of California, occupies an enclave adjacent to Point Mugu airfield, part of Naval Base Ventura County – the unit has been resident there since the late 1980s.

The Wing's 115th Airlift Squadron (AS) is responsible for eight aircraft and is manned by around 350 full-time staff and 900 part-time ANG members.

In addition to its traditional airlift operations, the 146th AW is one of four USAF units that annually contributes aircraft and personnel to airborne firefighting, also known as the Mobile Airborne Fire Fighting System (MAFFS) mission.

This role is particularly demanding of the crews and as Lt Col Chris Dougherty, Commander of the 115th AS explained, requires its "most talented and qualified crews".

AIR EXPEDITIONARY GROUP

The 115th AS makes two C-130Js available for each fire season. Three other USAF units make similar commitments with older C-130H Hercules, namely the 153rd AW at Cheyenne ANG Base, Wyoming, the USAF Reserve's 302nd AW from Peterson AFB, Colorado Springs and the 152nd AW of the Nevada ANG at Reno, Nevada.

In early 2016 the latter took over the MAFFS mission that had been undertaken by the North Carolina ANG's 145th AW for the past 33 years following a brief transition period.

Combined, the aircraft form the MAFFS Air Expeditionary Group, which is effectively a pool of firefighting USAF aircraft under the control of the National Interagency Fire Center (NIFC) based in Boise, Idaho.

The C-130Js assigned to the 115th AS have more powerful and responsive engines than the earlier C-130H variant, meaning it can transit at higher speeds and has better low-speed control.

As Lt Col Dougherty explained: "the firefighting mission has to be a very flexible

one and crews have to be certified for operations."

Crew training and certification takes place annually before the start of the official fire season, which roughly runs from May to October or early November. Although each of the assigned units has to maintain at least five MAFFS-certified crews ready for fire duty, actual numbers are often considerably higher – of the 45 pilots assigned to the 146th AW, around 30 are fire qualified.

Every five years, 'large group' certification training also takes place – all the contributing units last came together for this in May 2016. The event was hosted by the 146th AW at its Channel Islands ANG base and nearly 400 military and civilian personnel flew in for the gathering.

In addition to the unit's own C-130Js, a further six Hercules from the other units, and nine 'lead aircraft' from the US Department of Agriculture's Forest Service flew more than 200 sorties over the five days from May 2-6.

As part of the process, military flight instructors trained alongside US Forest



“The 2016 MAFFS training and re-certification event was unique because it gathered all five military wings then assigned to the MAFFS role together for training.”

LAST RESORT

Actual operations are very much an inter-agency process and involve the US Forest Service and other federal agencies, as well as the State of California’s Department of Forestry and Fire Protection (CAL FIRE), contractors and other state bodies. Precise coordination is therefore vital.

In essence, the USAF MAFFS provides an emergency capability to supplement existing federal and commercial air tankers. When all other tankers are occupied, but further assistance is needed, the Forest Service can request help from the MAFFS units.

Lt Col Dougherty said “we are the last resort after all other assets are committed, particularly to large or long-running fires when the Forest Service, CAL FIRE, or contracted aerial firefighters become overstretched.”

The reason for such huge firefighting commitments becomes obvious when you look at the risks, losses and costs associated with wildfires. In 2015 alone CAL Fire logged nearly 6,000 wildfires affecting 150,000 acres.

As population and building levels have increased in the Western USA a 2015 ‘Wildfire Hazard Risk Report’ estimated that: “there are now more than 897,000 residential properties in areas that are at high, or very high, risk for wildfires. If destroyed, those homes would cost \$237bn to rebuild.”

To counter this risk, the US Forest Service and related agencies spent \$1.5bn in firefighting and suppression during 2015, and another \$500m in contract firefighting costs. This is in addition to significant State and local expenditures – for instance, over \$200m

a year in emergency suppression costs. By comparison the MAFFS commitment is relatively modest, albeit an important one.

Since its inception in 1974, MAFFS has been very much a joint effort. The US Forest Service owns the equipment and supplies the retardant used for firefighting, while the Department of Defense (DoD) provides aircraft and flight crews, as well as maintenance and support personnel to fly missions.

For a wildfire in California, the California State Governor can activate the 146th AW to assist CAL Fire in firefighting activities. For operations outside the state, or in the case of a major incident, the MAFFS crews can be called upon by the federal-funded US Forest Service following recommendation by the National Multi-Agency Coordinating Group (NMAC). The NMAC is located at the National Interagency Fire Center (NIFC) in Boise, Idaho. The US Forest Service then submits a Request for Assistance to the DoD.

Before the MAFFS crews are called into action, fires may have been burning for some weeks or they may suddenly have become more threatening in their nature. “We usually receive 24 hours’ advance notice of activation,” says Lt Col Dougherty. “[The unit] maintains its two sets of MAFFS equipment, which can be fitted into C-130s in around two hours. Activation involves significant numbers of staff including aircrews, maintainers, loaders and support staff.”

Coordination and tasking of the MAFFS Hercules fleet is maintained by the NIFC’s National Interagency Coordination Center (NICC), which is also located at Boise, Idaho. NICC is responsible for allocating resources, including the tankers, to individual fires and is staffed by members of all four USAF MAFFS units.

In early 2016, when the 146th AW had an aircraft allocated to airlift duties in the Middle East, the unit was moved to the bottom of the on-call list for the duration of the detachment to prevent it being overstretched.

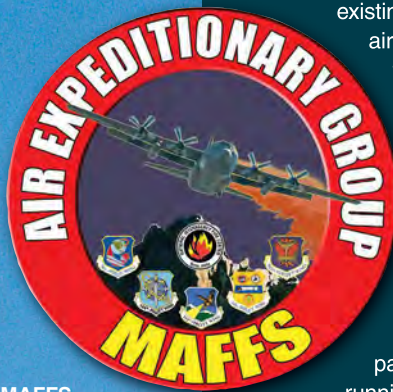
UPGRADE

The original equipment was upgraded to MAFFS II standard from 2008 onwards. The units fit inside the C-130 and are manufactured by the MAFFS Corporation, ▶

Left: A Lockheed Martin C-130J Hercules of the 146th AW of the California ANG performs water drop training in southern California. USAF/Tech Sgt Alex Koenig

Right: The MAFFS C-130s, from four different wings, work together as an Air Expeditionary Group.

Below: The California ANG 146th AW is unique among MAFFS units in flying the C-130J. Dr Kevin Wright



Service aircrew and honed their skills in the mountainous terrain of Southern California. While the aircrew practised over simulated fire lines, the ground crew members fine-tuned their skills servicing and reloading the aircraft when they returned from training drops.

Speaking after the event, Col David Bakos, Commander of the 146th AW, said:



A 146th AW C-130J drops a line of retardant over the trees in support of a CAL Fire call-out near Palm Springs. USAF/ANG Sgt Nicholas Carzis

which is a combination of United Aeronautical and Blue Aerospace.

Older versions of the MAFFS equipment required the water to be dropped through two large-capacity hoses out of the aircraft's rear ramp. However, the MAFFS II system replaces the left rear para-troop door with one that allows the retardant to be dropped out of one side of the aircraft. One great advantage of this is that the aircraft can remain pressurised, thus enabling the Hercules to fly at higher altitudes and achieve faster transits to reach more distant fire targets when necessary.

Lt Col Dougherty explained that "the retardant tank on the C-130 is balanced over the aircraft's centre of gravity and as the tanks drain from the bottom, there is no sudden in-flight attitude change, even if all the retardant is released very rapidly – although the aircraft does become more responsive the lighter it gets."

The aircraft can drop either water or, more usually, a proprietary retardant called Phos-Chek. This is more commonly known as 'slurry' and comprises of 80-85% water with 10-15% ammonium sulphate as well as a gelling agent and a red colouring. The red dye in the retardant is intended to help pilots see where previous loads have been dropped. If required to drop directly onto a fire, and for training drops, ordinary water is used.

Along with retarding the fire, the slurry acts as a fertiliser and the system discharges the agent in a mist so as not to cause damage to buildings.

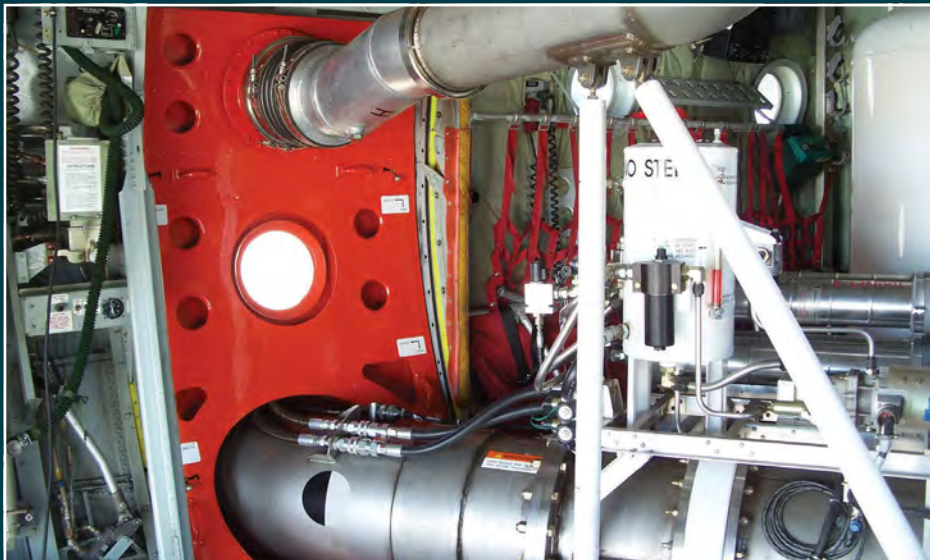
The MAFFS equipment can discharge its maximum 3,000 US gal (11,356 lit) of retardant – weighing some 28,000lb (12,701 kg) – in less than five seconds, covering an area 1,320ft (402m) long and 60ft (18.29m) wide.

The variable controls on the pintaile nozzle also mean that the retardant can be dropped in a single square area or in smaller drops of up to 20 seconds. The retardant is usually dropped from a height of around 150ft (45m) but different altitudes, airspeeds, wind direction and pintaile nozzle settings all affect dispersion patterns.



Above: **The palletised MAFFS II unit is installed in under two hours and is manned by a Crew Chief in the rear of the aircraft.** USAF/SSgt Stephany Richards

Left: **Owned and maintained by the US Forest Service, this MAFFS II unit is being prepared for loading onto a Wyoming Air National Guard C-130H.** USAF/Staff Sgt Natalie Stanley



Left: The MAFFS II unit has a nozzle affixed through a door plug and enables the aircraft to be pressurised in flight. US Forest Service/Richard Stowers

Below: The pintale nozzle can be used at various settings for different retardant dispersal patterns and rates. US Forest Service/Richard Stowers



RETARDANT BOMBING

According to Lt Col Dougherty: "flying firefighting missions requires a very different skill set to our normal transport operations. Pilots must have 4-5 years' experience before we will consider them for a MAFFS co-pilot position.

"Before being considered for a pilot position the individual must demonstrate good 'stick and rudder' skills and prove his/her ability to fly the steep climbs, dives, banking and low flying involved in aerial firefighting. They must also have been a co-pilot for three or more seasons and successfully completed 20 fire drops.

"A co-pilot normally has no role in flying the aircraft but is the trigger man for the retardant release." Units can remain active for several weeks at a time. "It is a very dynamic arrangement" Lt Col Dougherty explained, "and during that time we could be operating from various airfields. We might be at Channel Islands ANG Station, any of the CAL FIRE airfields [such as Paso Robles, Foxfield or San Bernardino], the NIFC at Boise, Idaho or – potentially – any airfield in the USA that



has the ability to refuel a C-130 and fill it up with retardant."

Lt Col Dougherty outlined the daily routine: "Whilst activated the crews receive a morning brief giving details of the general weather, ongoing fires, other [firefighting] assets, smoke conditions and so on. Some days we sit around waiting for a call, on other occasions we might fly continuously from dawn until dusk. When we receive a launch order we can be airborne in 15 minutes if needed. We fly with a crew of two pilots and two loadmasters and all of our drops are flown under Visual

Flight Rules [VFR], in daylight up to around 15 minutes before sunset.

"After take-off we head towards the target and work with air traffic control to get the best routing. They also give us a picture of factors that affect our work, including weather, smoke density and air congestion around the fire. This is also aided by listening in to other participants including other tankers, ground units and fire controllers aboard the CAL FIRE helicopters or OV-10 Broncos. We can be monitoring five or six voices at any one time, so crews are kept very busy just listening in. ▶



The MAFFS C-130s can discharge a full load of fire retardant or water in less than five seconds. USAF/Tech Sgt Alex Koenig

“We can be called in immediately to drop our load but more often we approach at altitude and hold while flying left-hand rectangular circuits at around 120-140kts so the pilot can keep an eye on things. We then announce our presence, keep clear of the main activities and wait to be called down.”

The C-130 can be called upon to drop its retardant load in various ways. In order to be effective the crew need to drop their slurry ahead of the fire and this is generally done along a line decided by the airborne fire controller known as the Air Tactical Group Supervisor, better known as ‘Air Tach’. Air Tach works with another aircraft, a Lead Plane, which the C-130 follows to the drop.

The Lead Plane is normally a Forest Service Beechcraft 90 and can fly a ‘show and tell’ run to indicate to the Hercules crew the line they should adopt. The C-130 follows around 1,000ft (305m) behind a lead aircraft. The lead pilot

indicates when they want the Hercules crew to release their load by emitting a puff of white smoke.

Descending to approximately 150ft on the run in to the target, the pilot concentrates

‘The lead pilot indicates when they want the Hercules crew to release their load by emitting a puff of white smoke.’

on getting the aircraft in the correct attitude, following the right line, maintaining the correct speed, listening to instructions from the lead aircraft and being aware of potential escape routes in case of problems. Flap and

power control are particularly critical as the speed decreases.

The retardant is dispensed on the call “Ready... ready... drop”, when the co-pilot pushes the release button having pre-selected whether a short 2-3 second spray is required or a more controlled 20-second spray is required. As the slurry leaves the aircraft, it finally becomes lighter and thus more manoeuvrable, helping the crews climb away to safety.

During activation periods 12-hour flight days are not unusual and individual mission durations can vary considerably depending on how long it takes to reach the incident and the time the aircraft is kept holding prior to dropping.

After landing the aircraft can be filled with a new load of retardant and ready to go again in less than 20 minutes if required.

Whilst on the ground, flight crews are looked after by support staff from the various participating agencies and when particularly busy have been known to eat meals in their seats whilst the aircraft is being refilled with retardant.



A MAFFS-equipped C-130 from the 302nd AW approaches a major wildfire near Pocatello, Idaho on August 10, 2016.

USAF/Lt Col Frank Wilde



A US Forest Service ‘lead plane’ guides two C-130s to the drop coordinates. Dewey Baars



Each year the four MAFFS units undertake qualification and certification together. Here a C-130H from the Wyoming ANG's 153rd AW discharges its load during 2016 drop training. USAF ANG/Tech Sgt Emerson Marcus



The Nevada ANG's 152nd AW 'The High Rollers', took over the MAFFS role from the North Carolina ANG during 2016. Here the last unit is loaded for transportation to its new home at Reno. USAF ANG/1st Lt Monica Ebert

RISKY BUSINESS

No matter how exciting these missions sound, the dangerous nature of MAFFS operations should not be forgotten.

On July 1, 2012, a C-130H from the North Carolina ANG's 145th AW crashed while fighting a wildfire near Edgemont, South Dakota. The official Air Accident Investigation Report detailed that it was brought down by "a microburst of turbulent air out of a thunderstorm" at the cost of four lives and two more crewmen who suffered major injuries.

On August 3, 2016 the Air Expeditionary Group was activated in response to a US

Forest Service support request. Aircraft conducted sorties out of Boise, Idaho primarily attacking the so-called 'Pioneer Fire' in the Boise National Forest.

Crews from the 302nd AW and 153rd AW were engaged first, followed by aircraft and crews from Nevada ANG's 152nd AW – the latter undertaking its first 'live' missions since being activated in the MAFFS role. The crews also fought other wildfires across Idaho, Nevada and Oregon for a month.

On August 17, the 146th AW was also activated, this time to support CAL FIRE wildfire suppression efforts within California. The unit mainly flew from its home base and was committed to deal with the major 'Rey Fire', just 38 miles (61km) away near Santa Barbara. The efforts peaked on August 23 when crews made a total of 27 drops.

MAFFS firefighting missions were also undertaken against fires in the Hearst Castle area of San Luis Obispo before the 146th AW stood down on August 30. During the activation period the two California ANG aircraft and crews made 112 drops using around 288,000 US gal (1,090,195 lit) of retardant.

The Federal MAFFS year ended on September 3 by which time a total of 165 drops had been performed and 396,632 US gal (1,501,411 lit) of retardant dispersed.

At the end of the season the C-130s and their crews returned to normal transport flying and the MAFFS equipment was removed from the aircraft to be cleaned, serviced and maintained by US Forest Service personnel in readiness for the next call-out. **AN**



Colouring the 'slurry' enables following crews to see where retardant has previously landed. USAF/SSgt Stephany Richard