MILITARY AERIAL FIRE-FIGHTING – A DROP IN THE OCEAN!

Ben Drew, Head of Programmes, takes a look at aerial fighting performed by the world's armed forces and asks why they do not perform this mission more widely considering their current aircraft inventory and the increasing global threat from wildfires.

Some air forces already play a pivotal role in the fire-fighting response, as governments expand their military's mission to protect their people and resources. The assets which include army and naval aviation helicopters units, have operated in this mode in countries like the US for many years, to back up civil protection and homeland security authorities firefighting efforts.

But, considering the number of military fixed-wing transport aircraft in global operation, I am surprised that the aerial firefighting mission is not more widely exploited by senior military echelons. Clearly aerial firefighting is not a primary military mission but most air force crews are well- trained in Container Delivery System (CDS) dropping techniques. Usually it is in the replenishment or humanitarian missions, but with new CDS aerial firefighting systems now available they might start recognising their ability to operate aircraft that could provide an immediate aerial firefighting response. The aerial firefighting mission also provides extra sway when submitting new defence budgets - air forces can add another mission to the same aircraft.

Some new military transports and aerial firefighting delivery systems have been tested recently to provide armed forces with the most adaptable mission and cost effective solutions to attack wildfires. These tankers have huge capacities to deliver large amounts of retardant in support of ground firefighting operations directly onto brush and forest wildfires or to lay down fire lines in terrain.

While civil operators in the US employ VLATS-Very Large Air Tankers - which are conventional passenger aircraft adapted with internally fixed aerial delivery tanks - this is not the case for the military. All large military transport aircraft employ rear ramps for quick cargo Roll on/Roll Off (RO/RO) entry and exit.

Newer entrants into the market include the Alenia Aermacchi C-27J Spartan and Antonov An-32P Firekiller, with some imminent entrants including the Airbus C-295W Water Bomber and Embraer KC-390. All are multi-mission transports which have interchangeable operational mission packages, including RO/RO systems, and as part of the current multi-mission transport package offer good value for taxpayers money.

The most commonly operated military air tanker and aerial firefighting delivery system is the Lockheed Martin C-130 Hercules & MAFFS 2 (Modular Aerial Fire Fighting System II) RO/RO combination which is also operated by four other air forces around the world. In the USA, the USAF Air National Guard have three Squadrons - 146th Airlift Wing (California ANG); 145th Airlift Wing (North Carolina ANG) and 153rd Airlift Wing (Wyoming ANG). These aircraft are considered a 24-hour resource which means, when activated, they will take 24 hours to arrive at any wildfire as the C-130s have to be pulled from their regular military duties and fitted out. Operating one of the eight MAFFS aircraft costs between $5-6,000 per hour.

The first generation MAFFS 1 units are no longer in use but the MAFFS 2 aircraft are stationed at eight locations around the USA. MAFFS 2 has a 3,000 US Gallon (11,000 litre) tank and can be refilled in 15-20 minutes by two tanks of on-board compressed air. Maintenance and repairs of the units are performed by six technical crew supplied by the USFS-United States Forest Service.

Last year the USAF received $16 million from US Congress to improve the MAFFS 2 programme even further and, subsequently, the MAFFS 2.5 will have a lighter carbon composite material tank to increase the capacity to 4,000 USG (15,000 litres) which improves drop load by 1,000 gallons and decreases weight to improve aircraft performance. Its nozzle will also be improved to provide a 220 foot wide retardant line. The USAF Air National Guard will own the two MAFFS 2.5 units and store them at the California Air National Guard 146th Airlift Wing at the Channel Island base in Point Mogu. MAFFS 2.5 will become operational by the summer of 2015.

With so many C-130 MAFFS 2 in current operation with air forces around the world it is a surprise to me that it has not been more widely accepted as a backup system by countries plagued by wildfire such as Australia, Indonesia, Malaysia, South Africa, South Korea and Taiwan considering the number of C-130 Hercules in operation.

A recent RO/RO rival to MAFFS 2 has emerged. The Retardant Aerial Delivery System XXL tank – or RADS-XXL – can also be installed on a C-130 and, presumably, other military transports. The controller, with cockpit interface, provides a flow rate changes of up to 1,600 USG per second (6000 litres) in real time to ensure correct coverage and drops up to 4000 USG (15000 litres) which can be programmed for pinpoint accuracy. RADS-XXL can empty the tank in 2.2 seconds. Installing or removing the RADS-XXL tank takes less than 30 minutes and requires no additional crew or equipment, according to the manufacturer.

Also in 2015 the USAF Air National Guard will perform formal Operational Test & Evaluation (OT&E) of the Precision Container Aerial Delivery System (PCADS) which is another innovative RO/RO aerial delivery system designed to combat wildfires. PCADS consists of a 1-ton bulk liquid package that disperses suppressant onto a specific target from 300+ ft Above Ground Level (AGL). The system requires no modifications to the airframe and is deployed using standard military Container Delivery System (CDS) procedures during airdrop operations. The system can drop up to 3,800-12,000 USG (14,000-45,500 litres) of suppressant onto a wildfire. PCADS provides direct aerial attack at safe altitudes, able to operate in high winds, day or night and opens the operational window for mass attack using multiple aircraft. The manufacturer claims over 75 flights and 500 PCADS system tests have been performed by US government agencies so far.

Other international forces using MAFFS 2 include the Colombian Air Force's 81 Escuadrón de Transporte in Bogota; the 1st Group Troop Transport of the Brazilian Air Force; the Royal Moroccan Air Force based at 3rd Air Force Base in Kenitra and the Royal Thai Air Force's 601 Transport Squadron at Don Muang Air Force Base, just north of Bangkok. They frequently receive training from USAF personnel in the use of MAFFS 2 to keep them current.

Interestingly, some air forces, such as the Colombian & Royal Moroccan Air Forces, operate both the C-130 and C-295 - a mix of aerial firefighting ability which could operate most of the mentioned delivery systems – though Morocco already operates Bombardier 415 amphibians, at an extra cost….

Seeing the success of the C-130 as a firefighting platform, other military transport manufacturers are now demonstrating their interest in this mission.

Russia's Ilyushin Il-76 firefighting aircraft was first unveiled in 1990 and has been in operation with EMERCOM for many years and includes a 13,000 USG (49,000 litres) VAP-2 twin tanking system with gravity release. That is 3.5 times the capacity of the C-130 Hercules - which makes the aircraft ideally suited to combating large forest fires and to also dropping fire retardant capsules that explode on impact. The tanking system takes a lengthy 1.5 hours to install and remove on any Il-76 but should also fit the new military Il-78M-90A (Il-478) - which is based on the Il-76MD-90A. This is further behind the delivery curve but a prototype will be delivered to the Russian Air Force in 2015.

In 2013 Airbus Military in Spain completed a second round of tests on their C-295W Water Bomber firefighting aircraft programme to develop data on the firefighting performance of its own water dropping system. They conducted tests at a special range near Cordoba where seven water drops were completed using ground equipment designed to measure the dispersal pattern of the water. The aircraft carried one 3,500 litre tank (900 USG) and the water was gravity-ejected through two dispensers in the belly. These trials involved the aircraft dropping water into a field containing hundreds of small cups spread over a wide area. These cups then collected the water dropped by the aircraft and provided engineers the dispersal measurements of the drop-load. From the results, the statistical attributes of the aircraft can be assessed to combat large-scale wildfires.

The C-295W trials were conducted between France's Securite Civile, which is considered a potential customer for the aircraft, and the CEREN wildfire research agency, near Aix en Provence in France. The data has been examined by CEREN but has not yet been made public after nearly 18 months. However, decisions are now being taken on the final firefighting configuration which is expected to see two 3,500 litre (900 USG) tanks being deployed using a RO/RO system.

Several other nations have expressed an interest in the C-295W, while the French Securite Civile has said that such an aircraft would give the agency the advantage of being able to project its capabilities well beyond French borders.

Like the C-130, Ukraine's Antonov An-32 has been in military operation for many years and it has seen wildfire action in Crimea, Libya, Portugal, and its traditional CIS markets. The Ukraine is hardly in a good position to think about aerial firefighting at the moment but their An-32P Firekiller is clearly a capable aircraft which was certified in 1995 and with more than 240 of the AN-32 aircraft being operated in countries with adverse climate conditions, this variant should be more widely operated.

Two AN-32P airplanes were used to extinguish the high-elevated forest fire in Yalta in 2007 where approximately 100 water drops were made over mountainous terrain and demonstrated real capability of this aircraft. A total of 8 tons (2000 USG/7500ltrs) of liquid can be discharged from the two external tanks simultaneously or one after the other. Drops were conducted at 40–50 m above ground level and at an airspeed of 240-260 km/h (150-160 mph). This provided a drop signature of 120-160m (400-500 ft) long and 10-35m (30-115 ft) wide with concentration of the liquid exceeding one litre per square metre (0.26 USG per 10 sq ft). Discharging the fire agent can be done simultaneously in a single discharge, or serially from one tank on either side of the aircraft with either an automatic delay or a manual control. Being external tanks they do not interfere with storage internally so the aircraft can


also carry smoke jumpers and airdrop their equipment into the forest fire area. Furthermore, because the AN-32P also employs rear ramps it could take a RO/RO delivery system as well. This has not been tested to my knowledge.

Three AN-32Ps were sent to Portugal in 2009 for the experimental operation. Each aircraft performed up to 10-12 flights per day totalling 545 firefighting flights.

However, the Firekiller has not been marketed enough by Antonov and many of the other airforces who have the AN-32 variant have not considered upgrading them for aerial firefighting.

The newest addition to aerial firefighting for the military is the Embraer KC-390 which has the potential to deliver an aerial firefighting capability – but this is still a few years away. With 28 firm orders to date, Embraer is now looking for further contracts and, so far, five countries have signed letters of intent for a total of 32 aircraft - Portugal (6), Argentina (6), Czech Republic (2), Colombia (12), and Chile (6) with the first three countries being involved in the KC-390 programme as industrial partners. We will see how this progresses – but being home to the Amazon Rainforest I suspect that this Brazilian-manufactured aircraft will be adapted to the aerial firefighting earlier than we think. It only takes one big wildfire.

Finally, Alenia Aermacchi of Italy is continuing its efforts to broaden the appeal of its slow-selling C-27J Spartan tactical transport with the introduction of a new firefighting system that has recently been trialled by the Romanian Air Force. It is a medium-sized military transport aircraft which has been ordered by the military air units of Australia, Italy, Greece, Bulgaria, Lithuania, Mexico, Morocco, Romania, Peru and Slovakia.

It is interesting that all of these countries own this aircraft and experience severe wildfires and yet, except Romania, do not adapt their C-27Js to the firefighting mission – instead they choose to buy amphibians or helicopters.

However, Romania ordered seven C-27J Spartans for delivery in 2008 to replace their Antonov An-24 and Antonov An-26 aircraft, beating the C-295, and the first two Spartans were delivered in 2010. The deliveries were completed in 2014. The firefighting aircraft now operate with the 902nd Transport and Reconnaissance Squadron of the 90th Airlift Flotilla at Bucharest-Otopeni Air Base.

Alenia recently conducted a test campaign in Romania's Carpathian mountains using one of its C-27Js. It was equipped with another RO/RO cargo delivery system called the Guardian System (USA) which drops up to six large cardboard containers containing 1,000 litres (260 USG) of water or fire suppressant onto wildfires.

Using a standard-sized container, the Guardian system is deployable in either the C-27J, or larger C-130, without any particular equipment or modification. The two aircraft can additionally drop the containers from up to 1,500ft (460m) which is a higher altitude than other firefighting platforms can achieve which increases mission safety and allows night operations.

Each Guardian unit is a specialized corrugated paper container made of biodegradable/recyclable materials and, depending on the type of aircraft, six to sixteen containers can be dropped from the rear ramp of the aircraft in succession. They open in mid-air creating a soaking rain that covers the wildfire. Most military rear-loading cargo planes can safely and accurately drop the Guardian from 800 – 1,000 feet (240-300) above the ground.

The Royal Australian Air Force (RAAF) has begun testing the Guardian delivery system on their C-130J and C-17A aircraft to possibly reinforce Australia's aerial firefighting mission response. They plan to begin an operation evaluation of the system in May 2015. Other air forces looking at Guardian include Chile, Peru, Greece, Italy and the US Air National Guard. The Italian Air Force is conducting a full operational evaluation this month. Their Test & Evaluation group certified the Guardian on the C-27J and C-130J in July 2014. The Guardian has also recently successfully passed the requisite Mil Spec G-Force testing in Natick, Massachusetts and will be part of the US ANG Operational Evaluation of firefighting Cargo Delivery Systems in 2015.

Meanwhile, a joint certification campaign for the equipment was concluded in 2012 resulting in the first shipment to Romania in August 2013. Alenia's efforts to certificate and deploy the Guardian system appear to be a direct response to Airbus Military's drive to introduce the smaller C-295W Water Bomber.

The Romanian Air Force will use this capability locally and intends to support the European Union's aerial firefighting mission.

Major Florin Ianculescu, Instructor Pilot for the C-27J Spartan in the Romanian Air Force, will be presenting their new firefighting combination of the C-27J Spartan and the Guardian System at Aerial Firefighting Conference in Zadar, Croatia on 29th & 30th April.

So what are the militaries' perceived problems with the aerial firefighting mission? Is it concerns over the corrosive nature of some of the retardants/suppressants on airframes? Is it more about maintenance and training issues? Or is it more about political will and diplomacy? I would particularly like to hear from international air forces on this subject ….

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