The rise and fall

With fluctuating investment over the past few years, the future of lighter-than-air unmanned technology is in doubt. However, a number of programmes remain active and are providing valuable capability in-theatre, **Beth Stevenson** reports.

The US Army was leading the charge with its LEMV programme before cancellation in February 2013. *(Photo: Northrop Grumman)*

Unmanned lighter-than-air (LTA) technology is arguably the mother of unmanned airborne surveillance, having been around in a variety of different forms for over 100 years.

Goodyear blimps and Zeppelin airships – in particular the *Hindenburg* famed for its crash in 1937 – are well known historical systems. However, far from remaining in the history books, revivals over the years have occurred, particularly in support of operations in Afghanistan and Iraq.

During these campaigns, FOBs have been protected by LTA systems, providing persistent surveillance of on-site and off-site activity, with arguably little cost and logistical burden.

'There has not so much been a revival, but a surge with the conflicts in Iraq and Afghanistan,' Ron Bendlin, president of TCOM, told *Unmanned Vehicles*. 'The demand for that period was due to the fact that aerostats are really the ideal application for persistent surveillance over these FOBs. It really was the right technology for that situation where you had to be stationary over a specific location for extended periods of time.'

According to an October 2012 Government Accountability Office (GAO) paper, US investment in aerostat and airship development ranged from $339 million in 2007 to $2.2 billion in 2010 and $1.3 billion in 2012.

MAJOR PROGRAMMES

Specific aerostat-related investment was $5.8 billion over the period 2007-2012, which accounted for more than 80% of the total. Over 90% of this investment, worth almost $5.4 billion, is attributed to the development and procurement of three US Army aerostat programmes: the Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS); the Persistent Ground Surveillance System (PGSS); and the Persistent Threat Detection System (PTDS). All three are successfully operating or on track to do so in the near future.

On the airship side of LTA development, the GAO stated that in the same period most of the $1.1 billion investment was for R&D, again with 90% of it focused on three main programmes, namely: the USAF Blue Devil II; DARPA's Integrated Sensor is Structure (ISIS); and the

Executives at TCOM, which manufactures the 22M system (pictured), believe there is still military interest in airship-based persistent surveillance. *(Photo: TCOM)*

US Army's Long Endurance Multi-Intelligence Vehicle (LEMV).

The difference with the airship development is that Blue Devil II and LEMV have both been cancelled since the report, while DARPA told *UV* that it is only focusing on the radar development for ISIS, with the airship element no longer a priority.

TCOM was contracted to develop the airship for the Blue Devil II programme, for which it provided the hull. Meanwhile, the LEMV hybrid air vehicle programme, which was cancelled by the US Army, was due to see a Northrop Grumman-led team develop the system.

Lockheed Martin also failed in its endeavour to keep its Hybrid Airship for the Missile Defense Agency airborne, a platform that was supposed to operate above the jetstream.

A DoD representative confirmed to *UV* that the High Altitude Long Endurance – Demonstrator (HALE-D) that derived from the Hybrid Airship flew on 27 July 2011, but encountered a problem at altitude and had to be brought down with a controlled descent. There are currently no plans to proceed with the programme any further, and Lockheed Martin was unable to comment.

CLOSING TIME

Other cancellations include the CargoLifter CL160 heavy-lift airship programme, which ended in 2002 when the company went into liquidation, as well as DARPA's experimental Walrus Hybrid Ultra Large Aircraft project that was cancelled in 2010 and would have been be a heavier-than-air vehicle producing lift through a combination of aerodynamics, thrust vectoring and gas buoyancy generation/management.

However, despite an apparent surge using tethered aerostats during recent operations, it has not been the same for airship development, as the technology struggles to remain relevant.

'The DoD is maintaining status quo for the foreseeable future,' George Bye, CEO of Bye Aerospace, and Ron Oholendt, executive VP for business development at Near Space Systems, told *UV*. 'With sequestration, 2013 R&D dollars were greatly reduced… and 2014 will see further retraction for R&D. The reduction in funding coupled with the drawdown [from Afghanistan] will severely limit R&D available.'

Bye Aerospace and Near Space Systems teamed up to develop the Naval Air Systems Command (NAVAIR) solar-powered StarLight stratospheric airship, designed to operate at an altitude of 85,000ft and made of an upper and lower stage, thus creating a new LTA category.

However, this again proved to be another airship programme that faced problems, this time due to funding issues.

'Our programme was deemed highly successful by NAVAIR, but funds were provided by a "Congressional plus-up" in 2010 and the moratorium in the House precluded any additional funding,' the pair explained. 'The navy did not have a programme of record to provide any follow-on funding.'

The airship was taken through critical design review and then the lower stage of the system was manufactured and integrated with subsystems, such as propulsion, power, manoeuvring and payload, before the programme was cancelled.

POSITIVE OUTLOOK

However, the two companies remain positive about the potential of such a system and claim it could replace HALE UAVs and satellites in the future. 'LEMV… and a number of other cancelled military programmes were airships, not tethered aerostats,' clarified Bendlin. 'These were very large-scale developments performed to aggressive schedules.'

He said that tethered aerostats are 'mission-critical assets' for different operations internationally, and the value for money is unmatched.

'While future military airship requirements are not defined, we continue to believe that there is military interest in providing persistent surveillance with the flexibility of an airship,' he added.

While admitting that the demand has peaked so far as Afghanistan is concerned, Bendlin said that his company is now looking to sustain business across a variety of areas.

'Before these conflicts came along, our business was fairly consistent in providing border surveillance products,' he noted.

'For the 12M in particular [a small tactical aerostat], where we see that going is in policing activities [and] disaster recovery. We've seen some trials go on with that for re-establishing communications; tactical applications where you want line-of-sight coverage with a camera; and also wanting a communications platform – we see commercial applications there as well.'

CONCEPT OF OPERATIONS

The 12M is the newest addition to the company's portfolio. It is a tactical aerostat system that has been delivered for test and evaluation to the US military, which is currently working out its CONOPS with the system, according to Bendlin.

'If you look at trends, we've gone smaller, with the 12M being our smallest to date,' said Matt McNiel, VP of business development at TCOM. 'This capability is more digestible and understood in the next series of combat operations, if you will, as militaries reset themselves from what's been the ongoing campaigns in Iraq and Afghanistan and take a look at things in new potential trouble hotspots in Sudan, the Horn of Africa and Southeast Asia.

'A focus towards a more mobile capability is probably going to continue to develop, and that is going to drive towards a smaller system, we think.'

LEMV, meanwhile, was designed to operate on-station for 21 days in order to cover a 3,000km radius. It was flown for the first time in 2012 with a crew on board, setting it up for deployment to Afghanistan in 2013. ➤

Reasons for the cancellation were given as performance and technical problems, as well as tight financial resources.

However the airship, developed by a Northrop Grumman-led team, including British company Hybrid Air Vehicles (HAV), has been bought back by the latter from the army. 'We've bought the vehicle and are planning to ship it back to the UK and will continue to develop it here,' Chris Daniels, head of partnerships and communications at HAV, told *UV*. 'We've agreed with the US Army that we'll share all development data with them free of charge.'

Daniels said that timelines are not yet set, but expects the airship will be transported to Cardington in the UK and inflated 'early next year'.

It is currently in a manned configuration – in line with the testing that took place in 2012 – and HAV will possibly look to make it unmanned-capable in the future, as originally planned. Keeping it in a manned configuration would initially aid in the certification of it in UK airspace.

'They certainly haven't closed the door on this yet,' Daniels said of the army's endeavour to procure a platform of this type.

TRIED AND TESTED

According to Bob Boyd, hybrid airships programme manager at Lockheed Martin, which lost out on the bid for LEMV: 'We believe wholeheartedly that it is not the technology [that led to the LEMV cancellation] – the technology is available and it will work.'

Boyd expects that the US Army will eventually regenerate the programme as it sees the cost benefits of using buoyancy systems.

'I think they [the army] are going to wait and see if somebody develops a commercial one like we're trying to do, and if it's working then they'll look at adapting instead of inventing from scratch like they did in LEMV,' he said. 'The concept of LEMV was that the sensor carrier users could develop a platform and then you could transition this to cargo. Well that didn't work out so well, so they're probably going to do it the other way round, with cargo first and then transition it back to ISR.'

The company is still developing a hybrid platform based on its P-791 offering, and is looking to develop a small, medium and large cargo-carrying airship. They will have a load-carrying capability ranging from 20-500t, initially focusing on the commercial market. It aims to have a system ready within three years.

FUTURE OPPORTUNITIES

Boyd explained that the unmanned, military and ISR markets will all be opportunities for it eventually.

Lockheed says that the P-791 proves the technology will work. *(Image: Lockheed Martin)*

'I'm sure as we get these out in operations we're going to get a phone call from many of the departments and the DoD who are interested in sensor carrying,' he continued. 'So we'll have some variants focused on that, probably at a much higher altitude than the cargo carriers will go, and probably with a much longer endurance, so they'll be unmanned.

'Right now, the cargo carriers are envisioned to be manned because of current FAA regulations, but you can make them unmanned relatively easily… [although] there's [currently] no legal way to make an unmanned commercial airplane.'

He said if the military was to become interested in the vehicle, making it unmanned would not be an issue and would open up that operating spectrum.

'Of course for the military you can conduct unmanned operations, so it may be that you go unmanned for military purposes first, and then eventually bring it back into the commercial market,' he said. '[We] could easily see an unmanned version of this in five years or so if the interest was there.

'When you get into the buoyant systems or the LTA market, anything negative would tend to be a bit of a "black eye" for the industry, but on the other hand with LEMV it was a completely different mission – it was an airship,' Ken Throne, director of persistent surveillance at Lockheed Martin Information Systems & Global Solutions, told *UV*. 'It is not a type of aerostat. I think if you look at the performance of tethered aerostats across the industry… the record for all of those systems is pretty incredible.'

PERSISTENT SUCCESS

One aerostat success story is the company's Persistent Threat Detection System (PTDS), which continues to be used in Afghanistan by the US Army.

It was first deployed in 2004, and some 37 systems remain in operational use, although the company could be asked to provide up to 65 platforms under the terms of its most recent contract. On 21 October, Lockheed Martin announced that PTDS will continue to be operated and supported by the company under a $345 million contract.

Throne explained that the US Army decided to complete the logistics and operator work being conducted in-theatre, which resulted in Lockheed Martin being awarded a one-year contract with a one-year option to provide up to 65 PTDS through to Q3 2015.

'However, we all know that we will not be operating 65 systems for the full two years, so we are supporting as the troops withdraw in Afghanistan,' noted Throne. 'That need to have systems on-site to provide that overwatch for the sites is declining, so we have fewer systems than the 65 that we bid.'

At least 36 systems are expected to still be operated by the end of 2013.

'What we've been told by our customer, the US Army, is that as long as there are troops in Afghanistan, whether they are US troops or US coalition forces, the PTDS will be there,' ➤

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The Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System, or JLENS, is expected to start operational evaluation in 2014. *(Photo: Raytheon)*

added Throne. 'If there are still troops out there beyond that time [2015], I expect there will be a follow-on contract, and it will remain there as long as there are troops.'

PROTOTYPE PROGRAMME

PTDS started out as a prototype programme to support US operations in Iraq, and has only just been awarded programme of record status. 'Last month, we were informed by the army that the PTDS programme was approved as an official programme of record for the army, and so we have built 65 systems, flown 51, and we're down to 37 now, and the army's plan is to designate 29 of those systems for the programme of record going forward,' explained Throne.

'So that means beyond the conflict in Afghanistan, these systems would be used by the army to pop up at whatever the next hotspot is worldwide.'

Lockheed Martin is currently in the process of returning the 29 designated systems to the US, where they will be reset to a standard configuration and go into storage until they are required.

'In addition to the 29 systems that we'll be bringing back and retrofitting/resetting for future use, we're going to have 21 systems back in Afghanistan that are referred to as the "enduring systems", and these will continue to support in Afghanistan,' added Throne

A PTDS typically operates at 5,000ft, while surveying a 24km radius. In addition to its day/night camera, a second camera or radar can also be integrated, notably the Northrop Grumman StarLite radar.

'It gives the army a pretty incredible capability in that we can detect motion in a wide area with the radar, then immediately fly the camera to the location to get "eyes on",' said Throne.

JLENS, the US Army's new missile defence tethered aerostat developed by Raytheon Integrated Defense Systems, meanwhile, is expected to complete engineering and manufacturing development at the end of 2013 and undergo operational evaluation at Aberdeen Proving Ground in mid/late 2014.

Keith McNamara, business development executive for global integrated sensors at the company, suggested that weight constraints on an airship might have something to do with the lack of success.

'Aerostats and airships have a finite weight limit, and by keeping the processing equipment

Lockheed Martin's PTDS is supporting US forces currently operating in Afghanistan. *(Photo: Lockheed Martin)*

and power generator on the ground, you maximise the system's payload because the only thing the blimp is carrying is the radar,' he said.

He noted that with a tether, the power runs up to the radar operated on board the platform, and then the data runs back down. This means that the power and processing systems can be grounded, saving weight.

'The capability is mission-dependant and based on the threat,' continued McNamara. 'The threat will always drive requirements, but the solution has to make economic sense. This is one of the reasons Raytheon sees so much promise in JLENS – the cruise missile and unmanned aircraft threat is growing, and JLENS offers a defensive capability in a cost-effective manner.'

With regards to UAV technology competing with LTA, he said that they are complementary, not competitive technologies. 'Early on in the [Afghan conflict], commanders were using UAVs to protect FOBs, but that was not the best use of that resource, and it didn't offer persistence.'

He continued that affordability will remain a factor for operators in the future, so the more capability that one system has, the better.

WIDER OPPORTUNITIES

'JLENS was first envisioned in the 1990s as a surveillance platform to support cruise missile defence,' he said. 'It does cruise missile defence quite well, but the threat has evolved and so has JLENS. In the past 18 months, it has demonstrated the capability to detect and track swarming boats and unmanned aircraft, and detect and discriminate a short-range ballistic missile in the boost phase.'

Internationally, South Korea is expected to deploy an aerostat system, believed to be worth some $22 million, to oversee the border between itself and North Korea. Details surrounding the acquisition have remained relatively scarce, although it is understood that it will be developed locally. China, meanwhile, is believed to have used aerostats during natural disasters in recent years.

The US appears to be leading both the success and failure of operations of this type of technology. However, with other nations such as South Korea and China – which is considering LTA for humanitarian assistance/disaster relief, homeland security and construction missions – seeking capabilities of this type, there may yet be another momentum shift in the future of LTA technology. UV