An example of IAI Elta Systems' ELM-2022ML, a lightweight X-band multimode airborne maritime surveillance radar. (Photo: IAI Elta Systems)

MISSION CONTROL

Previously a niche sector, the adaptation of aircraft for special missions is now seen by OEMs as ripe with possibility, with opportunities across the low-end to high-end spectrum. **By Beth Stevenson**

Special mission operations are trending as militaries realise the benefits of operating a low-cost and readily available – or in some cases already acquired – aircraft carrying a tailored sensor suite.

While the mission itself can vary from basic ISR to full-scale anti-submarine warfare (ASW), the commonality from integrating these capabilities onto an already-developed aircraft is apparent. In parallel, there is a clear move towards smaller platforms and sensors being used for these roles in an attempt to further reduce costs for the operators.

Replacement programme

One realisation of this has been the USAF's Northrop Grumman E-8C Joint Surveillance Target Attack Radar System (JSTARS) Recap effort, which is seeking a replacement for the Boeing 707-300-based system that entered service in 1991.

The mission of the ground surveillance/battle management aircraft remains largely the same in the Recap effort, although a shift is being made from the original airliner-sized E-8C, with two of the three contenders for the new programme selecting business-jet-based radar systems.

A Northrop team is offering a reconfigured Gulfstream G550 and a Lockheed Martin team a modified Bombardier Global 6000. The only airliner being offered is from Boeing, which is understandably offering its own aircraft in the form of the 737.

While reconfiguring an airliner could still appeal for special mission aircraft (SMA) ▶

An ATR 72MP MPA, for which the Italian Navy is the launch customer. The service will eventually receive four in total. (Photo: Leonardo)

development – the international supply chain and the support these programmes have tend to be robust – there is a clear move towards integrating these capabilities onto even smaller platforms with lower operating costs and a smaller logistical footprint.

'Aircraft that are bigger than required mean lower performance and higher operating costs,' Troy Miller, regional VP for military and special missions sales at Gulfstream, told *DB*.

Regarding JSTARS Recap, Miller said that an ability to reach high altitudes is beneficial for ground surveillance missions as the range at which the sensors can see is optimised. He added that ISR missions are now requiring multiple capabilities on a single platform: 'Because of the versatility and available payload, programmes are under development that will have radar capability as well as SIGINT, COMINT and EO/IR capabilities.

'There is also a growing interest in maritime surveillance and several nations are interested in dual-role aircraft that can provide both executive airlift and aeromedical evacuation capabilities.'

One such system that uses a baseline Gulfstream G550 is IAI's Conformal Airborne Early Warning (CAEW) aircraft. 'A number of different configurations are successfully supporting worldwide operations, but among them, our [CAEW] configuration is the most widely deployed,' Miller explained.

The first two of an order for four were delivered to the Italian Air Force in 2016, with the final two deliveries due in 2017, making Rome the third operator of the type after the Israeli Air Force and Republic of Singapore Air Force.

'The AEW market is quite steady, but it is a relatively small market,' Avishai Izhakian, deputy general manager for marketing, business development and sales at IAI's Elta division, added. He said that a typical AEW programme will only cover an acquisition of some three to four aircraft, but this is likely to exceed a $1 billion price tag.

'However, if you look at the overall market, you only see a few contracts signed every year in this area and the number of competitors is relatively limited,' he added. 'There are four to five competitors today in the market and there are only a few contracts per year, but each contract is on a large scale.'

He said that the principle developed for the CAEW system – 'a very high-performance solution on a business jet' – is being rolled into other special mission areas, most notably air-to-ground surveillance. 'The fastest growing solution is air-to-ground. We released a solution about three years ago designated ELI-3150 MARS2, which is a solution for the high end of the market.'

He pointed out that 20 years ago the only offering in this category was the JSTARS radar, which was not exported, so remained exclusive to the US. 'Today, you see this sort of programme in several countries. Usually they are classified, so I cannot go into the details, but clearly for us the air-to-ground market is one of the main emerging markets,' he said.

Surging need

Another key special mission area is for maritime patrol aircraft (MPA), for which there has been a surge in requirements due to an increase in piracy and the need to protect commercial shipping routes.

Izhakian highlighted the success of the Boeing P-8 Poseidon programme as evidence of this, although he highlighted that the high-end capability of this aircraft is not necessarily what all customers need.

'You also see a lot of contracts for the low-end, turboprop solutions,' he said, noting that there are four to five different levels of MPA markets on the spectrum. 'Historically our main focus was the high-end, high-performance solutions, but we have expanded our presence in the market over the last few years, offering the [Bombardier] Q400 – which is a mid-tier solution for MPA – and even the Beechcraft King Air-based solution we are offering to some of our customers,' he said.

In general, the King Air system primarily serves the low- to mid-tier ISR markets, he added, although the company is open-minded given its position as both a prime contractor and third-party payload provider.

'We are in a unique position in the market because we have a wide range of payloads in-house,' he said. 'Because we are providing both the [SMA] to the market as well as the payloads, we provide the package.'

Izhakian added that in addition to an array of radars that can be offered by IAI, it can also offer line-of-sight communications systems and self-protection suites for SMA, as well as SATCOM in both Ka- and Ku-band.

'In the SIGINT area, we have a relatively low-weight and high-performance solution, which can be installed on [SMA] as well as smaller platforms like UAVs,' he added.

'Our solutions are adequate for the small [SMA] – the Beechcraft type – to the medium level like the [Airbus] C295, ▶

Q400 and other [Leonardo] ATR solutions, up to the high-level solution of business jets, like the Gulfstream G550 or the [Bombardier] Global [family], or even in some cases the Boeing 737.'

The RAF's Raytheon Sentinel R1, meanwhile, is a Bombardier Global Express-derived SMA integrated with the Airborne Stand-Off Radar (ASTOR). 'The aircraft is a [high-altitude] stand-off platform and what it provides is wide-area surveillance capability overlaid with ground moving target indicator [GMTI],' Roland Howell, Raytheon's UK head of airborne solutions, told *DB*.

'Because of the nature of the platform – high flight on a business jet – and the size of the antenna, it is pretty much unique in terms of the wide-area surveillance benefit that it can provide.'

Howell claimed that the radar can cover 'huge areas' of land, carrying out wide-area surveillance using the synthetic aperture mode of the radar, which – combined with the GMTI element that can track smaller targets – allows operators to build a live picture of what is going on below. The radar processing is done on board and the analysis can either be done on- or off-board, he added.

Obsolescence issues

A five-strong fleet was delivered by 2009, but in June 2017 it was confirmed that the capability had been reduced to four examples. A number of threatened cancellations to the programme has led to the emergence of obsolescence within the radar due to a lack of capacity for long-term planning, and the current out-of-service date for the remaining aircraft is 2021.

A contract was signed in 2016 to cover support of the fleet up to the out-of-service date, which has allowed Raytheon to plan for some of the radar's modifications. 'We signed a contract last year for support arrangements going out to 2021, and as a follow-on from that, there has been work on some aspects of obsolescence redesign, particularly in terms of the back end of the radar,' Howell explained. 'Recognising that some elements of the radar were developed some time ago, there are some obsolescence effects.'

This, he said, is due to the fact that some companies within the supply chain of the original programme no longer exist. 'There is some work to do in terms of being able to source some of those elements of the radar at a card or line replaceable unit (LRU) level, and there is some obsolescence redesign work going on now to effectively redesign in some areas and reproduce in other areas to maintain the spares and repairs capability in order to maintain the aircraft out to 2021.'

Bird Aerosystems offers its Airborne Surveillance, Intelligence and Observation (ASIO) system, which configures a range of aircraft into special mission platforms. (Photo: Bird Aerosystems)

He said that this work is ongoing and will be delivered to the fleet over the coming years. 'In terms of going forward, we are working on a sustainment programme, which again is about sustainment [as] opposed to introducing additional capability, and we'll address a number of obsolescence issues in terms of having the spares and repairs capability to take the aircraft beyond 2021 if needed.'

Work has been carried out in the lead-up to this next stage, and Raytheon hopes that this will be contracted next year.

In 2014, it was announced that the UK government was considering a maritime upgrade to the radar, and while this is 'still very much an option', it is yet to be contracted. 'The decision was made not to take that up at that time,' Howell said. 'We're still looking at the requirements in terms of the obsolescence redesign activity that we expect to go on contract for, and it may or may not be included as part of that work, but it is not an identified capability upgrade currently.'

While both ASTOR and Sentinel are exclusive to the UK, the radar is part of a family of similar systems that Raytheon could offer to international customers, for which it is eyeing opportunities. 'We're working in the Middle East and North Africa region, where there are several opportunities which are at different stages of maturity, but there is definitely a demand in those regions for ISR capability,' Howell noted.

ISR capability

Elsewhere, a version of L3 Communications' King Air 350/350ER-derived SMA was delivered as an UOR for the mission in Afghanistan, under the USAF's so-called Project Liberty. The aircraft – designated MC-12W by the USAF – was delivered within eight months of the order being placed and a total of 37 aircraft were operated by the service at that time.

'There was an urgent need for an immediate capability for ISR. They could not generate enough,' Joseph Siniscalchi, senior VP of business development for aerospace systems at L3, told *DB*, adding that the aircraft can carry sensors such as EO/IR, surveillance radar and SIGINT.

The US Army also acquired an L3-configured King Air 350 under its Enhanced Medium Altitude Reconnaissance and Surveillance System effort, which took the same approach to fielding a quickly delivered ISR platform. ▶

The technology produced for Project Liberty was later rolled into the company's Spydr offering, which is the product name it uses to refer to the King Air family of SMA. A total of 60 Spydr examples are still in service with a variety of customers, Siniscalchi noted.

In 2016, L3 introduced the Spydr II, another King Air variant that allows for different sensor configurations to be swapped out using its Rapid Aircraft Payload Deployment System (RPADS). 'We tried to take [and insert] the technology that we wished we could have done with the Spydr into [Spydr] II,' Siniscalchi noted.

The RPADS allows the sensors to be swapped out within a number of hours, and the company fully certified the 26 different fitting locations with the US Federal Aviation Administration in 2016. In addition to surveillance sensors, Spydr II can carry a weapons load of some 68kg on each wing, although any King Air model can carry a similar payload.

L3 is still awaiting a launch customer for Spydr II, but claims that Spydr I is also still an option should a customer require it, with the Middle East being one target market for the latter. Siniscalchi said that US customers are the target market for the second iteration of the SMA given the higher-end sophistication of the capability.

Turboprop derivatives

One special mission offering that includes the manufacturer providing both the aircraft and sensors is Leonardo's ATR 42MP/ATR 72MP family. Derived from the company's regional turboprops, they are configured with a mission system, sensor suite and communications system, primarily targeted for MPA operations.

An Italian Air Force ATR 72MP made the aircraft's international debut at LIMA in Malaysia in March, which is a key market for the aircraft, Eduardo Munhos de Campos, head of international sales for Leonardo Aircraft, told *DB*.

'We received very good feedback and we took the opportunity to present the system to several potential customers,' he said. 'The region is a priority market for our ATR 72MP, and we are promoting the aeroplane for several countries including Malaysia and the Philippines, where an RfI has been issued by the country authorities.'

With a 10h endurance, the ATR 72MP is equipped with Leonardo's Airborne Tactical Observation Surveillance (ATOS) mission management system, as well as the company's Seaspray active electronically scanned array surveillance radar.

'The multirole intrinsic capabilities of the ATR 72MP are the most innovative part of our offer,' Munhos de Campos said. 'Before the ATR 72MP, the market was divided between MPA and ISR platforms. We have combined the best of the two in a single platform and also added a strong C3I component. The Italian Air Force's aircraft have some specific capabilities that make them a very powerful MPA/ISR/C3I/ELINT asset, fully integrated with the Italian armed forces command centres.'

The ATR 42MP, meanwhile, has been delivered to four customers, namely the Italian Coast Guard, Italian Guardia di Finanza, Libyan General Security Agency and Nigerian Navy. 'Today we are working on the Italian Guardia di Finanza and coast guard with new systems and sensors to keep them updated,' Munhos de Campos said. '[As for] the market potential for the ATR 42MP, we think that having more range and internal space at the same operating cost make the ATR 72MP a more attractive option for future customers.'

The sensors on board are of obvious importance, but the number of them found on an SMA can mean that an operator is swamped with different feeds of information. To this end, Leonardo provides the ATOS capability, which is effectively a mission management system that integrates all of the sensors and subsystems onboard into one tactical picture.

In 2016, it was delivered on board the first two of the Italian Air Force's new MPA/search and rescue-configured ATR 72-600/P-72A turboprops, which will be followed by two more examples at some point this year.

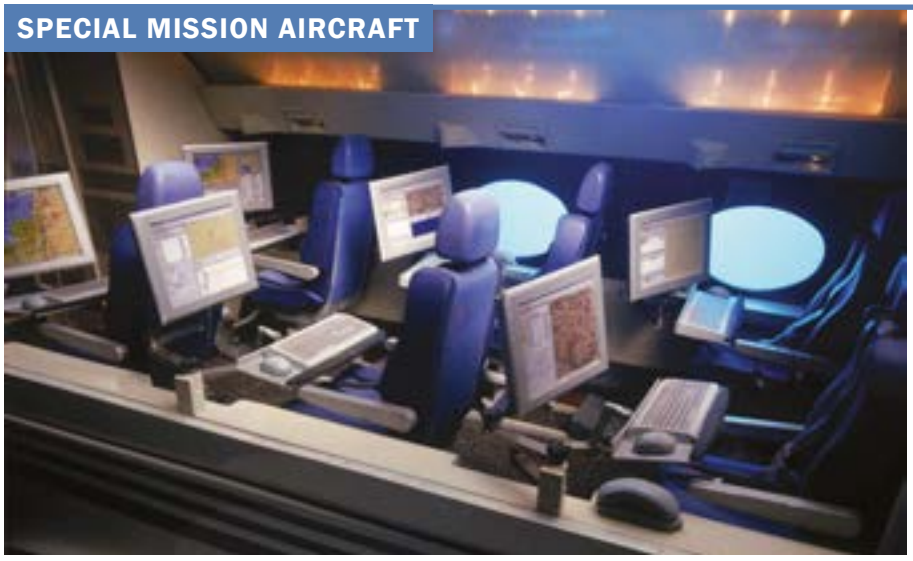
'ATOS is used for various missions – maritime surveillance up to more complicated and sophisticated missions such as ELINT, COMINT and anti-submarine warfare,' Cristina Massarenti, international marketing for Leonardo Airborne and Space Systems, told *DB*.

ATOS integrates all of the sensors and subsystems, fusing different feeds together, providing operators with a tactical picture of what is happening below. An example of this fusion could be the integration of a radar and AIS feed, which the system will identify as being the same target if the two streams of information correlate.

'The operator has a tactical picture including all of the different pieces of information coming from the sensors, and potentially the management of all of them,' Massarenti said.

ATOS is sensor-agnostic, she noted, although there is a desire from some operators to acquire a full suite of ▶

The Beechcraft King Air platform can serve the low- to mid-tier ISR markets and has seen success with the USAF as part of its MC-12W Liberty programme. (Photo: USAF)



Internal work stations for IAI Elta Systems' ELI-3150 MARS2, which is a solution for the high end of the SMA market. (Photo: IAI Elta Systems)

Leonardo sensors alongside the mission management system. 'We try to collaborate as much as possible with the Leonardo aircraft division,' she said, pointing out that the ATR aircraft contain the ATOS system. 'Of course, we try to maximise the work as much as possible.'

The amount of hardware installed depends on the configuration. A maritime patrol-configured King Air, for example, would need an EO/IR sensor, a surveillance radar and AIS feed, all of which would only need one operator console on board.

ASW-configured SMA, on the other hand, generally require more equipment, which could include additional systems such as sonobuoy launchers and ELINT sensors.

Smaller payloads

Leonardo is also offering an 'ATOS Lightweight' configuration, which is aimed at aircraft that have much smaller payload and passenger capacities, and can operate for some four to six hours at a time. 'In these cases, the hardware has to be adapted because of the payload,' Massarenti said. A smaller radar and camera is installed, and instead of a fully integrated operator console, a laptop-based system is used.

'We are seeing quite strong demand for this type of aircraft, especially [among] customers with lower budgets and those that monitor islands, like in South and Central America.' An example of this type of capability was delivered to the Italian Guardia di Finanza that has ATOS integrated on its Piaggio Aero P.166 twin-engine pusher, while Leonardo is also looking to other platforms for integration of the lightweight version.

'We are now developing a new prototype and have an agreement with Oma Sud, which is going to provide the SkyCar [with ATOS],' Massarenti said.

ATOS has seen success on board the ATR 42MP, having been delivered to Nigeria some years ago, and has been contracted for the King Air 350 for another undisclosed African customer. This operator will receive two examples configured with the management system and Leonardo's Seaspray radar, an Identification Friend or Foe transponder and interrogator, and Link 11 data link.

Leonardo is the prime for the contract and deliveries of the configured King Air 350ER variants are still pending, Massarenti said. The company is seeing a mix of requirements in terms of what set-up customers want, as well as the age of the aircraft being configured, be it new build or retrofit.

'There are some trends. Countries that need maritime patrol and surveillance of waters in some cases have older platforms that need replacing... or they are looking for a less expensive solution,' she said. Additionally, nations in Asia are looking for an ASW capability of some description to add to their fleets, while others want a full-scale ASW MPA potential.

An operator could have a transport to which it wishes to add a multirole capability. For example, it could already operate an SMA that needs upgrading or it could be acquiring a new aircraft altogether that will have a system like ATOS built in at production level.

'We see more new programmes than upgrades,' Massarenti said, adding that leasing is also a 'new and trending' option. One such example is the Australian Customs and Border Protection Service, which operates the DHC-8 aircraft configured with the surveillance information management – another name for ATOS – that is leased out by Cobham.

Integrating sensors

A similar concept is offered by Bird Aerosystems through its Airborne Surveillance, Intelligence and Observation system, which configures a range of aircraft into special mission platforms for maritime patrol, ground surveillance or border protection. It uses an open architecture to integrate sensors including EO, surveillance radar, AIS, COMINT and ELINT, and can be integrated on turboprops, jet aircraft and rotorcraft.

'The type of aircraft is dependent on the type of mission and can be either a new platform or an in-fleet platform,' Shaul Mazor, VP of marketing and business development, said. 'In recent years, we have seen a growing demand for installation on pre-owned existing aircraft in order to both utilise the existing fleet and minimise costs.'

While Mazor could not talk about who is using the system in detail, he noted that the Mexican Air Force is using it on fixed- and rotary-wing aircraft.

Developments for the system include an improvement to the mission planning element. 'This enhancement will enable integration with satellite images and information in order to better assess the demarcated surveillance areas and immediately convert this information into a mission plan for the aircraft,' Mazor said.

SMA come in a number of different forms, be it low-cost business-jet-configured systems, or the addition of multi-mission capabilities to higher-end platforms. Nations with lower budgets or those with specific mission requirements are taking advantage of smaller aircraft in this category that are easy to deploy and can be configured with a sensor suite to their liking.

What was once a niche market is now thriving, and with a heavy investment from manufacturers in expanding these special mission roles further, the market looks set to continue its boom. ■