Maritime vision: in search of lower cost capabilities

The IDR team offers some perspectives on achieving maritime visibility without breaking the bank

Maritime surveillance has traditionally required large, expensive assets and powerful high-end sensor suites, but the rise of easily accessible processing power and technology miniaturisation has brought new generations of lower-cost but increasingly powerful equipment within the reach of most countries.

Cutting-edge technologies remain expensive, but the high refresh rate of current technologies means that new systems offering what were considered high-end capabilities as recently as 10 years ago are now more readily available in affordable packages.

Affordability is clearly a relative term, but it applies as much to the largest navies as to the most modest. Despite its shrunken budget, the US Navy’s (USN’s) definition of ‘affordable’ differs significantly from most other navies’. Nevertheless, its funds are not infinite and the Office of Naval Research (ONR) has for the last few years been pursuing an effort to develop what it terms an affordable maritime radar that could be installed on a range of platforms under the Enterprise Air Surveillance Radar (EASR) project.

Since the start of EASR, the programme has transitioned from ONR to Naval Sea Systems Command (NAVSEA). In January 2015, Rear Admiral Thomas Moore, programme executive officer for aircraft carriers at NAVSEA, said the navy is planning to release a request for proposals (RfP) for EASR in March 2015.

In essence, the navy would like EASR to replace the Dual Band Radar (DBR) that it had originally planned to install onto the aircraft carrier John F Kennedy (CVN 79) currently in build. The DBR was originally acquired for Zumwalt-class destroyers and a version is currently installed on the aircraft carrier USS Gerald R Ford (CVN 78), making it the radar of choice for the future Ford-class aircraft carriers.
The US Navy’s newest carrier, USS Gerald R Ford, being pushed out at Newport News. If the EASR project works out, this may be the last installed with the Dual Band Radar developed for the Zumwalt class. (US Navy)

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However, the DBR was quite a pricey asset and the USN believes this project could deliver a cheaper radar that still meets all its capability requirements. Additionally, EASR could be installed onto future amphibious assault ships as well as retrofitted onto existing Nimitz-class carriers, helping to reduce acquisition and support costs through economies of scale. In fact, navy officials see EASR as a potential fleet-wide solution for an affordable, common radar, which could result in a truly revolutionary cost/capability argument.

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The rise of the micro MPA

While the concept of using business aircraft and airliners as the basis for maritime patrol (MP) platforms is now well established, the idea of employing light twin-utility types in the role is less developed, writes Martin Streetly.

Such aircraft are relatively inexpensive to acquire and operate, but have downsides including limited range and payload, together with severely constrained space and volume envelopes, and limits on the number of flight crew and system operators they can carry.
However attractive programme costs might appear, these solutions have therefore tended to fall at the first hurdle when matched to traditional open-water MP applications.

Yet the concept becomes significantly more viable where the need is for a platform capable of patrolling the littoral and suitable for paramilitary/quasi-civilian roles such as countering people/narcotics smuggling, undertaking counter-terrorism operations, and undertaking surveillance of off-shore assets such as fisheries and gas and oil fields.

Additionally, the development of small, powerful, and heavily automated sensor packages and control software has lessened the traditional need for manpower-intensive crewing, opening the way to greater adoption of small, light platforms in the role.

Currently, two families of 'MP lite' aircraft are to the fore: a branch based on Austria's Diamond Aircraft Industries' (DAI's) DA42 and one on Italian contractor TECNAM's P2006T design.

The DA42 has spawned a surprisingly wide range of manned and unmanned surveillance variants, of which the DA42 Multi-Purpose Platform (MPP), the DA42 MPP Guardian, and the Chinese Ocean Hawk derivative are germane to this survey.

An in-flight view of a DA42 ISR aircraft equipped with a belly radar (RDR-1700B equipment) and an EO turret beneath its nose. (Diamond Airborne Sensing)

The baseline DA42 MPP is best considered as a general intelligence, surveillance, and reconnaissance (ISR) aircraft conceptually developed by DAI subsidiary Diamond Airborne Sensing (DAS). Powered by a pair of Thielert Centurion heavy-fuel engines, it features nose and belly payload provision, a bubble canopy, optimised mission power supply, and a maximum take-off weight of 1,785 kg.

Intriguingly for covert patrol requirements, the propulsion is fitted with an engine-muffling system claimed to make the DA42 MPP "virtually undetectable" at an altitude of 1,000 m (3,280 ft) over a "suburban area". Specifically, a noise level of 59 dB is given for a 60% power setting (about 241 km/h forward speed) at a range of 150 m, and 78 dB at take-off power.
The DA42 MPP Guardian configuration differs from the first-generation DA42 MPP in being powered by 123.5 kW Austro Engine E4-B/AE300 engines and equipped with a fully integrated Garmin GFC700 autopilot. The platform can accommodate a flight crew of two and up to two system operators, and it has been trialled/equipped with and/or specified for a wide range of sensor systems. DA42 MPP Guardian specification data includes a maximum cruising speed of 328 km/h, an endurance of up to eight hours (single pilot and single system operator), a typical range of 1,452 km, the ability to lift a "useful load" of 500 kg, and a maximum take-off weight of 1,900 kg.

A general view of a typical system operator's position in a DA42 MP/MPP Guardian surveillance aircraft. Although fairly small, the cockpit provides plenty of space for modern lightweight computers and displays. (Diamond Airborne Sensing)

China Electronics Technology Group Corporation (CETC) is the latest instigator of a DA42 MP variant, with its Ocean Hawk based on the DA42 MPP Guardian. It is equipped with a nose-mounted electro-optic/infrared (EO/IR) imager (incorporating high-definition television and IR cameras and a laser rangefinder - LRF), a synthetic aperture radar/ground moving target indication (SAR/GMTI) radar, and an automatic identification system (AIS) application.

Ocean Hawk's EO/IR subsystem is billed as being capable of tracking a 4 m$^2$ target at ranges of up to 4 km in daylight and up to 10 km at night. Its maximum detection range is quoted as being in excess of 50 km when looking for a 200 m$^2$ target, while the aircraft's belly mounted radar is described as being able to detect a 50 m$^2$ (radar cross section or physical size not specified) surface vessel at ranges of up to 120 km. The system's LRF has a range of up to 20 km. As of November 2014, the type was scheduled to enter production at CETC's Wuhu facility in 2016.
A general view of the operator's station and UltraForce EO turret installed aboard the prototype TECNAM MMA aircraft. (Airborne Technologies)

Austria's Airborne Technologies has also played a major part in the development of TECNAM's P2006T-based Multi-Mission Aircraft (MMA). That aircraft is powered by a pair of 73 kW Rotax 912S multi-fuel engines and has accommodation for a pilot and a sensor operator. It is equipped with a mission suite that includes an EO-imaging turret (either L-3 Wescam's MX-10 or FLIR Systems' UltraForce), a satellite communication (satcom) capability, a high-frequency (3-30 MHz) tactical communications radio, a Euroavionics operator's workstation, and a GPS navigation facility.

Generic MMA specification data includes a maximum cruising speed of 269 km/h and a maximum payload of 385 kg.

The prototype TECNAM MMA seen at the 2010 Farnborough International Air Show. (IHS/Patrick Allen)
Airborne Technologies is known to have concluded a deal with the Russian contractor ChelAvia for an MMA application optimised for a "diverse" range of ISR missions including "police, border patrol, drug enforcement and urban surveillance" missions. Airborne Technologies also continues to promote the MMA as a low-cost ISR and MP tool.

Elsewhere in the world, in January 2012 Spanish contractor Indra announced it had teamed with Airborne Technologies, FLIR Systems, Selex ES, and TECNAM to create the P2006T-based "light" Maritime Reconnaissance and Intelligence (MRI) aircraft - formerly designated as the Maritime Surveillance Aircraft (MSA) - capable of undertaking fishery protection, drug/people trafficking surveillance, pollution monitoring, and search-and-rescue missions at off-shore ranges of up to 241 km.

Indra’s MRI aircraft is characterised by a belly radome for its Seaspray 5000E AESA radar and an EO sensor turret beneath its rear fuselage. (IHS/Patrick Allen)

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Sea level: Italy’s experience of coastal surveillance

The waters off Italy are the break point for waves of smugglers looking to land illegal immigrants, narcotics, people, and other contraband from north Africa, Syria, and the eastern Mediterranean, or across the Adriatic, writes Luca Peruzzi.

In addition to the country’s obvious responsibilities to tackle maritime crime, the apparent rise of tactics in which smugglers abandon refugee-laden vessels - such as the freighter Ezadeen in January 2015 - to drift off the coast presents a hazard to shipping as well as the ships’ occupants.
As a result, Italy has a wealth of experience in maritime surveillance and has built up an integrated array of situational awareness sensors along its coastline to meet its maritime responsibilities, protect its sea-borne economic interests and its environment, and safeguard its borders. In humanitarian emergency crises such as the Operation 'Mare Nostrum' in the southern Mediterranean, more than 150,000 illegal migrants were rescued by Italy's navy, air force, carabinieri, customs service, coast guard, Ministry of Interior, and Red Cross personnel in about one year between October 2013 and 2014.

Much of this has been underpinned by the range of command-and-control (C2) systems, active and passive sensors, developed by Finmeccanica. As well as Italy's maritime surveillance chain, the company is stringing together a similar, sea-scanning sensor network along the coast of Yemen.

Finmeccania - Selex ES has created a range of vessel traffic-management systems (VTMS) applications and developed solutions for maritime border surveillance based on active and passive sensor networks and C2 systems. Their elements include the Lyra radar family, providing fixed surveillance points and manportable gap-filler radars.

A EUR63 million (USD71 million) contract awarded to Selex ES by the Italian Ministry of Defence (MoD) in 2010 kicked off development of a new dual sensor suite to upgrade the Italian Navy's coastal surveillance network across the southern regions of Calabria, Puglia, Sardinia, and Sicily. Each transportable, remotely controlled sensor suite - named RASS-CI (Radar di Avvistamento per la Scoperta di Superficie - Costiero ISAR) - includes a dedicated version of Selex ES's X-band RAN-30X/I shipborne multimode radar known as ARGOS-30X (RASS-C for Italian Navy) dedicated to the surveillance task and the same company's X-band Gabbiano T200C power system for high-resolution targeting imaging. Both sensors are housed in single standard transportable shelter, alongside U/VHF equipment for remote surveillance and sensor control.

It has been extensively operationally tested - initially on the Adriatic Sea and then on Lampedusa - returning long-range air and surface surveillance, and over-the-horizon (OTH) detection capabilities. In essence, the ARGOS-30X is able to detect and track small vessel traffic at a 70-80 n mile-range even against a littoral background and in harbour areas, as demonstrated alongside Albanian coasts.

Once the RASS-C sensor detects and tracks traffic of interest, the Gabbiano T200C package takes over target radar imaging using high-resolution inverse SAR (ISAR), GMTI, and spot and strip SAR modes.

Radar data is then transmitted to a new coastal surveillance centre Finmeccanica - Selex ES has established under a separate contract at the Italian Navy's operational centre near Rome, where it is processed for target identification and classification, with a populated national radar signature database supplied by the Italian MoD.
Selex’ Aulos passive radar offers an unusual take on affordable surveillance by exploiting other emitters.
rather than requiring organic transmit elements. A new evolution is, however, being developed with an active section to fill gaps and ensure operation. (Selex ES)

To complement the network of traditional active coastal surveillance radars, Selex ES is also now offering its new Aulos passive sensor, based on passive covert radar (PCR) or passive coherent locator (PCL) technologies.

Aulos was developed jointly with research and development funding from the Italian MoD and Finmeccanica - Selex ES. It exploits non-cooperative illuminators of opportunity, such as FM radio stations, TV broadcasts, and broadband communications signals for covert surveillance, not only of stealth and low-flying air targets, but also for maritime applications such as coastal surveillance, vessel detection and tracking, and harbour protection.

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