New-generation USVs offer increased mission diversity

Maritime forces are showing mounting interest in the application of unmanned surface craft to a range of front-line applications. *Richard Scott* reports

The past decade has seen burgeoning interest in the use of unmanned surface vehicle (USV) systems as adjuncts or alternatives to manned maritime platforms.

USVs offer the potential — and in some cases the demonstrated ability — to reduce risk to manned forces, function as force multipliers, perform tasks that manned vehicles cannot, and drive down mission costs.

In fact, the use of unmanned surface craft at sea is by no means new, with radio-controlled drones having served for many years as target tugs for surface ship and aerial gunnery. Some navies have in the past decade introduced remotely controlled influence minesweeping systems to help 'take the man out of the minefield'.

But it is the development of a new generation of increasingly autonomous USVs for missions as diverse as intelligence, surveillance and reconnaissance (ISR), anti-submarine warfare (ASW), anti-surface warfare (ASuW), maritime security and communications relay that has awoken naval force planners to the long-term potential offered by unmanned platforms in the networked maritime battlespace of the future.

Perhaps most pertinent in the near term is the application of USVs to provide a force protection (FP) capability against potential small boat and/or suicide threats, and their use in port inspection and protection.

US Navy: 1294422

Lockheed Martin's AN/WLD-1(V) remote minehunting system was deployed by the DDG-51 Flight IIA destroyer USS *Bainbridge* in December 2007 in an exercise off the Spanish coast.

US Navy master plan

This broad range of roles has latterly been recognised by the US Navy (USN) in its USV Master Plan, the first edition of which was published in July 2007. Chartered by the Program Executive Officer for Littoral and Mine Warfare (PEO LMW), it provides the guide for USV development to "effectively meet the US Navy's strategic planning and Fleet objectives and the force transformation goals of the [US] Department of Defense [DoD] to the year 2020".

The 'USV Vision' articulated in the master plan states that USVs "will augment current and future platforms to deliver enhanced steady-state and surge capability to help deter the enemy at the regional, transnational and global levels. USVs will be highly automated to reduce communication/data exchange requirements and operator loading. They will deploy and retrieve devices, gather, transmit or act on all types of information, and engage targets with minimal risk or burden to US and coalition forces".

Reflecting this vision, the USV Master Plan sets out to define USV capabilities for the near, mid- and far terms; establish levels of performance and USV 'classes' aligned with capabilities; and evaluate technology needs to assess current readiness and recommend future investments. Its analyses have also identified seven high-priority USV missions to support Joint Capability Areas, these being (in priority order): mine warfare (MIW); ASW; maritime security; surface warfare; special operations forces (SOF) support; electronic warfare; and maritime interdiction operations (MIO) support.

The conclusion of the master plan is that these seven USV Joint Capability Area missions can be accomplished in three standard vehicle classes and one non-standard vehicle class. These comprise:

- the 'X class' – a small, non-standard class of systems capable of supporting SOF requirements and MIO missions. It would provide a 'low end' ISR capability to support manned operations, being launched from small manned craft such as the 11 m rigid inflatable boat (RIB) or the combat rubber raiding craft;
- the 'Harbor class', which is based on the USN's Standard 7 m RIB and focused on the maritime security mission, with a robust ISR capability and a mix of lethal and non-lethal armament. It could be supported by the majority of the fleet since it uses standard 7 m interfaces;
- the 'Snorkeler class', a ~7 m semi-submersible vehicle that supports mine-countermeasures (MCM) towing (search) missions and ASW (Maritime Shield) and is also capable of supporting special missions that can take advantage of its relatively stealthy profile; and
- the 'Fleet class', which will be a purpose-built USV consistent with the handling equipment and weight limitations of the current 11 m RIB. Variants of the Fleet class will support MCM sweep, protected-passage ASW and 'high end' surface warfare missions.

The USN's master plan includes a raft of key findings and recommendations. These included the need to align acquisition strategies to the four classes of vehicle identified above (with common core systems and interfaces to the greatest degree possible); measures to 'wean' from the bandwidth (by endowing USVs with greater autonomy to reduce data requirements in both directions); and a requirement to continue to deploy modules (non-standard) to Littoral Combat

Ship (LCS) and other fleet platforms to meet critical milestones and provide early operator feedback.

The master plan also calls for continued risk-reduction activity for technology and operations; the fielding of systems in the fleet for sea trials, before or in parallel with acquisition efforts; and exploitation of the USV's ability to deliver capability in 'crawl-walk-run' sequence, by delivering initial man-in-loop capabilities now and using that experience to guide development of future semi-autonomous and fully autonomous upgrades.

In addition, for 'weaponised' USV options, the master plan recognises a need to "investigate or develop the necessary rules of maritime law and law of war associated with operating autonomous armed vehicles [and to apply] these rules early and throughout the design and development process". It also outlines the requirement to invest "in a balanced USV technology programme, which includes five technical imperatives", namely autonomy, obstacle/collision avoidance, coupled payloads/weapons, launch and recovery, and advanced hull, mechanical and electrical systems.

Other goals are to develop USVs consistent with USN and DoD guidance, including compliance with the Joint Architecture for Unmanned Systems; comply with the PEO LMW-chartered and industry-led unmanned systems standards currently under development (standardise the vehicle interface to the host as well as within the vehicle, with standards for each class and common vehicle functions leveraged among different classes); and continue working with operations, doctrine and training commands to "expand and refine employment concepts for USVs, to ensure they are integrated with the concepts of [USN] transformation".

Spartan Scout ACTD

Perhaps the most high-profile USV research, test and development effort of recent years was the Spartan Scout advanced concept technology demonstrator (ACTD) programme, established in Fiscal Year 2002 (FY02) to demonstrate a militarily useful system of USVs for FP, assured access, ISR, precision engagement and MIW. It was subsequently expanded to demonstrate an ASW capability.

The US Naval Undersea Warfare Center (NUWC) Newport Division led the Spartan Scout ACTD as technical manager. Aggregated funding through the six-year programme, which concluded at the end of FY07, amounted to around USD53 million, with contributions from France and Singapore also.

The ACTD had four principal objectives: to demonstrate FP against asymmetric threats; to increase battlespace awareness through networked ISR; to demonstrate the benefits of extended unmanned sensor and weapon capabilities provided by USVs; and to reduce manning.

The core Spartan system comprises a 7 m or 11 m RIB platform; a remote-controlled/semi-autonomous command decision system; a basic ISR suite comprising a navigation radar and video/infrared (IR) camera; a navigation system; and communications. On top of this core vehicle functionality, Spartan was designed to accept a variety of specialised mission packages. The ACTD demonstrated four modules: ISR/FP, MIW, precision strike/ASuW and ASW.

As part of the ACTD, an unarmed ISR Spiral 1 (configured with an electro-optical [EO]/IR surveillance turret, surface search radar, digital imagery transmission suite and remote command-and-control facility) was embarked aboard the Ticonderoga-class cruiser USS *Gettysburg* as part of the Enterprise Carrier Strike Group in mid-2003, marking the first major deployment of Spartan with the USN fleet.

According to NUWC, the ACTD has generated numerous benefits. These include the development of a modular system architecture, the creation of an industry and common lexicon, and the definition of concepts of operation

Furthermore, the ACTD has promoted the transition of significant technical and performance requirements into the USN's Littoral Combat Ship (LCS) programme. For example, the Spartan indicative design was adopted for two 11 m ASW USV advanced development modules for LCS ASW mission package Flight 0, and the core system/modular architecture has been pulled through in its entirety. Furthermore, LCS has leveraged much of the Spartan technical documentation, such as test plans/procedures, standard operating procedures and safety materials.

The Spartan technical and performance requirements also supported the broad agency announcement that culminated in October 2006 with General Dynamics Robotic Systems being awarded a USD12.7 million contract by the US Navy Space and Naval Warfare Systems Center to deliver up to four 11 m engineering development model (EDM) USVs as part of the LCS ASW mission module. General Dynamics' industry team also includes Navatek, Alion Science and Technology, Signal Systems Corporation, International Logistics Systems and Chesapeake Sciences Corporation.

Spartan additionally bequeathed the indicative design for the LCS ASW mission package USV mission system. The EDM vessels themselves are 11 m craft adopting a novel M-hull platform.

QinetiQ: 1294417

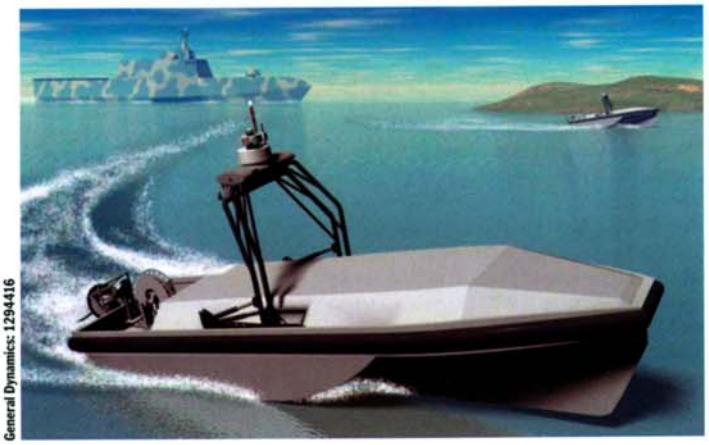
(Above) QinetiQ's Sentry is a fast, low radar-cross-section unmanned reconnaissance and surveillance craft that marries military design requirements with a compact jet ski-type vehicle based on a high-speed planing hull.

Speed/tow force trials

In a separate initiative to transition unmanned technology into the US fleet, the Naval Surface Warfare Division (NSWC) Carderock Division is trialling two purpose-built unmanned sea surface vehicles (USSVs) intended to respectively demonstrate high-speed (HS) and high tow-force (HTF) performance characteristics. The programme was established in 2003 under the sponsorship of the Office of Naval Research (ONR); the craft were built by Maritime Applied Physics Corporation in Baltimore.

According to NSWC Carderock Division, both USSVs are intended to leverage "advanced system integration and craft expertise" to provide "a highly versatile mission system capable of deploying numerous warfare payloads". Principal programme objectives include the demonstration of USV concepts of operation, automated launch and recovery, and autonomous operations.

The 34 ft (10.4 m) USSV-HS is optimised for high speeds (35 kt-plus) using hydrofoils that lift the craft clear of the water so as to provide a stable platform and eliminate wave slap. A key design objective was to continue operations in Sea State 3 while maintaining speed.



General Dynamics: 1294416

General Dynamics Robotic Systems is building 11 m engineering development model USVs as part of the LCS ASW mission module.

US Navy: 0560833

Remote control: as part of the USN's Spartan Scout ACTD programme, an unarmed ISR Spiral 1 craft was operated from the cruiser USS *Gettysburg* as part of the Enterprise Carrier Strike Group in mid-2003.

NUWC: 0564162

Spartan Scout is lowered from USS *Gettysburg* during its deployment to the Persian Gulf. The Spiral 1 system was embarked aboard *Gettysburg* for five months.

The USSV-HTF design, at 39 ft in length, employs fixed-tunnel propellers to propel the craft to a top speed in excess of 20 kt. It is optimised to tow MIW and ASW equipment in its wake.

An early initiative to demonstrate the front-line utility of the USV was undertaken by the ONR in the mid-1990s using the Sea Owl Mk II vehicle originally developed by Navtec (later acquired by DRS Technologies). An ONR Blue Book selection, Sea Owl Mk II was sent to the northern Persian Gulf in May–June 1995 to participate in mine surveillance proof-of-concept demonstrations; it was subsequently deployed with US Central Command in Bahrain in 1997; it operated the following year in waters around Camp Lejeune, North Carolina, as part of Riverine Insertion Operation Exercise 98; and it later participated in Fleet Battle Experiment-Juliet in mid-2002.

Originally developed under a US Office of Special Technology proof-of-concept prototype programme between 1992 and 1994, Sea Owl Mk II incorporated starlight, daylight and IR cameras and a commercial side-scan sonar, commercial GPS for navigation and tracking, and commercial single- frequency radios for telemetry, control and data transmission. A commercial spread-spectrum radio was installed for side-scan data transmission, as well as a commercial autopilot.

During its deployment to Bahrain between May and August 1997, Sea Owl Mk II conducted and demonstrated capabilities to perform waterside security, port and harbour surveillance, and maritime interception operations. It was also launched and recovered from a variety of 'mother' ships.

Robert Murphy, the originator of the initial Owl vehicle and now managing director of Marine Robotic Vessels International (MRVI), has gone on to develop a series of USV prototypes and demonstrators. These include Sentinel (a light-duty, jet-driven prototype 5.2 m USV built and tested in 2001) and Ghost Guard (an advanced engineering prototype based on a 5.8 m glass-fibre deep-V hull, which began testing in 2003).

Early in 2007, MRVI unveiled its fourth-generation Interceptor USV, developed in collaboration with AAI Corporation.

Remote multimission vehicle swims ahead and searches for new roles

Lockheed Martin's AN/WLD-1(V) remote minehunting system (RMS), which uses a diesel-powered semi-submersible vehicle towing a side-scan sonar to search for mines, was originally developed to provide an organic mine-reconnaissance capability for Arleigh Burke-class Flight IIA destroyers. However, the programme is now very much aligned to the US Navy's (USN's) Littoral Combat Ship (LCS) programme, with the mine-warfare module for LCS Flight 0 planned to include two AN/WLD-1(V) vehicles.

The RMS includes the remote multimission vehicle (RMMV), a launch-and-retrieval system, the AN/AQS-20A variable-depth sonar, communications equipment, and software to integrate the AN/WLD-1(V) into the host ship's combat system.

The RMMV itself uses a Cummins 370B diesel engine, offering long endurance (>24 hours), high performance (16 kt transit speed and 6–12 kt search speed) and economy (USD450 fuel cost per sortie). Using GPS precision navigation, it carries its own Doppler sonar and video camera for obstacle avoidance and can transmit sensor data and video images to its mothership via an above-water mast antenna.

There are two data communications modes. For shorter-range (line of sight) communications out to about 12–15 n miles, a high data-rate AN/VRC-99B UHF radio link can send back continuous sonar data to the host ship. When operating over the horizon, a surface-wave VHF link (using a PRC-117F radio) transmits snippets of data back at a lower data rate of 45 kbit/s.

In the RMS application, the RMMV tows the AQS-20A variable-depth sensor to detect, localise, classify and identify bottom and moored sea mines. Real-time sonar snippets are then relayed to the host ship via datalink.

In 2005, US Naval Sea Systems Command awarded Lockheed Martin a low-rate initial production contract for three RMMVs, with a contract for four more vehicles following in 2006. Lockheed Martin announced in January 2008 that it had delivered the third production RMMV to the USN, the first and second vehicles having been delivered in April and August 2007 respectively.

Towards the end of 2007, the full AN/WLD-1(V) RMS was deployed by the Flight IIA destroyer USS *Bainbridge* to conduct reconnaissance operations off the coast of Spain in advance of a forthcoming operational evaluation (OPEVAL). *Bainbridge* undertook operations with its embarked RMS off the Spanish coast on 10 December as part of a NATO naval task force exercise. The mission, lasting more than 10 hours, comprised real-time, shallow-water minefield operations with the AN/AQS-20 mine-reconnaissance sensor at a range of approximately 7 n miles from the ship. The ship's operators concluded the training with a night recovery of the system.

A team comprising USN civilian and Lockheed Martin personnel deployed to observe operations. As well as providing a demonstration of the system's capability to locate and classify sea mines, the training evolution was also designed to help prepare *Bainbridge*'s crew for a pending OPEVAL. The RMS had completed an operational assessment in mid-2006 and a technical evaluation in March 2007. OPEVAL will follow during 2008.

Lockheed Martin believes that the RMMV could have utility in a variety of roles, such as bistatic anti-submarine warfare; covert intelligence, surveillance and reconnaissance; influence minesweeping; and organic mine neutralisation (equipped with an expendable mine destructor). Other areas where the RMMV is seen to offer significant potential include special warfare operations, above-water surveillance to support harbour and coastal security, and force protection.

Specifically designed for security and public-service applications such as anti-piracy patrol, harbour security and oil-rig surveillance, Interceptor is a 6.5 m craft driven by a Steyr 266 hp diesel powering a Hamilton waterjet drive.

Trials of the Interceptor demonstrator started in September 2006 and are said to have satisfied early expectations. MRVI and AAI believe that the USV's capabilities could be extended by integrating a small organic unmanned aerial vehicle to increase its surveillance range and act as a communications relay.

UK above-water research

The UK Ministry of Defence (MoD), through its Maritime Surface Effects (MSE) research programme, is studying the application and utility of USVs in the above-water battlespace through a capability concept demonstrator (CCD) programme. This entails a series of trials in order to inform an effective assessment of the possible operational roles of USVs within the Royal Navy (RN).

BAE Systems' Corda consultancy arm is leading the MSE research programme, for which the MoD's Directorate of Equipment Capability (Above Water Effects) – DEC(AWE) – is sponsor. The USV CCD is contracted through the Defence Equipment and Support organisation's Future Business Group.

An initial phase of trials was conducted in the first half of 2007 at the British Underwater Test and Evaluation Centre range on Scotland's west coast. These involved QinetiQ's Sentry mini-USV and remote-controlled Pacific 22 RIB, and ASV Ltd's SASS 6M Mk II USV. BAE Systems' Talisman autonomous underwater vehicle also participated.

QinetiQ's activities in the unmanned surface domain first came to prominence in 2003 when it led efforts to convert a number of combat support boats for use in the remotely controlled Shallow Water Influence Minesweeping System (SWIMS). Since then the company has sought to exploit its capability to address a range of emerging requirements. For example, QinetiQ has delivered remotely controlled fast inshore attack craft (FIAC) surrogates to the RN for FP training purposes under a GBP500,000 (USD1 million) contract awarded in May 2005. The company had in fact, as a private venture, already demonstrated the underpinning remote-control USV technology on its own Pacific 22 Mk 2 RIB.

ASV: 1294418

ASV's SASS 6M Mk II vehicle was trialled in June 2007 as part of the UK's USV CCD programme.

Under the terms of the contract, QinetiQ provided remote-control equipment and associated services for the conversion of existing Pacific 22 Mk 1 RIBs into FIAC representative targets (RTs). It is also providing long-term support for the system via a five-year post-design service enabling arrangement.

According to QinetiQ, its FIAC RT design solution uplifts proprietary remote-control technology previously used in SWIMS. The original RIB manufacturer, VT Halmatic, was subcontracted to implement the design modifications required for the target role, including the incorporation of a steel armour package to protect the electronics payload from small-arms fire. Delivered in the third quarter of 2006, the craft are operated from Jupiter Point, Plymouth, on behalf of the RN's Flag Officer Sea Training organisation.

QinetiQ's unmanned fast harbour patrol craft (FHPC) builds on this same concept, using a standard RIB platform (such as a Pacific 22) equipped with a datalink, multi-sensor payload and loud hailer for surveillance of sensitive areas and as a first-level response asset. The company envisages the FHPC addressing harbour patrol and inspection requirements.

Sentry stands guard

Sentry, another QinetiQ project, is a fast, low radar-cross-section unmanned reconnaissance and surveillance craft that marries military design requirements with a compact jet ski-type vehicle based on a high-speed planing hull. Able to carry multiple payloads, the craft is being offered for roles such as harbour patrol and security, ISR and intruder interdiction.

The company says that Sentry's modular design enables straightforward upgrade or payload changes and support for remote-control, autonomous and regular operations. Capable of speeds of up to 50 kt and with a proven endurance of around six hours, the vehicle has an overall length of 3.5 m, a beam of 1.25 m and a height above the waterline of just 1.1 m. A simple PC-based remote-control operations console allows full control of the vehicle and the onboard features from a non-visual line-of-sight operations location.

The basic payload includes microwave datalink communications and camera, with payload options comprising stabilised real-time day/night high-resolution cameras, a full lighting rig that meets current maritime

Inspector demonstrates surveillance skills at HPT07

ECA Sindel demonstrated the ability of its Inspector USV to operate as part of an integrated harbour protection system during NATO's Harbour Protection Trials in September and October 2007 (HPT07).

Staged in Taranto, Italy, HPT07 was the latest in a series of NATO-sponsored trials led by the Italian Navy within the Conference of NATO Armaments Directors programmes for asymmetric threat defence. The trials are designed to explore new technologies that will enhance maritime protection against terrorist attacks. Earlier trials were carried out in 2004, 2005 and 2006 in the Gulf of La Spezia.

According to ECA, the Inspector USV was brought into HPT07 at the request of Selex Sistemi Integrati – lead contractor for the TALOS Harbour Protection System – to perform surveillance, inspection, interdiction and alert functions. The system was managed autonomously from a shore-based command-and-control station. The USV was subject to a number of simulated attacks from the sea by a low- and slow-flying AB 212 helicopter and up to two fast inflatable boats, roled as fast inshore attack craft surrogates. Several different simulated attack profiles were executed, according to both threat axis and speed, as well as different threat combinations – helicopter/dinghy, dinghy/dinghy, helicopter only, dinghy only – in order to evaluate detection capability and reaction time.

ECA has already sold seven examples of its 7.2 m Inspector USV to the French Navy. The first craft is being used by the Centre d'Essais de Lancement Missile (a missile test range near Toulon), with the remaining six due to be embarked aboard French frigates.

ECA: 1294423

ECA Sindel's Inspector USV has been demonstrated in harbour protection trials.

QinetiQ: 1294419

ASV: 1294420

The UK has purchased FIAC surrogates and fast marine target drones from QinetiQ and ASV respectively.

navigation standards, a loud-hailer system and a smoke-marker launcher. The radio-frequency (RF) control link enables Sentry to operate at up to 16 n miles (radar line of sight). There is also an autonomous system control module and an autonomous mission-planning software option.

Another UK company pursuing multiple opportunities in the military USV market is ASV Ltd. Its original survey autonomous semi-submersible (SASS) concept developed in 1995 from discussions concerning the high peripheral costs (particularly ship and labour costs) associated with survey activities. SASS technology was intended to permit a small unmanned semi-submersible vehicle to deploy sensors for gathering data from above or below the surface at significant distances from a ship or from the shore.

With a maximum speed of 12 kt and a payload capacity of 200 kg, ASV's SASS 6M design uses a semi-submersible platform with a submerged torpedo-like body running just below wave depth, a ballasted keel for stability, and a strong upright fared strut or spar protruding through the water surface. The spar provides the buoyancy to float at the correct depth with the mean waterline halfway up the spar. It enables RF coverage for communications and GPS or DGPS positioning, and also provides a stable structural component above water that is essential for launch, recovery and refuelling.

The full-scale SASS 6M Mk I technology demonstrator underwent first open-water trials in 2004, proving the hydrodynamic characteristics, construction materials and fabrication methods. It has subsequently been demonstrated with a series of payloads, including a surveillance TV camera, synthetic-aperture sonar and bathymetry sonar.

ASV envisages a number of military applications for SASS vehicles, including mine reconnaissance, minesweeping, ISR, hydrographic survey and maritime surveillance.

Rafael: 1294421

Rafael's Protector USV has been deployed operationally by the Republic of Singapore Navy.

It sees their principal attributes as long endurance, excellent seakeeping, a very stable sensor platform and a deck footprint one third of that of a RIB.

In May 2007 the SASS 6M vehicle was upgraded to a Mk II standard in preparation for trials as part of the UK's USV CCD programme. This entailed relocating the diesel powerplant from the top of the strut into the main submerged body.

Another larger SASS design, the ASV 9500, has recently been completed and is aimed at offshore surveillance. With a length of 9.5 m, the vessel has a patrol speed of 15 kt, a range of more than 1,500 n miles, and can remain at sea for several weeks (or even months depending on the operational profile) in all but the most extreme conditions.

ASV's sister company, Seaspeed Marine Consulting Ltd, delivered four fast marine target drones (FMTDs) to the UK MoD in August 2007, less than eight weeks after receiving a production order. The company was subsequently contracted to provide operational support for these craft during MoD exercises, enabling simultaneous and integrated multi-vessel operation to simulate the threat of small FIACs.

A prototype FMTD, based on an off-the-shelf 5 m aluminium planing craft capable of speeds up to 25 kt, was fitted with a control system supplied by ASV for initial demonstrations. After successful trials, the company was contracted to provide a further three craft with associated control systems. It is understood that a further follow-on order has now been placed through ASV.

The control system provides multi-vehicle, close-quarters operation out to a range of 10 km. The craft feature forward-looking video cameras, microphones and GPS, this outfit providing good situational awareness for the controllers of the craft and a fail-safe system to control and monitor the outboard motors. Craft are fitted with internal closed-cell foam to minimise water ingress after damage.

Israeli know-how

The long experience of Israeli industry in the field of unmanned systems is reflected in its development of a number of USV solutions. Rafael, for example, has produced the Protector USV, based on a purpose-designed 9 m hull. The vehicle, capable of reaching speeds in excess of 30 kt and controlled by either line-of-sight or non-line-of-sight communications, is configured to carry an anti-terror/FP mission payload comprising a commercial navigation radar, Rafael's Toplite EO director, its Mini-Typhoon small-calibre stabilised weapon station, a searchlight, loudspeaker and microphone.

The Republic of Singapore Navy became the first customer for the Protector system in 2004 and deployed two USVs to the northern Arabian Gulf in early 2005 to support maritime security and interdiction operations from the 8,500-ton Endurance-class landing ship RSS *Resolution*. According to Singapore's Ministry of Defence, their performance in-theatre was "highly effective".

Closer to home, the Israel Navy, with technical support from Rafael, has undertaken a series of concept development and operational evaluation activities using Protector. Rafael says that the Israeli navy has subsequently conducted operations in "various combat scenarios".

BAE Systems and Lockheed Martin Maritime Systems and Sensors have partnered with Rafael to promote Protector for potential US anti-terrorism and FP applications. A series of demonstrations was undertaken at locations around the coast of the United States in mid-2006.

Israel's Elbit Systems is also looking to penetrate the USV market. Having previously demonstrated the Stingray USV — based on an unmanned jet-ski concept originally developed by AD&D — Elbit subsequently acquired an 11 m glass-reinforced plastic fast boat — based on a Cafe Racer 35 platform from the Florida-based Cigarette Racing Team — and modified it to serve as a USV technology demonstrator.

The resultant product development, known as Silver Marlin, offers an endurance of 24 hours, a range of more than 500 n miles at cruising speed and a sprint speed of 45 kt. Payloads of up to 2,500 kg can be carried, with Elbit advertising options such as ISR, FP, ASuW, MIW, search and rescue, port and waterway patrol, and electronic warfare. The baseline mission fit includes an El Op CoMPASS EO director and an Elbit 7.62 mm Overhead Remote Control Weapon System.

Additionally, Elbit has undertaken development of the Autonomous Helmsman USV system, which uses heuristic methods for autonomous high-level decision-making. The company's intention has been to engineer a vehicle control system designed for optimal performance on low-level control activities such as turning rate, speed for fuel consumption, and accurate sailing and navigation with stabilisation systems to prevent capsize. Autonomous Helmsman is also auto-adaptive, being capable of self-tuning control responses to reflect environmental or mission changes. ■

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