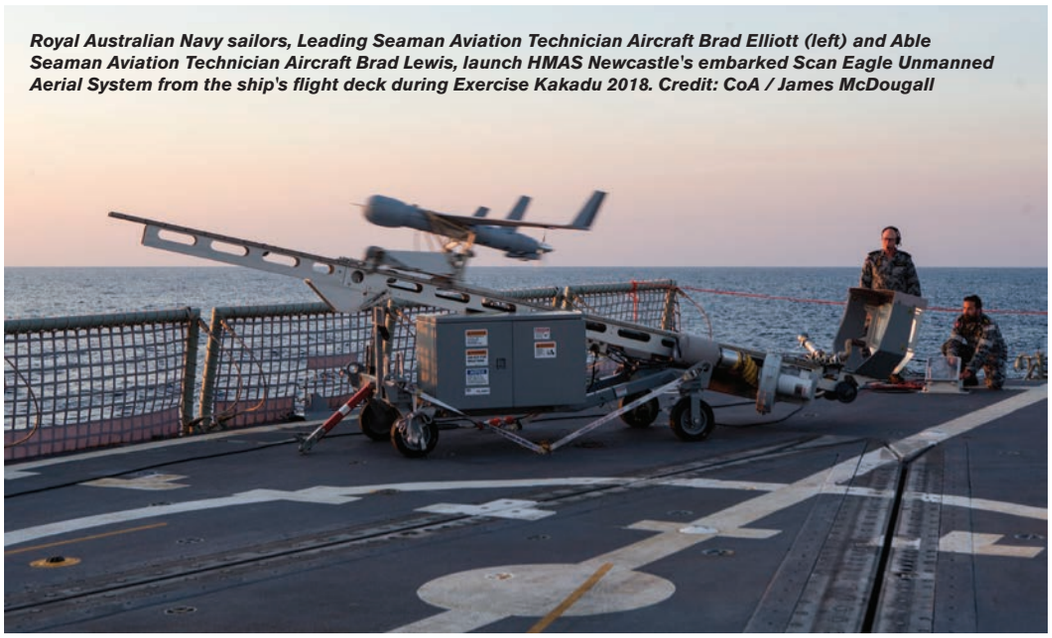
GEOFF SLOCOMBE // VICTORIA

AUTONOMOUS UNCREWED VEHICLES IN THE MARITIME DOMAIN

As Australia's Department of Defence continues to develop plans for manned platforms, like frigates and submarines, that are going to cost billions of dollars and not produce any increments in capability until well in the future, but are they planning to spend scarce project dollars on the wrong things? Many observers, including this one, believe that manned vessels should be command centres for hosts of small uncrewed autonomous vehicles which can overwhelm any antagonist.

Uncrewed vehicles does not mean "no crew". Just as an aerial drone requires a ground-based pilot, flight planning and supervision, and a ground crew to marshal, arm and maintain an aircraft, uncrewed vehicles in the maritime domain will require a highly skilled support crew at sea and ashore.

The roles for navy operators will be changing and the roles for industry support must change also. A highly capable sovereign industry capability will contribute to availability of uncrewed systems though fast turnaround of planned maintenance and urgent defect repairs, constant attention and development of a local supply chain, and the capability to modify systems to meet unique Australian requirements.



Royal Australian Navy sailors, Leading Seaman Aviation Technician Aircraft Brad Elliott (left) and Able Seaman Aviation Technician Aircraft Brad Lewis, launch HMAS Newcastle's embarked Scan Eagle Unmanned Aerial System from the ship's flight deck during Exercise Kakadu 2018. Credit: CoA / James McDougall

AUSTRALIAN DEFENCE INDUSTRY CAPABILITIES

When APDR asked Darren Burrowes, co-founder and Chief Technology Officer of Australia's Blue Zone Group (BZG) for his views on defence industry's role with respect to supplying and supporting uncrewed vehicles. He told us:

"In the context of surface warfare uncrewed platforms are evolutionary not revolutionary.

"BZG is involved in a number of initiatives in both mine warfare and anti-submarine warfare, two key elements of uncrewed surface warfare as a whole. In both cases the company has learned that autonomous and automated platforms and systems are not a capability of and by themselves. They do not replace manned capability; they augment and amplify it.

"Therefore, it is essential to modify and adapt systems to work seamlessly with sovereign warfighters.

"This requires a strong, trusted and professional partnership between ADF operators and Australian industry. BZG has worked hard over the last 20+ years to establish such a relationship and now it can boast an unparalleled level of collaborative activity to design, develop and deliver maritime uncrewed capability across the ADF."

In the context of Australian military needs, uncrewed vehicle capability is defined by the payloads not by the vehicles. Therefore, it stands to reason that the capability to develop payloads locally, and in close cooperation with the ADF, is an essential industrial requirement.

To achieve this a company like BZG has had to developed a wide range of technical skills across a range of OEM-supplied vehicles, a workforce skillset tailored to integrating systems, sensors and platforms against the ADF's requirements and a supplier network that guarantees access to a proven, reliable and contemporary technology base.

UNCREWED AERIAL VEHICLES

SEA 129 Phase 5 Block 1 is Defence's project to equip the future Arafura Class offshore patrol vessels (OPVs) with autonomous uncrewed aerial vehicles which may be either helicopters or fixed wing aircraft or both.

The choice of aircraft type depends on the characteristics sought, given the likely roles for these OPVs. Rotary types can carry heavier loads, be launched from a small area of deck, but have limited range.

Fixed wing types carry lighter loads, with much greater endurance, but have the challenge of how to launch and recapture them at sea.

In March 2021 Defence announced the five companies whose offers they will evaluate in the next phase of their Block 1 OPV maritime tactical unmanned (now uncrewed) aerial systems (MTUAS) procurement activity.

Those companies are BAE Systems Australia, Insitu Pacific, Northrop Grumman Australia, Raytheon Australia, and Textron Systems Australia.

While BAE Systems Australia has not revealed publicly what they have offered, their approach will leverage their experience and expertise in autonomous systems, sensors and the integration

of platforms and systems with major surface ships, while optimising Australian Industry Capability outcomes.

Insitu Pacific have proposed their ScanEagle2/ Integrator® family, while the other three companies have all proposed helicopter platforms.

APDR took an opportunity to discuss the ScanEagle/Integrator® family with Andrew Duggan, managing director of Insitu Pacific, without reference to the MTUAS project since Defence could have a problem with that based on their normal strong reaction against journalistic probing.

Mr Duggan said:

"Insitu Pacific was pleased to have been shortlisted in March. We look forward to providing our proposal to support and sustain vital maritime domain awareness capability through our globally proven UAS solutions."

"ScanEagle is currently operating with the Royal Australian Navy's 822X Squadron in Nowra as part of the Navy's efforts to assess the effectiveness of UAS to support maritime ISR requirements.

"The Insitu Family of Systems is delivering a wide range of battlespace effects, and enduring capability to enable 24/7 intelligence, surveillance and reconnaissance.

"The Insitu family of systems are designed to maximise commonality with common launch and recovery equipment, GCS and software and analytics – saving money on life-cycle costs and training."

APDR established that ScanEagle has now experienced 1.3 million flight hours at 50 sites. The new version called ScanEagle 2 features upgraded avionics, expanded payload options and a new heavy fuel purpose-built propulsion system that dramatically improves reliability and performance.

ScanEagle 2 can carry a 5kg payload supported by up to 150W of onboard power, while the bigger Integrator® has 18kg maximum payload weight, combined with longer 24+ hours endurance.

Mr Duggan urged us not to concentrate on size but rather on how to pack more smarts into the chosen vehicle.

He explained that the ScanEagle 2 and Integrator® have the same avionics so the choice is really about capabilities for operational missions. Both use the same catapult launcher and pole system recapture.

For SEA129 Phase 5 Block 1 APDR understands that Northrop Grumman Australia will be tendering the Leonardo AWHero, Raytheon Australia will offer the Schiebel S-100 Camcopter, and Textron Systems Australia will propose Aerosonde Mk4.7/HQ.

UNCREWED SURFACE VEHICLES (USV)

Four Ocius Bluebottle autonomous uncrewed vehicles have been undergoing trials in the Timor Sea. In the past five months they have been making passages in an impressive display of their capabilities.

Commander Maritime Border Command, Rear Admiral Mark Hill responded to APDR's questions with these comments:

"MBC's area of operation is vast and resource rich, and I welcome technological advances, such as these autonomous sea vehicles, to advance our strong border protection arrangements.

"I am very happy to be part of this trial with the Royal Australian Navy, and while still subject to review, the initial results have demonstrated this technology works well with our existing capability and further enhances our ability to detect, deter and respond to on-water threats."

Robert Dane, CEO of Ocius informed APDR that four Bluebottles have been operating in the Timor Sea since October. Darwin operations in the first 2 months had covering 6400 nautical miles (10 Sydney to Hobarts) in 2 months with zero carbon footprint.

The Ocius website also has a video which can be watched showing the routes taken by the trial vessels

HMAS Ballarat's embarked MH-60R helicopter and S-100 Schiebel Camcopter on the flight deck, while sailing off the coast of Queensland during Exercise Talisman Sabre 2021. Credit: CoA / Ernesto Sanchez

so far.

When APDR checked with a Maritime Border Command spokesperson specifically on these trials, they told us that:

"Maritime Border Command recently participated in the Royal Australian Navy and Ocius Bluebottle trial of Uninhabited Surface Vehicles (USV). The trial, from August to December 2021, was conducted from Darwin and completed in the vicinity of Ashmore and Cartier Islands.

"The objective of the trial was to assess the use of the Bluebottle as a relatively persistent maritime surveillance system to support civil maritime security. Specifically, its ability to detect and assess small boats that pose a potential threat within its area of operation was tested, as was its capability to respond to requests from MBC to investigate areas of interest.

"The trial is still underway."

When APDR asked Navy, their spokesperson told APDR that:

"The RAS-AI Directorate are the sponsors of the Defence Innovation Hub (DIH) project which is conducting the Bluebottle trials, operating from Darwin. Through the DIH, the Directorate has been kept informed of the trial progress. As the trial is still underway, no conclusions have been drawn thus far."

Boeing's Liquid Robotics Wave Glider made headlines when it undertook a solo passage from San Francisco to landfall near Bundaberg, Queensland. It started on 17 November 2011 and navigated on a pre-programmed route across the high seas battling shark attacks, overcame severe currents and navigated through Cyclone Freda (a Category 4 cyclone) to reach Lady Musgrave Island on 14 February 2013.

The Wave Glider's revolutionary design converts wave energy into forward propulsion and uses solar energy to power the onboard sensor payload, communications and computing. No fossil fuels are used.

Another impressive surface vehicle is the Martac Mantas family, available through BZG, which can perform in environments and conditions where other USVs cannot. The family has a range of models from two metres up to 15 metres length overall.

Equipped with solar panels, it has electric or diesel electric propulsion, with lithium batteries for C5ISR and vessel operations. Short burst speed capability is up to 80 knots.

UNCREWED UNDERWATER VEHICLES (UUV)

Best known are the REMUS family – 100, 300, 600.

BlueZone Group has supplied REMUS 100 & 600 and continues to supply parts, including replacement batteries and other components, as trials and development continue in Australia.

This experience has shown that original parts and sub-systems can be difficult to obtain as manufacturers rapidly develop and update products, continually improving function and performance. Manufacturers often do not retain stock of previous models and versions as they are motivated only to provide the most advanced functionality. The implications for Defence supply chains must be considered.

Boeing's Echo Voyager is a fully autonomous extra-large uncrewed undersea vehicle (XLUUV) class that can be used for a variety of missions that were previously impossible due to traditional UUV limitations.

o Voyager is complete with an extensive internal and external payload volume and available energy capacity, expanding the parameters of what is possible in current uncrewed undersea systems.

The vehicle's advanced autonomy enables it to perform at sea for months at a time, delivering a more affordable, mission-capable solution over traditional UUVs.

Boeing has designed and operated manned and uncrewed deep sea systems since the 1960s, including Rockwell International legacy systems and U.S. Navy support programs. Prior to Echo Voyager, Boeing developed Echo Seeker and Echo Ranger, autonomous and large UUVs as test beds for its current XLUUV.

IN CONCLUSION

Extensive and continual operation of uncrewed systems in the field will truly test their operational benefits and limitations.

In 2007, the then Rapid Prototyping, Development and Evaluation group within Navy/Defence conducted trials at Jervis Bay of uncrewed systems. 14 years later, it is sobering to consider whether or not Navy could field uncrewed systems for an extended operation in a remote area during a time of heightened tension.

The procurement practices for uncrewed systems must be overhauled to make them a better fit for the rapid development of the field, with the aim of getting technology into the war fighter's hands faster.

Australia doesn't need to waste money developing new uncrewed vehicles. There is a plethora of vehicles readily available on the market, operated by allies and priced for global sales, not sovereign budget.

Australia can easily access appropriate platforms with the dynamic characteristics needed for whatever task the ADF defines. There is no need to pay a premium to develop a new platform as the chances of a return on investment are slim. It would be much wiser to acquire a low-cost platform and invest in the local capability to maintain, adapt and operate the platform locally.

This will yield a return on investment through the savings made by avoiding returning the platforms of the overseas OEM for repair and maintenance over its service life.

The Remus experience is a good example. There are multiple Remus UUVs for a multitude of missions and BZG is developing many skills to maintain sovereign support for the various models chosen by the ADF and projected for future investment.