UNINHABITED SYSTEMS GROWING IN IMPORTANCE FOR AIR COMBAT

SOTG IN AFGHANISTAN AND THE BRERETON REPORT

INTERVIEW: STÉPHANE MAROUANI, MATHWORKS AUSTRALIA

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A s the end of 2020 approaches there are a number of major developments unfolding – both good and troublesome. Australia’s relationship with China is at something of a low point with no particular end in sight – and the consequences for the economy could be serious if Beijing seeks to inflict further punishment by restricting more imports. As unpleasant as this might be to consider, this could be the new reality that we all have to live with.

The reasons for the unhappy state of affairs are various – and there is fault on both sides. China under President Xi has become more bellicose and aggressive with a number of countries in the region feeling the effects. India is losing territory in the Himalayas; Taiwan is intimidated; Japan is nervous and is increasing defence spending – and this is taking place at a time of great uncertainty in the US as Donald Trump and apparently most of the Republican Party incorrectly claiming that he has actually won the Presidential election because of massive voter fraud favouring his opponent.

The quick summary is that we are now seeing more clearly the seismic shifts that have been underway for several years: the growth of China and the relative decline of the US. One very obvious characteristic of the attitude of Beijing is its sensitivity to megaphone diplomacy and a tendency to push back when it can. This is simply a fact and it doesn’t matter whether Australian politicians, business and the media like it or not.

Perhaps the time has come for the hollowed out Australian diplomatic corps – a process that started under Kevin Rudd and has accelerated since then – to be restored so that we can make our views clearly understood in the region behind closed doors and use public shouting as a last resort. The same can be said for the aid budget – we will need all the friends we can get in this rapidly changing part of the globe and for the miniscule amounts of money involved Australia can generate a lot of good will far into the future.

If, as expected, Joe Biden is sworn in on January 20 next year as US President, that will make life more predictable for Australian planners, but only slightly so. He and his team are deeply experienced and committed to the international system – especially alliances with trusted allies. However, domestically the US has been fractured by the last five years and the clock can never be wound back to a happier time when all sides of politics at least pursued common goals in the national interest.

It is quite possible that political gridlock will continue in Washington with the Republicans continuing to hold the Senate – the two seats up for grabs in Georgia notwithstanding. Should this be the case, the country will be hamstrung by an inadequate response to COVID-19 – both from an economic and public health perspective – and a broad policy malaise where nothing much will happen will continue, apart from the regular appointment of conservative judges. With this as background, the country is hardly likely to waste much energy on foreign policy and may well expect allies to look after themselves.

The good news, of course, is the reality of an effective vaccine for COVID-19 being rolled out firstly in the UK. Vaccines are also being deployed in both Russia and China – though to a different level of personal safety to that which is acceptable elsewhere in the world. More are on the way and within months this will start to have a measurable impact on combating the pandemic.

While estimates vary, it might be that by the second quarter of next year international travel really starts to pick up if millions of travellers can be inoculated against the virus before boarding their flights. Thankfully Australia has a very good healthcare system and plans are well advanced for how to protect the most vulnerable first – front line health care workers and the elderly – before moving on to the broader population. Because of a robust education system – and it must be said a generally responsible media – most people look likely to accept the medical advice that vaccines are safe. This will make for a far happier 2021 than the previous year has been.

As the concluding editorial for this year, mention must be made of the Brereton Report, covered separately in this edition. It has had a profound effect on everyone in the Defence community and is causing a great deal of understandable reflection on how collectively we have arrived at this point. The ADF is overwhelmingly an organisation staffed and run by decent, hard-working, truthful and courageous people. However, some cultural changes will be needed, and tough decisions taken – not only by senior people in uniform but also by politicians who are the ones actually making decisions about which conflicts Australia should be involved in and the manner of that participation.

At the end of one of the most difficult years in living memory, there is more reason to be positive than negative about the future of the country. We will pull through COVID-19 in far better shape than many comparable countries – and the lessons that we have painfully and sometimes clumsily learned will be vital for when we face the next pandemic. Our economy is robust and our institutions stable and effective – though like any complex system, continuous monitoring and adjustments when necessary will be required.

Best wishes to all of our readers, industry partners, supporters and critics, friends and families. At APDR we all hope you have a merry Christmas and a happy, prosperous – and most importantly of all – peaceful New Year.

From the publisher

As 2020 draws to a close, I sincerely thank my team at APDR who have worked tirelessly throughout this very difficult year. I wish our readers a happy and safe festive season to come, and we hope for brighter days ahead in 2021.

Merry Christmas & Happy New Year!

- MARILYN TANGYE BUTLER
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AUSTRALIA COLLABORATES WITH THE US TO DEVELOP AND TEST HIGH-SPEED LONG-RANGE HYPERSONIC WEAPONS

1 December 2020

The Morrison Government is delivering on its commitment to develop high-speed long-range strike capabilities to build a more capable and agile Australian Defence Force (ADF).

Last week Australia and the United States signed a new collaborative agreement to develop and test hypersonic cruise missile prototypes.

This agreement will take place under the Southern Cross Integrated Flight Research Experiment (SCIFiRE) to cooperatively flight test full-size prototype hypersonic cruise missiles.

Minister for Defence, Senator the Hon Linda Reynolds CSC said maintaining Australia's technological edge and capability superiority is key to this Government's strategic planning.

"I am pleased to see this agreement come to fruition following my discussions with then Secretary Esper during my visit to the United States in July this year," Minister Reynolds said.

"At AUSMIN, we acknowledged the unique role of our defence partnership to maintain our competitive edge, and affirmed the value of bilateral collaboration on hypersonics.

"The Morrison Government remains committed to keeping Australians safe, while protecting the nation's interests in a rapidly changing global environment.

"That's why we will continue to invest in advanced capabilities to give the ADF more options to deter aggression against Australia's interests including the $9.3 billion earmarked in the Force Structure Plan 2020 for high-speed long-range strike and missile defence, including hypersonic development, test and evaluation.

"This is part of our unprecedented $270 billion investment in defence capability over the next decade which is creating jobs right across Australia while delivering vital capability for the ADF:

"The SCIFiRE Program is based on more than 15 years of collaboration between Australia and the United States on science and technology research into hypersonic scramjets, rocket motors, sensors, and advanced manufacturing materials.

"Minister Reynolds said the experiment will culminate in flight demonstrations to show how the weapon performs in operational conditions, which will inform any future acquisitions.

"Developing this game-changing capability with the United States from an early stage is providing opportunities for Australian industry," Minister Reynolds said.

"This demonstrates the Morrison Government's commitment to strengthening Australia's sovereign defence industry while creating more high-tech Australian jobs and enhancing the ADF's self-reliance.

"Investing in capabilities that deter actions against Australia also benefits our region, our allies and our security partners.

"We remain committed to peace and stability in the region, and an open, inclusive and prosperous Indo-Pacific."

Mr Michael Kratsios, Acting Under Secretary for Research and Engineering, US Department of Defense, welcomed the new collaboration.

"SCIFiRE is a true testament to the enduring friendship and strong partnership between the United States and Australia," said Mr Kratsios.

"This initiative will be essential to the future of hypersonic research and development, ensuring the US and our allies lead the world in the advancement of this transformational warfighting capability.

"We thank the Australian Department of Defence for their shared commitment to this game-changing effort."

Air Marshal Mel Hupfeld AO, DSC, Chief of Air Force was excited about SCIFiRE's potential.

"The SCIFiRE initiative is another opportunity to advance the capabilities in our Air Combat Capability Program to support joint force effects to advance Australia's security and prosperity," Air Marshal Hupfeld said.

"Working with our Defence scientists here in Australia and our partners in the US Air Force and across the US Department of Defense on leading edge capabilities brings out the best in our Air Force team.

"We are maximising our learning during development to better define the capabilities and needs as the system matures, and we are gaining insights as we go that will help us integrate it into the future Joint Force."

ROYAL AUSTRALIAN AIR FORCE AND ROYAL AIR FORCE FORMALISE COOPERATION

2 December 2020

Chief of Air Force has announced the signing of the Air Cooperation Framework with the Royal Air Force formalising the two services’ long standing collaboration.

The Framework provides a structure aligned to the overarching Australia-UK Military Cooperation Framework and is based on shared platforms, workforces and like-mindedness.

Air Marshal Mel Hupfeld, AO, DSC, Chief of Air Force said the Royal Australian Air Force and the Royal Air Force have enjoyed a rich history of working side-by-side.

"We look forward to promoting closer cooperation as we introduce a range of common platforms and systems into service and support them in operations," Air Marshal Hupfeld said.

"Our forces share multiple platforms; from the venerable C-130 Hercules, to the very new F-35 Lightning, and to our future platforms like the MQ-9B SkyGuardian.

"All of our shared capabilities provide valuable opportunities for us to work together to achieve our capability and interoperability goals."

Under the Air Cooperation Framework, Air Force and the Royal Air Force will enhance interoperability, harmonise activities and the development of doctrine.

The agreement will also rationalise programs to leverage each other’s capabilities, share lessons, and mutually support activities from each other’s bases.

"We face an increasingly uncertain geostrategic situation within our region and welcome the UK’s renewed engagement in the Indo-Pacific," Air Marshal Hupfeld said.

"Exploiting areas of common ground between our Royal Australian Air Force and the Royal Air Force will help us to respond to our countries’ respective national interests."
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EM SOLUTIONS SECURES FURTHER ORDERS FROM L3HARRIS TECHNOLOGIES FOR ITS SATELLITE TERMINAL TRANSCEIVERS

2 December 2020, BRISBANE, AUSTRALIA

EM Solutions, a wholly-owned subsidiary of Electro Optic Systems Holdings, has recently received a second order to supply its Ka-band transceivers for the L3Harris Technologies Panther II Very Small Aperture Terminals (VSAT).

The new contract, valued at more than $US2M, will deliver over 100 Ka-band transceivers to L3Harris across the first half of 2021.

EM Solutions CEO Dr Rowan Gilmore, said "We are delighted to have been chosen as the exclusive provider of our latest broadband Ka-band transceivers into the new Panther II program. These transceivers build further upon our core technology that has been supplied over recent years into numerous maritime, airborne and land mobile systems. Based on the latest GaN technology, they cover both the military Ka-band spectrum and commercial Ka-band as well."

Jerry Adams, general manager of VSAT for L3Harris, said "L3Harris and EM Solutions have been working for several years to perfect a transceiver that had the right size and weight for the Panther II terminal, yet was powerful enough to meet the tough WGS satellite certifications. The new transceiver fits the bill perfectly."

Adams continued "We are pleased that our collaboration with EM Solutions has yielded such great results, so that our Panther II manpack terminal will remain at the forefront of military satellite communications, globally. The Panther II terminal is the smallest physical terminal in use by the Marines. It can be carried as a manpack and set up by an individual within 10 minutes."

The contract award to EM Solutions follows an earlier order to supply 50 transceivers that are already being delivered to L3Harris.

AUSTRALIAN INNOVATION CENTRAL TO BABCOCK AUSTRALASIA’S LAND125 BID

24 November 2020

Australian Industry Capability (AIC) and innovation are at the forefront of Babcock Australasia’s bid to equip Australian soldiers with next generation technology as part of LAND125 Phase 4.

The LAND125 Phase 4 project will provide Australian soldiers with “best of breed” products, defend the nation armed with the latest, disruptive advances in modern warfare.

The project will deliver an Integrated Soldier System (ISS) integrating all elements and subsystems that are used, worn or carried by soldiers in any operational context or environment for up to 72hrs without resupply.

Babcock Australasia’s Executive Director – Strategy and Future Business, Graeme Nayler, said Babcock is grateful to all Australian industry partners who responded to its call to bring next generation technology to the Australian Defence Force (ADF).

“Australian small and medium enterprises (SMEs) and training providers are integral to Babcock’s proposed solution, with over 40% of the project’s requirements able to be either designed or manufactured in Australia,” Mr Nayler said.

“Babcock has approached LAND125 Phase 4 in an innovative way that is beneficial for Defence, looking at ‘best of breed’ products and enabling Australian SMEs to integrate their world-leading product into the ISS for an optimal cost."

To enable the integration of specialist products by different providers, Babcock has introduced a digital development environment as part of its solution.

“A challenge for industry, in developing a solution for the ISS ready to respond to a Request for Tender (RFT), is obtaining access to a soldier who is accurately configured and kitted out the way they are on operations,” Mr Nayler said.

“By designing and configuring the solution in virtual reality, Babcock’s approach will also ensure development cost savings across the complete ISS design and integration.

“This will enable us to ‘mix and match’ equipment from different suppliers, to visualise and explore the impacts on the overall integrated system.

“This technology creates a pathway for AIC to happen, allowing us to configure and integrate the soldiers’ equipment, elements and subsystems in virtual reality.

“Our engineers are able to better understand the equipment interfaces and potential human factors issues before they arise."

Babcock Australasia’s Head of Business Development, Mick Burgess, said Babcock continues to deliver on its commitment to AIC to generate sovereign industry capability for the ADF.

“In partnership with Defence, Babcock brings extensive, proven expertise in technology integration and asset management to the LAND125 Phase 4 project, delivering an ISS to equip Australian soldiers now and into the future,” said Mr Burgess.
Hanwha’s fighting vehicle experience is directly applicable to Land 400 Phase 3

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NEW APPROACH TO SUSTAINMENT OF NAVY FLEET TO BOOST REGIONAL DEFENCE INDUSTRY
1 December 2020

Defence is looking for an Australian industry partner to deliver a new, innovative approach to the sustainment of Navy’s fleet, which will boost defence industry in the regions through the establishment of Regional Maintenance Centres.

A tender has opened for a Regional Maintenance Provider for Defence’s first Regional Maintenance Centre – Regional Maintenance Centre North East in Cairns.

Regional Maintenance Providers will ensure sustainment capability in strategic Navy homeports and over time will be able to conduct maintenance on a range of vessels.

Head Maritime Systems, Rear Admiral Wendy Malcolm said the new approach will ensure delivery of complex naval capability and will increase opportunities for local small and medium businesses.

“The new approach, as outlined in Defence’s Plan Galileo, is part of the Australian Government’s investment of over $170 billion in naval shipbuilding announced in the 2020 Force Structure Plan. This will result in the fleet doubling in tonnage and significantly increasing in complexity,” Rear Admiral Malcolm said.

“Regional Maintenance Providers will coordinate the delivery of maintenance and build resilient local and regional supply chains on behalf of the Commonwealth.

“This will provide more stable work packages and remove barriers to entry for local small and medium businesses, enabling the opportunity for increased participation.”

Regional Maintenance Centre North East is the first of four to be set up, and will be in place by the end of 2021 to initially sustain Navy’s new Evolved Cape Class Patrol Boots.

This will be supported by the Australian Government’s Skilling Australia’s Defence Industry Grants program, which provides businesses servicing the defence sector with upskilling and training opportunities.

It also aligns with the Australian Government’s recently announced $1.5 billion Modern Manufacturing Strategy which will build resilient supply chains.

The tender opened on 27 November 2020 and will close on 12 March 2021. Further information is available on AusTender.

LOCKHEED MARTIN SIGNS DEALS WITH AUSTRALIAN SMES FOR AIR6500

25 November, 2020, CANBERRA

As part of the commitment to continuing a long-term sovereign capability to support the Australian Defence Force’s AIR6500 program, Lockheed Martin Australia (LMA) announced contracts with five Australian small to medium enterprises (SMEs) to explore Australian sovereign technologies that may be incorporated into the AIR6500 system solution.

LMA, together with innovative Australian SMEs which include Consilium Technology, Consunet, Shod, Silentium Defence and Ultra, will investigate and develop capabilities that can be integrated into an open architecture framework to support 5th generation concepts and application development. A key focus of the SMEs will be to explore technologies ranging from electronic warfare battle management, contested communications, cyber protection, advanced systems engineering and passive sensing.

According to Steve Froelich, Lockheed Martin Australia AIR6500 program executive, “over the past four years, the LMA AIR6500 team has been steadily adding to our sovereign presence and expanding our Australian team. Critical to that effort has been our focus on proactively engaging and establishing partnerships with Australian industry to identify and invest in ‘best of breed’ local capabilities to deliver a truly sovereign capability solution for Australia.”

To achieve this, LMA has conducted roadshows in every capital city and across large regional centres in Australia, and due to COVID-19 restrictions, most recently held a virtual industry session with New Zealand’s defence industry to investigate partnerships for AIR6500. From these engagements LMA has identified and validated more than 130 Australian SMEs as potential industry partners with technologies that could be incorporated into the AIR6500 program solution.

“Today’s announcement demonstrates our steadfast commitment to work with industry, academia and government to create opportunities for technology transfer, grow the top-level skills base and capabilities to add additional high-tech jobs that help build a stronger, more secure Australia,” said Froelich.

Joe North, chief executive Lockheed Martin Australia and New Zealand, said that there is a vitality and capacity within Australian industry to deliver world-class defence capabilities. “We are committed to working with like-minded Australian industry partners to elevate the technology base in Australia and to help advance the innovative Australian high technology businesses so they can actively contribute to a major defence program and shape Australia’s future defence capabilities. We have a proven track record of partnering closely with Australian industry as stewards, to develop, integrate, build, supply and maintain future technologies and capabilities within Australia and New Zealand,” North said.

LMA actively supports an Australian sovereign defence capability which sees a highly skilled workforce of over 1100 across Australia who partner with defence and industry to deliver, integrate and sustain advanced technology solutions. In turn, the company’s programs and projects directly support a further 5,000 Australian jobs in the advanced manufacturing and high technology defence industry sector.

Industry partner, Nick Cooper, chief information officer at Consilium Technology, said he is delighted to be a partner to LMA to develop an advanced open architecture technology to deliver a world-class solution for Australia’s future joint all domain capability.

Consilium Technology is excited by this terrific opportunity to contribute to this major defence program that will strengthen Australia’s national security. We are pleased to be collaborating with Lockheed Martin Australia to explore and create advanced technologies that will support our nation’s ability to protect against future threats,” Cooper said.
Without wishing to be too precise, the rot seemed to start setting in around 2001 when the SAS were used unnecessarily to land on the MV Tampa to intimidate asylum seekers and the ship’s crew from landing in Australia – an entirely political decision. This seemed to give the organisation a profile and political clout that has since been used for everything from demanding and receiving their own compound and their own special food in Afghanistan, to refusing to refund unfairly paid allowances, to defying the beret ban (a health and safety measure) and demanding (and receiving) special treatment in the selection of personal weapons.

In all of these cases of trying to limit or remove special treatment, the Army hierarchy were overruled by the Defence Ministers and Prime Ministers of the day. That does not let Army off the hook entirely because it seems there was no pushback against the over-use of Special Forces, which have become the preferred solution by governments to any 21st century military mission – particularly in Afghanistan. The report also concludes that even though people in headquarters were lied to and were not responsible in a legal sense for the killings, they share some of the blame in a broader moral sense of allowing themselves to be bluffed into not taking remedial action.

The senior levels of the Army also cannot plead complete ignorance because after four separate incidents involving the SAS in 2012, the US officer in charge of their Special Forces, Major General David Burford, demanded that the Australians be removed from Afghanistan. This was ignored.

The reverberations of the Brereton Report may go on indefinitely. Russia and especially China have now piled on, the latter posting a doctored image of an Australian soldier cutting the throat of an Afghan child clutching a sheep. Rather than ignore this obvious provocation, Prime Minister Morrison reacted with fury – a move that gave this sordid episode a much higher profile than it deserved. As sure as night follows day, photos then emerged of SAS soldiers in Afghanistan dancing with and drinking beer from the prosthetic leg souvenired from a dead Taliban fighter. Try justifying that one. More images to come.

The suggestion that somehow the conduct of Australian SF was a complete mystery to everyone is refuted throughout the report. Indeed, part of the genesis of the investigation were numerous credible media reports of wrongdoings – throwing prisoners off cliffs, shooting an Imam, mutilating corpses – have been around for years and have been summarised by the Federal Parliamentary Library here:


The senior levels of the Army also cannot plead complete ignorance because after four separate incidents involving the SAS in 2012, the US officer in charge of their Special Forces, Major General David Burford, demanded that the Australians be removed from Afghanistan. This was ignored.
The accounts consistently paint a picture of a gradual erosion of standards, contributed to by the character and tempo of the deployments (and redeployments), inappropriate metrics of success imposed from above and warping behaviour within SF Task Group, a lack of clarity about purpose and a general loss of confidence in both the mission and the higher chain of command, a fractured, compartmentalised, dysfunctional leadership and a general lack of oversight aided and abetted by the very people who should have been providing it. This combination of factors led to a normalisation over time of behaviours that should never have been considered normal and ultimately, the effective covering up of, or wilful blindness to, the perpetration of war crimes.

That sounds like there is a lot of soul searching required at all officer levels within the Army. To make a bad situation even worse, even now many in the Special Forces are in complete denial that they did anything wrong:

“Some domestic commanders of Special Air Service Regiment (SASR) bear significant responsibility for contributing to the environment in which war crimes were committed, most notably those who embraced or fostered the ‘warrior culture’ and empowered, or did not restrain, the clique of non-commissioned officers (NCOs) who propagated it. That responsibility is to some extent shared by those who, in misconceived loyalty to their Regiment, or their mates, have not been prepared to ‘call out’ criminal conduct or, even to this day, decline to accept that it occurred in the face of incontrovertible evidence, or seek to offer obscure and unconvincing justifications and mitigations for it.

Although many members of SOTG demonstrated great courage and commitment, and although it had considerable achievements, what is now known must disentitle the unit as a whole to qualification for recognition for sustained outstanding service. It has to be said that what this Report discloses is disgraceful and a profound betrayal of Australian Defence Force professional standards and expectations. It is not meritorious. Revocation of the award of the meritorious unit citation would be an effective demonstration of the collective responsibility and accountability of SOTG as a whole for those events.”

The pushback at a political level against the revocation meritorious unit by the SOTG has already visibly commenced – and like all of the other things they have objected to may once again result in this being overturned. If so, it will be yet another example of Special Forces refusing to be reined in.

ADFIS

The report makes clear at numerous points that there were attempts by other parts of the ADF to investigate what was going on in Afghanistan, but they were blocked at every turn. In particular, the Military Police – at the time known as the ADF Investigative Service – tried to find out what was happening but were unable to do so.

To paraphrase the outgoing Leader of the Free World, “who knew military justice was so complicated?” because another figure in all of this is the Provost Marshal of the ADF, whose people in ADFIS were clearly alarmed at what they were hearing and tried to figure out what was happening. At page 442:

“The PMADF submission to the IGADF Afghanistan Inquiry concluded:

Over the period of 2007 to 2016, the ADFIS have had many interactions with SOCOMD. There have been several positive interactions, however; the majority of interactions have indicated a deep-seated culture of command-supported interference and resistance towards ADF Investigators. This culture appears to be spread across SOCOMD and is evidenced at most rank levels. There appears to be a command-sanctioned practice of using SOCOMD LEGALOs to actively interfere with and obstruct investigations and when this does not achieve the desired result, there appears to be a willingness to conceal, or at best, obstruct the collection of evidence. There are also examples of using physical and operational security ‘barriers’ to achieve this end-state’.

“The investigations provides an illustration of a fraught relationship between ADFIS and SOCOMD, characterised by considerable distrust on both sides and a consequent lack of cooperation. Neither side is without fault. However, the state of distrust had an adverse effect on the efficient conduct of the investigation, and contributed to the time taken to conclude it. It was a manifestation of a wider distrust between the two organisations, to which a (but by no means the only) contributing factor was a resistance on the part of SOTG to external scrutiny, which is also manifest in other examples referred to above.”

APDR put the following question to Defence after reading the report:
“If SOTG consistently refused to cooperate with ADFIS over a period of several years, why did this not have alarm bells ringing in Army at the highest levels?”

The Department has basically dodged the issue, for the record sending this non-answer:

“It is important to acknowledge that the Australian Defence Force Investigative Service (ADFIS) as an entity no longer exists. ADFIS was the unified Service Police investigative arm of the Australian Defence Force, from its formation in 2007 until its amalgamation with the general duties policing elements of the three services into the Joint Military Police Unit (JMPU) at the beginning of 2020. The JMPU now integrates into a single unit the investigative and policing elements of the three services to generate a professional and focused Military Police capability for the ADF that protects its people, values, resources and reputation.”

**WHAT IS TO BE DONE?**

The Canadian solution of scrapping their Special Forces units is worth considering – especially as already there is considerable resistance within SOTG to accepting any responsibility for what has occurred.

However, given that politicians seem to crumble whenever SOTG pushes back – and as mentioned we are already seeing that regarding the withdrawal of unit citations – a number of practical measures will be introduced. These include the mandatory wearing of body cameras during operations; greater internal scrutiny and accountability; more counselling about the need to refuse to obey unlawful commands and those sorts of things.

But will additional counselling make the slightest bit of difference? Another disturbing part of the report is at page 337:

“It is a striking and troubling feature of the incidents described in Part 2 that, although they must have known that what they were being told to do was unlawful, there is no evidence of any subordinate who was told or encouraged to commit an unlawful killing objecting, resisting or even questioning it. This bespeaks a deference to superiors so extreme that it overrides legality and morality. It may also reflect a ‘Lord of the Flies’ syndrome. It points to a need to reinforce that obedience to the chain of command does not require or permit obedience to unlawful orders, and that it is a member’s duty to refuse to implement obviously unlawful orders.”

**AUSTRALIAN CULTURE AND MILITARISM**

Military organisations are reflections of the societies that produce them and so there is plenty in the Brereton Report for all of us to contemplate. Perhaps without realising it, the contemporary Australian culture has become one of veneration of the armed forces, be it the jingoism that now applies to much of Anzac Day; the $500 million expansion of the War Memorial; the $100 million white elephant in the form of the museum at Villers-Bretonneux Military Cemetery named after Sir John Monash – all the way through to the appointment of numerous retired officers as Commonwealth and State Governor-Generals.

All of this – and much more – have put sections of the military on a pedestal. That being the case, it is hardly surprising that some have developed a feeling of being special and therefore above either scrutiny or reproach. Journalists working in the domain know how frustrating it can be to do their job and cover what is going on, be it mundane procurement matters or the detail of current operations.

As the Brereton Report shows, if there had been more scrutiny of the SAS in Afghanistan the outcome for everyone might have been better.
DEFENCE MISLEADS ON TIGER ARH DETAILS

Journalists are used to Defence being economical with information, but peddling outright falsehoods is mercifully rare. However, when APDR submitted a number of questions about why Army’s 22 Tiger helicopters will be replaced, many of the answers were outright distortions. For clarity, see below the questions from APDR, the official response from Defence and then our comment on the information provided:

1. Please summarise why the Tiger helicopters need to be replaced when they still have a great deal of airframe life remaining.

Answer: The ARH Tiger (Tiger) is an aircraft designed in the 1990’s - Of note, the current structural service life for Tiger is 22 years, which results in seven aircraft needing to be retired prior to the Planned withdrawal Date (PwD) timeframe of 2028. On average, there is only 40 per cent of the 22 year calendar life left on the Armed Reconnaissance Helicopter fleet. Independent analysis indicates significant risk trying to extend this beyond 2030. Due to its dated design and lack of Original Equipment Manufacturer (OEM) design support, it cannot be upgraded to meet contemporary threats nor integrate with modern ADF capabilities.

APDR comment: this answer is false, or at best misleading. The life of platforms such as helicopters are measured in flight hours, not calendar years. Everyone knows that. The Australian Tigers have flown an average of 2,400 hours to date. French Army Tigers have a current predicted flight life of 6,000 hours; German Tigers are currently rated for 8,000 flight hours. The Australian Tigers have some differences, but these are structurally minor.

All helicopters are monitored for fatigue. Generally speaking, Tigers have proved to be structurally extremely sound due to a good design and extensive use of composites. Following routine procedures there is no reason why the Australian Tigers could not keep flying until 2040.

The fact that Tigers were designed in the 1990s is a positive, not a negative. Apache first flew in 1975; the first Cobra (predecessor to the Viper) flew in 1965. All helicopter types receive upgrades during their lives to keep them current.

2. Please explain why 29 attack helicopters are now needed, rather than the 22 in service – and is it essential that 29 is achieved with a single type?

Answer: The original acquisition under Air 87 sought a commensurate number of aircraft. It was promised Tiger would deliver the same rate of effort, with less aircraft than any other tender at the time, through higher availability of the fewer aircraft. It has never achieved this. Our analysis confirms up to 29 aircraft is the right number for the capability required at known availability rates for contender aircraft.

APDR comment: This is false. The tender for Air 87 never specified a number of helicopters. The requirement was for two active squadrons of six helicopters, with sufficient numbers to allow for some of the fleet in maintenance and also extra helicopters for the vital task of training. To meet this requirement Boeing offered 19 Apaches; Airbus 22 Tigers; Bell around 20 Vipers; Augusta Westland 24 A-129s and Denel 24-25 Rooivalks.

Defence provided an indicative budget and it was left up to industry to calculate the number of helicopters needed to generate an operational effect. The number 29 seems to be a fiction. Even journalists at the time were predicting that 20 - 24 helicopters would be needed to meet the requirement.

3. Why did Australia decide not to join France, Germany and Spain in the Mk 3 upgrade.

Answer: The Tiger Mk III, as currently presented, is still conceptual in design and does not align with our assessment of the improved capability needed. Of note, France and Germany are still yet to contract to the Tiger Mk III.

APDR comment: at best misleading. France has committed to the Mk 3 upgrade of their Tigers; negotiations are ongoing with Germany and Spain.

4. Why has Defence / Army declined Airbus Helicopters offers to integrate Link 16;

Answer: Defence has evaluated the Airbus proposal to integrate Link 16, concluding that the complexity, technical risk and likely cost did not align with maintaining the current capability until the Tiger is replaced. The incorporation of Link 16 requires significant development work beyond simply installing a Link 16 radio. This includes the development of new interface components, the interfacing of Link 16 with Eurogrid and a number
of other Tiger systems, the software to support this complex function and the re-architecture of the aircraft. This presents as unsuitable risk and unknown possible cost escalation.

**APDR comment:** At best misleading. Platforms like Tiger have their flight control and mission computers updated at regular intervals to incorporate technology changes. In the case of Tiger this is every two years. Incorporating Link 16 during one of these periods is relatively straightforward. There is no need to re-architecture the aircraft.

Using this process the Australian Tigers have been upgraded to Mode 5 IFF – essential for participation in US-led operations - and also to be able to fire the latest version of Hellfire missiles. That work has been carried out by Airbus in Australia.

If the Department used Google they could see that in 2016 Airbus Australia integrated Link 16 onto RAAF’s C-130 fleet. The company - using their Brisbane software engineers - will probably do the same for the worldwide A-330 multirole tanker transport fleet, including Australia’s KC-30s.

5. The last comprehensive briefing from Army Aviation on Tiger was in late 2018, where the information was very much along the lines that availability issues were now being well managed, the fleet was meeting expectations, users were very positive about the capability, Army had reviewed many of their operational and support processes – and so on. What has changed since then?

**Answer:** As announced in the 2016 Defence White Paper, and re-confirmed in the 2020 Defence Strategic Update, the Australian Government will operate the Tiger helicopter until it is replaced from the mid-2020s.

Information presented in 2018 was presented in the context of commitment to replacing Tiger from 2025. Whilst Tiger still generates sufficient flying hours to meet Defence’s current needs and demonstrates minimum acceptable levels of performance in a number of areas; it does not achieve the level of flying hours or the capability envisaged at acquisition, nor required for the future capability. The Tiger aircraft’s obsolescence, reliability, along with support and supply chain performance continue to be problematic, albeit under management with significant additional effort.

**APDR comment:** Much of this is contestable. Some of the issues of availability shortfall are the result of Army’s own processes. If the lack of capability referred to is Link 16, that can be fixed (see question 4). Recent mission success rates for Tiger have reached 98%.

6. Defence says the cost per flying hour of Tiger is around $32,000. Please provide a rough breakdown of that. To achieve such a number the calculation must be lumping in a lot of non-flight related costs.

**Answer:** The hourly cost of operating the Tiger is $34,487, which is based on the Defence’s Annual Report 2019-20 and is a running three-year average of sustainment costs and a five-year average for rate of effort. Cost data indicates the direct cost and not the full cost (full cost includes depreciation, whereas direct cost is more relevant for this discussion and an amount is included for fuel).

The comparative operating costs of Tiger with other platforms is as follows:

<table>
<thead>
<tr>
<th>Aircraft</th>
<th>($/AFHR)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A38 EC665 Tiger</td>
<td>$34,487</td>
</tr>
<tr>
<td>N48 MH-60R Seahawk</td>
<td>$10,735</td>
</tr>
<tr>
<td>A15 CH-47F Chinook</td>
<td>$8,921</td>
</tr>
<tr>
<td>A40 MRH90 Taipan</td>
<td>$31,757</td>
</tr>
<tr>
<td>A25 S-70A Black Hawk</td>
<td>$10,104</td>
</tr>
</tbody>
</table>

* This data is generated in accordance with Defence Finance Group directed methodology and is incorporated but not yet published in the latest version of FINMAN 4 FY19/20.

**APDR comment:** Misleading. To understand how hourly cost is calculated it is necessary to know what is included. Defence persistently refuses to provide any form of breakdown so that a genuine apples-to-apples comparison is impossible. These figures are close to meaningless – but extremely damaging to Tiger – unless Defence can show how the number has been reached.

7. Has Army discussed cost per flying hour figures with any other Tiger users.

**Answer:** The Commonwealth does not routinely compare total ‘cost per flying hour’ with the other Tiger operating nations, as achieving meaningful ‘like for like’ figures would require the disclosure of commercial-in-confidence contractual information and potentially nationally sensitive information in order to achieve the detailed comparison required. However, our engagement with other user nations indicates costs of ownership are commensurate.

**APDR comment:** disingenuous, given that Defence will not disclose how they calculate cost per flying hour. If they spoke with other users – as APDR has done – they will learn that some say the cost per flying hour is considerably less than US $10,000. The other users – particularly France – are extremely satisfied with their Tiger fleet, which has always had a consistently high availability rate.
8. Has Army / Defence ever taken up OCCAR on joining the organisation specifically for additional access to Tiger spares?

Answer: The Commonwealth has completed negotiations to join the Organisation Cooperation en matiere d’Armement (OCCAR) framework. The decision to sign the OCCAR Framework Agreement is with Government where it is anticipated that it will be presented to the Federal Executive Council later this year.

9. Are any Army / Defence people familiar with the French deployment of Tigers to Mali or the earlier Libya deployment on a Mistral class amphibious support ship?

Answer: Defence maintains regular contact and information exchange with other operators of the ARH Tiger.

APDR comment: France has been using their Tiger helicopters in continual combat operations since 2009, including in very harsh desert and maritime environments. The Tigers have been performing exceptionally well.

10. Has Defence / Army looked at AIC and the jobs impact of replacing Tiger with what presumably would be a fully imported product requiring a complete overhaul of...

BELL AH-1Z VIPER – THE THIRD AIR 4503 CONTENDER

KYM BERGMANN // CANBERRA

In previous editions we have examined the incumbent helicopter, the Tiger, in some detail, along with the replacement that Army seem to be pushing for – the AH-64E Apache. However, the Viper is also part of the mix – and since it is being operated by the US Marines is the most marinised of the solutions. Since amphibious operations are such an important part of Army’s future, some argue that it is the obvious low risk alternative to the other two.

Prime contractor Bell says the Viper – of which more than 200 have been built - brings a range of capabilities to the potential arc of crises - from disaster response, grey-zone operations, deterrence and lethal combat.

Capabilities include one of the world’s best electro-optical sighting systems, a fully integrated cockpit and fire control system – which can be air-to-ground and air-to-air simultaneously, precision rockets, advanced JAGM missiles, AIM-9X, Link 16, Manned-Unmanned Teaming (MUMT) and the Intrepid EW pod - as some of these are being rapidly incorporated from the USMC spiral upgrade program. The company says the onboard mission computers have plenty of capacity to support a growth trajectory out to 2040 and beyond. Sophisticated onboard electronics, dual redundant systems and a design for survivability give aircrew the best chance of mission success and getting home. Furthermore, Viper is faster, flies farther, and can stay on mission longer than most others.

Viper is not a ‘like for like’ capability. Bell says the marinised features make Viper a standout for any austere environment and align with the Australian Government’s strategic intent for rapidly deployable, connected, protected and potent capabilities with high situational awareness. The digitised architecture and information sharing systems will enable Viper to plug into the Joint Force network – even to work with UAVs and JSF. The 4-minute blade fold down time and rapid setup mean Viper can be rolled out of a C17 and be flying in 30 minutes.

Viper has instant commonality with the USMC who are based in Australia every year, and who are ‘first responders’ for the region, even as they are currently pivoting from the land wars of the last two decades to the maritime, littoral and amphibious environment of the Indo-Pacific. The USN is ramping up its focus on this region too, hence Viper’s value as a helicopter that can operate from almost any ship.

Several of Australia’s regional partners are long term Cobra customers who are considering their replacement options. There is considerable opportunity for Australian industry in forming part of a Viper supply chain, including MRO in Australia - to support not only Australia’s 29 airframes, but also the USMC and the wider region.

According to Bell, Viper’s high performance and availability, combined with low acquisition and life of type costs, interoperability and opportunities for Australia’s sovereign industry capability make this a ‘value for money’ transition that is worth examining closely.

In addition to this, in-country support will be provided by long-term partner BAE Systems. The companies have formed Team Zulu Viper, which has carried out an extensive program of local industry engagement.

Royal Australian Navy sailor, Leading Seaman Aviation Support Jamie Kennedy, marshals a United States Marine Corps AH-1Z Viper helicopter as it departs HMAS Adelaide during a multi-spot exercise. Credit: CoA / Ronnie Baltoft
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the support system, including logistics and training.

**Answer:** Defence has conducted an analysis of the Australian Industry Capability (AIC) noting that any replacement for Tiger will require an Australian based workforce of commensurate size. All Defence submissions to Government include an assessment of AIC. We consider some options may actually present a higher Australian based workforce with a better investment of that workforce in a broader industry base than that provided by Airbus today. The future Request for Tender on the support contract is the opportunity to further explore this.

**APDR comment:** It seems unlikely that the two competing US platforms (Apache and Viper) could offer the same amount of AIC as has been achieved with Tiger, let alone something better. US companies are typically constrained by a lot of regulation limiting the amount of work – particularly regarding sensitive technologies – that can be conducted offshore.

11. Chief of the Army Rick Burr told the committee that there would be a competition to replace the Tiger helicopters; Mr Shane Fairweather appeared to contradict this saying that the procurement strategy has yet to be decided. Please clarify which is correct.

**Answer:** LAND 4503 is expected to be presented to Government for consideration in Q4 2020. A decision on the procurement pathway is an element of this consideration.

12. Regarding the number of 29 replacement helicopters – was this a calculation based on an internal Defence assessment or were any third parties involved in the decision.

**Answer:** LAND 4503 released a Request for Information to Industry in 2019 seeking a range of information to inform options for Government. This RFI also included requesting information to support options up to 29 aircraft. This number of aircraft is the result of lessons learnt, analysis of possible fleet performance and experimentation.

**APDR comment:** See Question 2. It is difficult to know where the number 29 comes from. An unsolicited offer from Airbus to supply 22 upgraded Tigers plus 7 highly capable H-145Ms for a saving of $3 billion compared with the purchase of new helicopters has been rejected by Defence.

13. Has Defence collected comparative data on the availability rates for a) Apache; b) Viper & c) Tiger.

**Answer:** Defence has consulted with both Industry and other militaries seeking a range of information to develop options for Government’s consideration of LAND 4503. As expected, Government requires sufficient information, including cost drivers, schedules, availability rates, supply chain confidence and the like.

**APDR comment:** France, Germany and Spain are all able to achieve excellent rates of availability for their Tiger fleets.

14. Is it correct that Army has sought pilot training places for Apache helicopters at Fort Rucker?

**Answer:** Defence has sought to understand all possible options for the conduct of training for all contenders. This is normal for a Project to provide the best information possible to government for decision and is commensurate with activities undertaken for Tiger acquisition. No one contender has been treated any differently.

**APDR comment:** It’s good to know that Defence aren’t playing favourites.
UNMANNED VEHICLES IN THE MARITIME DOMAIN

The Royal Australian Navy has become very serious about the contribution newer technologies can make to Navy’s future capabilities. On 9 October 2020 Chief of Navy Vice Admiral Michael Noonan launched the Navy’s Remote and Autonomous System & Artificial Intelligence Strategy 2040. This 28-page strategy document was downloaded shortly afterwards by APDR and it makes very interesting reading.

The RAS-AI Strategy, as it is now commonly known, is based on force protection as a partnered force under Australian control, with the potential to project force to places where it may be required.

The whole RAS-AI concept is in an Australian context covering geography with great distances and dispersion; an environment with diversity, disaster and responsibility; and an evolving strategic environment where there is regional military modernisation occurring and reduced warning times.

For the strategy to succeed it must be a national enterprise which takes a national approach requiring a warfighting culture, with skilled naval shipbuilding capacity and strong defence industry partnerships.

The current project for maritime unmanned systems is SEA 129 Phase 5 Tactical Unmanned Aerial Systems (TUAS), now divided into three blocks. Block 1 is for ANZACs and Arafura OPVs, to come into service in 2024. Block 2 will be for the Hunter Class frigates from 2028 and Block 3 will be future upgrades of the TUAS in service.

Navy’s 822X Squadron, based at Naval Air Station Nowra, is already flying the Schiebel S-100 Camcopter and Insitu’s ScanEagle under its non-capitalised Navy Minor Program 1942.

Trials in the delivery phase of Block 1 are planned to occur at Naval Air Station Nowra, at sea from Offshore Patrol Vessels, ANZAC Fast Frigate Helicopters (FFH) and other ship classes. Additional trials may take place in other parts of Australia, depending upon the trial requirements and availability of ranges and Defence assets.

Trials will involve 822X Squadron, Aircraft Maintenance and Flight Trials Unit and Maritime Warfare Centre. Trials are aimed at evaluating systems and informing subsequent Blocks of the SEA129 Phase 5 Continuous Development Program.

The few examples provided in this article show that the RAN is gaining the agility and technological edge to respond to an evolving geostrategic environment.

SEA 129 PHASE 5

A Defence spokesperson told APDR that ‘A key focus for SEA129 Phase 5 is to assist in the development of Australian unmanned industrial capabilities. This approach will help ensure Australian industry’s ability to support the ADF Unmanned capabilities is enhanced over time.

‘The Invitation to register released Australian Industry Capability Information Requirements that focused on the potential for Australian industry participation in Block 1 and beyond. The SEA 129 Phase 5 evaluation will consider responses to the AIC Information Requirements as part of any down-select decision.’

‘SEA129 Phase 5 will provide opportunities for the Australian unmanned systems industry for Block 1. Initially these opportunities are anticipated to be for assembly, component manufacture, ship integration systems, sensor development and manufacture, support systems (including deep level maintenance), analysis software and unmanned system research and test and evaluation. There is potential for these opportunities to develop over time to include air vehicle and related system development and manufacture.’

TIMELINE TO THE COMMONWEALTH ACQUISITION DECISION

When APDR asked for a timeline to SEA 129 Phase 5 Block 1 decision, a Defence spokesperson told us ‘SEA129 Phase 5 Block 1 will run between mid-2024 and mid-2029. Responses to the Invitation
to register for SEA129 Phase 5 Block 1 closed on 25 October 2020. Defence is currently evaluating the responses. Results from the Invitation to Register evaluation are planned to be publicly announced on 17 December 2020.

‘First Pass consideration by Government will occur by October 2021. A restricted Request for Tender (RFT) is planned in late 2021/early 2022. Second Pass consideration by Government is planned by mid-2023. Block 1 Initial Operating Capability is planned for 2024-25.’

**UNMANNED UNDERWATER VEHICLES (UUVs)**

Defence Science and Technology Group operates UUVs, including the REMUS 100, REMUS 600 and Gavia, for testing autonomous vehicle concepts for tasks such as underwater survey and maritime mine detection.

The RAN operates UUV REMUS 100 for hydrographic survey and seabed search and survey. This capability provides high definition seabed search, depth rated up to 100m of water in addition to collecting soundings to meet charting standards in accordance with the International Hydrographic Organisation. The REMUS 100 can be deployed from a wharf, beach, zodiac or the Deployable Geospatial Support Teams recently introduced Survey Craft.

Three SLOCUM gliders were trialled by the RAN, with a Huon Class MHC HMAS Melville as mother ship, in the Coral Sea and in the Indian Ocean near Perth during 2020 to 2021 to test Military Survey options.

The gliders evaluated the piloting effort and training necessary to support larger fleets of these types of long endurance remotely operated systems. The gliders were put through configuration, launch and shallow dive tests before beginning their programmed deep dive, supported by the Marine Tech Systems remote control headquarters in Western Australia.

The gliders are capable of a range of oceanographic observations including tracking ocean currents within specific depth ranges.

Melville’s Commanding Officer, Commander Michael Kumps, said launch day was an exciting morning for all of the ship’s company. “Particularly for our geospatial officers and sailors, as they engaged with the new technology and procedures. The SLOCUM Glider is an innovative and efficient solution to the challenge of oceanographic data collection. Acquisition of these gliders represents a significant capability improvement for the Hydrographic Force and the Royal Australian Navy.”

The RAN’s Huon Class minehunter coastal vessels are fitted with a pair of electrically powered Saab Double Eagle Mk. II remotely operated underwater vehicles for mine disposal. The Double Eagle is equipped with a searchlight, closed-circuit low light television camera and an on-board close-range identification sonar. Commands are relayed via a fibre optic link inside the vehicle’s 1000 metre tether, which also relays sensor images for display on the ship’s multifunction console in the operations room.

Each Double Eagle is fitted with either a disposal charge slung beneath or an explosive or mechanical cutter designed to sever the wire rope or chain holding moored mines.

**UNMANNED SURFACE VEHICLES (USVs)**

Advantages seen for maritime domain military USVs include continuous and wide coverage, greatly reduced capital costs, no fuel, food or crew, elimination of errors due to human fatigue and no people or expensive assets are in harm’s way.

APDR attended Autonomous Warrior 2018 at HMAS Cresswell, Jervis Bay and was particularly impressed with the Insitu Wave Glider and the Ocius Bluebottle USVs. We have kept up-to-date with commercial and military trial activities for both of these platforms.

Defence’s spokesperson told us ‘In collaboration with industry, Defence Science and Technology Group have conducted trials with Unmanned Surface Vessels such as the Ocius Bluebottle, which are designed for persistent operation at sea and using renewable energy, and the WAM-V twin-hulled Unmanned Surface Vessels for shorter duration tasks.’

APDR have followed progress of trialing of the original 5.5 metre/18-foot Ocius Bluebottle USVs, Bruce and Bob, studying their characteristics as renewable energy-powered vessels which use solar, wind and wave energy so that they can stay at sea indefinitely, limited only by biofouling.

As versatile USVs they have a five-knot hull speed and can be launched from a boat ramp or ship. They can carry a 300 kg modular payload while consuming 50 watts average payload power. Control is by an intelligent network which can activate team behaviours, while humans remain on the loop, not in the loop.

Back in July this year Ocius received permission for their Bluebottle USVs to operate autonomously in Australia’s Exclusive Economic Zone. Their first fully autonomous trip was from Botany Bay to Ulladulla.

Bob used 360-degree cameras, radar, Automatic Identification Systems and collision avoidance software to autonomously navigate safely during the voyage, with engineers at the R&D facility at UNSW Campus Randwick and at Charles Darwin University Darwin taking it in turns being the ‘human on the loop’ supervisors.

Following this successful trial, Bob headed to Darwin to begin logistics and sea trial tests before the first new next-generation Bluebottle, Beth arrived in September.

On 19 August 2020 this author joined in virtually via Google Meet to Ocius celebrations for the christening of “Beth”, the first of their five next generation larger 6.8 metre/22-foot Bluebottle USVs. He was pleased to raise his champagne glass and toast ‘God bless this ship and all who don’t sail in her’.

On 24 November Ocius christened “Bonnie”, the second of their larger Bluebottle USVs.

These will be followed by three more large Bluebottles in 2021, each armed with Thales thin line sonar arrays,
radar, cameras and other sensors. Under Ocius’s new Defence Innovation Hub $5.5 million contract, in 2021, they will deploy 5 Bluebottles in an intelligent networked squad to 3 different Areas of Operations doing 3 different types of jobs.

In 2013 Australia’s Blue Zone group supplied eight Liquid Robotics SV2 Wave Gliders to the Royal Australian Navy Maritime Signature Management & Target Services SPO and supported them since by establishing maintenance, repair and overhaul capability in Newcastle NSW and Perth WA. BZG has also designed and implemented modifications to this fleet as well as supplying ancillary systems.

The Army Littoral Riverine Survey Squadron operate 2 Z-Boat Unmanned Surface Vessels for hydrographic survey in potentially hazardous areas. The capability provides above and below water georeferenced Geospatial Information in low sea conditions such as harbours and lakes.

Defence also introduced the Hydrographic Industry Partnership Program (HIPP) to provide the National Hydrographic Survey Program early this year which will provide the opportunity to investigate commercial USVs suitable for future military survey requirements.

Commercially, Fugro (Adelaide based) is the first company to use a USV for hydrographic survey in South Australian waters for the HIPP in 2020. IXBlue (Brisbane based) has operated an indigenous designed USV internationally for several years with the first survey to be conducted in Australia expected in 2021. The Drix, operated by IXBlue, is usually based in New Zealand.

Commercial industry uses USVs to augment ship hydrographic work to improve efficiency. Within the HIPP it is anticipated industry will increase the use of USVs to improve hydrographic survey efficiency, as the low noise, and designed stability has already demonstrated significantly improved results over sensors operated from manned platforms.

Navy will investigate these systems further in 2021 for the future military survey requirement.

RAN TRIALS UNMANNED VEHICLES FOR HADR

In November this year the RAN announced it and the defence Industry started putting robots to the test in a simulated counter-disaster operation in Brisbane. Autonomous Warrior Genesis – the first of Navy’s flagship events exercising Robotics, Autonomous Systems and Artificial Intelligence (RAS-AI) saw Unmanned Vehicles (UxVs) deployed by air, land and water to respond to a fictional Humanitarian and Disaster Relief (HADR) scenario on the Brisbane River.

Minister for Defence Linda Reynolds said the exercise demonstrated Defence working with Australian Industry to integrate emerging technologies with Navy platforms to rapidly respond in emergency situations.

‘Australia’s commitment to maintaining a strong and secure region is predicated on ongoing modernisation of Defence capability as new and disruptive technologies emerge,’ Reynolds said. ‘As announced in the 2020 Force Structure Plan, the government recognises the exploration of autonomous and un-crewed systems will further safeguard Australia’s capability and achieve expanded reach across the region.

‘Using autonomous systems to respond to disaster scenarios is a potential game changer for Defence by providing the agility and technological edge to rapidly support our region in times of crisis.

‘Navy’s recently launched RAS-AI Strategy emphasises the importance of strengthening Defence’s relationship with Australian industry to ensure that together we develop innovative new capabilities to respond to an evolving geostrategic environment.’

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Hydroid is now a part of Huntington Ingalls Industries, Technical Solutions; bringing together the full range of UUVs.
Chief of Army’s Strategic Guidance 2019 for the Army in Motion sees an integrated Joint Force comprising current in-service systems as well as future in-service systems. Manned vehicles like the protected mobility Bushmaster and Hawkei, together with the combat reconnaissance Boxer and the infantry fighting vehicle being procured under LAND 400 Phase 3 will be supplemented by unmanned vehicles for the surface including riverine environments and low altitude aerial systems.

Drones give their users valuable information during surveillance and reconnaissance flights. When these are flown by an adversary it is obviously desirable to neutralise them.

A Defence spokesperson told us that ‘The Australian Defence Force uses the full range and layered approach of its current capabilities to protect its people and missions. Across the Australian Defence Force, modernisation efforts are working to ensure that future threats can be dealt with effectively.’

Key future projects include LAND 129 Phase 3 which Defence’s formally describes as replacing and enhancing the existing Shadow 200 v1 TUAS capability operated by 20th Surveillance and Target Acquisition Regiment (20 STA Regt).

Army has contracted BAE Systems Australia to support Optionally Crewed Combat Vehicle (OCCV) experimentation from 2020-2022, with 20 M113AS4 platforms of mixed types.

Army has also contracted Deakin University to provide five trucks, to be optionally crewed, leader follower capable, with advanced obstacle detection and collision avoidance. Concept demonstrations are scheduled for June 2021.

A Defence spokesperson commented when discussing unmanned land surface vehicles with APDR ‘The Army Littoral Riverine Survey Squadron operate 2 Z-Boat Unmanned Surface Vessels for hydrographic survey in potentially hazardous areas. The capability provides above and below water georeferenced Geospatial Information in low sea conditions such as harbours and lakes.’

The Teledyne Oceanscience Z-Boat 1800, supported by Australia’s Blue Zone Group, is a fast, reliable, accurate, and surveyor-tested remote survey system. With an echosounder selected specifically for use on a remote vessel, the Z-Boat 1800 can be configured to suit every survey challenge especially crystal-clear bottom imagery from side scan option.

**LAND 129 PHASE 3**

Project LAND 129 Phase 3 is currently engaged in Tender Evaluation activities and is preparing for presentation to Government in mid-2021.

As noted above this project is to replace and enhance the existing TUAS capabilities with performance parameters equal to or better than Shadow 200 v1. These include:

- Range at least 125 km
- Electro optical/infra-red (EO/IR) coverage of the area of interest,
- Laser pointing,
- Laser range finding,
- Laser designation, and
- VHF/UHF communications relay.

Other requirements include 24/7 system ‘on-target’ within unit Brick packing constraints, include modular payload space, STANAG 4586/AEP-84 Level of Integration up to Level 3 with non-Global Communication Systems, additional classes of airspace other than Military restricted, runway Independent and fuel source compatible with shipboard storage.
The project will grow the capability to provide a third sub-unit and provide an enduring capability effect that enables 24/7 intelligence, surveillance and reconnaissance (ISR) coverage in two separate focal areas. The TUAS capability should integrate with existing and future in-service systems in order to disseminate information and intelligence to the supported Land Commander.

Defence has advised that there are five core TUAS tasks:
- ISR: surveillance
- Targeting: target detection
- Targeting: enhanced lethality
- ISR: Intelligence support
- Organic support

Earlier this year a shortlist for LAND 129 Phase 3 contenders was released. That shortlist comprised Insitu Pacific, Leidos Australia, Raytheon Australia and Textron Systems Australia.

APDR does know that Insitu Pacific proposed their Integrator and ScanEagle 2. Their larger ScanEagle has been extensively trialled and evaluated by Navy.

Leidos Australia does not have an in-house UAV design. However, it is leveraging on its experience as a system integrator, engineering and technical services provider in its LAND 129 bid. For LAND 129 Phase 3 they have teamed up with Israel’s Aeronautics Limited to provide the Aeronautics Orbiter 4 UAS.

Raytheon Australia’s bid was Schiebel’s S-100 Camcopter already in service with Navy, where a lot of operational experience has been gained by 822 Squadron at Naval Air Station Nowra.

The Australian unit of Textron offered the Aerosonde consideration, their formal response was ‘Tender Evaluation activities are still underway for LAND 129 Phase 3 and Defence cannot comment whilst these activities are ongoing.’

Because of this response APDR is unsure of whether or not all four shortlisted contenders are still under consideration – though the Canberra rumour mill puts the Textron Aerosonde in a good position.

Continuing, our Defence spokesperson told us that ‘The LAND 129 Phase 3 platform is intended to deploy

The Teledyne Oceanscience Z-Boat 1800, supported by Australia’s Blue Zone Group, is a fast, reliable, accurate, and surveyor-tested remote survey system. With an echosounder selected specifically for use on a remote vessel, the Z-Boat 1800 can be configured to suit every survey challenge especially crystal-clear bottom imagery from side scan option.

UAS for LAND 129. Textron says the Aerosonde Fixed Wing is designed for ‘expeditionary land- and sea-based operations and equipped for simultaneous day/night full-motion video, communications relay, signals intelligence and a customer-selected payload in a single flight’ adding that the type ‘is field-proven with more than 450,000 flight hours, including desert heat and Arctic cold’.

‘When APDR asked a Defence spokesperson if all four shortlisted contenders were still under active
in the Land Domain in a capability brick consisting of Bushmaster PMV with the Ground Control Systems and other C4I networks integrated, and 40M transport vehicles.

‘Operations are also planned from the Canberra-Class Landing Helicopter Dock in support of the land force. The LAND 129 Phase 3 platform will also deploy by air in a variety of aviation transport platforms (C-17, C-130, CH-47), deplane, and operate from the ground in either a PMV mounted or dismounted configuration.’

OTHER UNMANNED AERIAL SYSTEMS USED BY ARMY

APDR asked Army about the main UAS in use by army at the nano, multi-rotor and small levels. Are there any current plans or projects to extend this range of UAS?

Their response was ‘The only in-service Nano Unmanned Aerial System in use by Army is the Black Hornet, produced by FLIR. The in-service Small Unmanned Aerial System used by Army is the RQ-12 Wasp, produced by AeroVironment.

‘All Army units have a DJI Multi Rotor to explore Unmanned Aerial System use in unclassified environments. These are either the DJI Phantom 3, DJI Phantom 4 or DJI Mavic.

‘Under LAND 129 Phase 4, Army will acquire a new small Unmanned Aerial System in 2023/24 to replace the RQ-12 Wasp. This will have extended range and capabilities on the current system.’

THE THREAT OF AN ADVERSARY’S SUICIDE DRONE ATTACKS

Television news footage of the recent conflict between Armenia and Azerbaijan over the disputed enclave of Nagorno-Karabakh showed main battle tanks being destroyed, as well as unprotected infantry being killed, by explosive-laded UAS making suicide attacks. This could be a real concern for the armoured CRV and IFV vehicles being procured by two phases of LAND 400.
An Australian Strategic Policy Institute’s ‘The Strategist’ website post on 21 October 2020 by Malcolm Davis entitled ‘Cheap drones versus expensive tanks: a battlefield game-changer?’ discussed this challenge in some detail.

APDR asked its friendly Defence spokesperson ‘Could an Active Protection System like ‘Iron Fist’ successfully take out loitering explosive-laden drones as they begin their attack on Army’s armoured vehicles and ground troops? What other choices are available which could be activated from within an armoured vehicle?

He responded ‘Army fights in teams (Combined Arms Teams), using the complementary strengths of its individual capabilities to achieve objectives. These Combined Arms Teams are becoming more connected, protected, lethal, and enabled, to meet the missions against new and emerging threats, as assigned by Government.

‘Suicide Unmanned Aerial Systems are a new method of employing a top attack munition threat, similar to the existing/previous methods provided by artillery and missile delivery systems.

‘What makes this unique is the ability to guide their way onto the target through direct video link with the firer or pre-programmed GPS guidance. There are a number of weaknesses for these guidance methods, which will be targeted through different defence systems within the Combined Arms Team.

‘Due to sensitivities surrounding the capabilities of Active Protection Systems, such as the Iron Fist Light Decoupled (IF-LD), Army cannot comment on technical capabilities. What can be assured is that Army’s combined arms force is future ready and in future the IFV fleet will operate as part of the Joint Land Force, where multiple capabilities will detect and neutralise such threats prior to triggering on-board defence systems.’

**UNMANNED SURFACE VEHICLES – AUTONOMOUS M113S**

Late last year, BAE Systems Australia supplied two fully autonomous vehicles for a ‘battlefield simulation’ demonstration for the Australian Army, providing crucial insights into the capabilities of integrated autonomous technologies on future battlefields.

In a six-month project, engineers and technicians installed hardware and software in the vehicles enabling them to operate autonomously. The innovative technologies being explored could one day help remove soldiers from future battlefields and enable a range of other applications including intelligence gathering and logistics support. The on-board systems were designed to comply with the rules of engagement, which always require a human in the decision-making loop.

BAE Systems Australia CEO Gabby Costigan said ‘This project highlights our commitment to leading the development of new technologies and collaborating across industry and academia to advance autonomous capabilities. Autonomous technologies will support soldier responsiveness in an accelerating warfare environment - increasing their ability to outpace, out-maneouvre and out-think conventional and unconventional threats.’

With the BAE Systems autonomous technologies now integrated into the M113 prototype, the vehicles are being used by the Army to experiment and better understand the opportunities to employ autonomy on the battlefield, as part of its recently released Robotics and Autonomous Systems Strategy. The vehicles will also be used as test vehicles for technology developed by the Commonwealth’s recently announced Trusted Autonomous Systems Defence Cooperative Research Centre (TAS-DCRC).

The TAS-DCRC was announced by the Australian Government in 2017 under the Next Generation Technologies Fund to deliver game-changing autonomous systems that ensure trusted, reliable and effective cooperation between people and machines during military operations. BAE Systems is a founding member of the CRC and the industry lead for Land Autonomy, working closely with Army and with Defence Science and Technology Group to ensure soldiers have what they need to be future ready.

**IN CONCLUSION**

Army provided this statement to APDR to summarise their approach to unmanned vehicles in the land domain.

‘Army’s Dismounted Combat Program is actively exploring the utility of ground and air robotic systems to improve the generation of dismounted combat effects. Army has established a Combat Application Lab to support this effort.

‘The Combat Application Lab is a live battle lab that has been formally established in partnership between the Dismounted Combat Program and Army’s Combat Training Centre in Townsville.

‘The lab is part of Army’s effort to set the conditions for transformational learning and explore emerging concepts such as a Semi-Autonomous Combat Team and an Artificial Intelligence enabled Combat Team. Through experimentation with emerging disruptive technologies, Army is seeking to understand and quantify the capability benefit in terms of improved speed and quality of tactical actions and the range at which combat effects can be applied.

‘Industry engagement and interest has been high in the context of the initial theme of exploring the benefit of Human Machine Teaming (HUM-T), incorporating robotics and autonomous systems at the tactical level, and using exemplar ground and air robotic systems.

‘The Combat Application Lab complements the other critical labs and integration organisations, such as the Land Network Integration Centre, Diggerworks and DSTG’s Future Soldier Lab.’
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There are three key programs summarised in the 2020 Force Structure Plan: 1) acquisition of six MQ-4C Triton High Altitude Long Endurance (HALE) UAS ($1.8-$2.7 billion); 2) up to 12 MQ-9B Sky Guardian Armed Medium Altitude Long Endurance (MALE) UAS ($1.6-$2.4 billion); and 3) the ‘Loyal Wingman’ Teaming Air Vehicle, currently in an experimental stage but potentially having an acquisition budget of $7.4-$11 billion from the mid-2020s.

In order of technical maturity:

TRITON

The massive Northrop Grumman MQ-4C is in low rate initial production (LRIP) for the USN and the first operational aircraft arrived in Guam this January. The USN said that the two aircraft will fall under Commander, Task Force (CTF) 72, lead for patrol, reconnaissance and surveillance forces in 7th Fleet:

“The introduction of MQ-4C Triton to the Seventh Fleet area of operations expands the reach of the U.S. Navy’s maritime patrol and reconnaissance force in the Western Pacific,” said Capt. Matt Rutherford, commander of CTF-72. “Coupling the capabilities of the MQ-4C with the proven performance of P-8, P-3 and EP-3 will enable improved maritime domain awareness in support of regional and national security objectives.”

Only a few weeks later in February, the program received a major jolt when the US Presidential Defense Budget request called for a two-year acquisition freeze. This is believed to have happened because the Trump administration placed a temporary priority on manned platforms. Anecdotally it appears that the USN is fully committed to the acquisition and might have actually added two extra MQ-4Cs to the indicative 2022 Financial Year budget.

The costs for Triton are within budget, and Defence will continue to work with the United States as part of the Cooperative Program to refine sustainment costs.

With a range in excess of 15,000km and a top speed of 575kmh due to being jet-powered, a Triton could take off from RAAF Base Tindal, travel to anywhere above the South China Sea and remain on station for 10 hours before returning home. This is an unprecedented level of capability for broad area surveillance and because the aircraft typically operate in calm air above commercial traffic at 40,000 feet, it also has a huge sensor footprint for its surveillance radar, gimballed EO turret and ESM system.

However, Triton will not be working in isolation but typically in coordination with manned aircraft such as RAAF’s P-8A Poseidons. Defence explained:

“Together, the P-8A Poseidon and MQ-4C Triton aircraft will provide Australia with one of the most advanced maritime patrol and surveillance capabilities in the world. There are three Australian MQ-4C Triton aircraft and associated ground systems on contract for production. Plans for the further acquisition of Triton aircraft are yet to be considered.
by Government.”

Asked about the current situation in the US, Defence said:

“Questions on US procurement processes are best directed to the US Government. That said, the three approved Australian Triton will not be impacted by the proposed US Navy production pause. The United States still plan to acquire additional Tritons and are continuing development of capabilities associated with the Triton. They are not cancelling Triton aircraft, but instead pausing production beyond their current orders.”

Discussing the unusual nature of the acquisition – Defence is contracting for them one at a time – a spokesperson said that Australia is continuing an incremental approach to balance the desire to acquire them as a complement to P-8As, against the developmental nature of the program. The costs for Triton are within budget, and Defence will continue to work with the United States as part of the Cooperative Program to refine sustainment costs.

The production of this aircraft has been enabled through Australia’s participation in the Cooperative Program with the United States Navy. Australia provides financial and non-financial (personnel) contributions to the Poseidon and Triton Cooperative Programs. Cooperative Programs allow liability to be shared in agreed proportions during the developmental phase, as well as a level of insight into the programs not usually provided through other procurement methods.

The Cooperative Program strengthens the ability to develop advanced capabilities to meet Australian conditions and ensures our capabilities remain interoperable with the US, while sharing in the benefits of their technical expertise and project costs. Further, this Program enables Defence to influence the priority of future Triton capability requirements to ensure our specific regional requirements are met. This includes the development of subsystems, logistics and other support elements.

Defence says that through Australia’s embedding of Defence personnel within the Cooperative Program they are also able to develop Australia’s workforce to understand future capability developments and sustainment activities. Importantly, our participation in the development program enables Australian industry to participate in the development and sustainment of the capability. This engagement has proven successful in other Cooperative Programs such as the Joint Strike Fighter, which has already achieved over $1.7 billion of Australian industry contracts.

**SKY GUARDIAN**

The MQ-9B made by General Atomics – Aeronautical Systems Incorporated (GA-ASI) is the latest evolution in the Predator MQ-9 series of armed drones. The launch customer is the Royal Air Force and sales have already been made to Australia, Belgium, the UAE and Taiwan. It is considered likely that the dozen or so Predator users will gradually replace their fleets with Sky Guardians – though legacy MQ-9s are still being built and might remain in service in the US for many years to come.

Similar to Triton, MQ-9Bs have an endurance of up to 40 hours – depending on the payload – but because they are propeller-driven they are not as fast and do not fly as high. However, they are far less expensive and their major attraction for most customers is that with a payload of 2,000kg they can carry a wide range weapons, including laser guided...
UAS

bombs and Hellfire missiles. Predators have been used continually in combat for years – particularly in the Middle East and Africa – and are responsible for numerous attacks on high value insurgent and terrorist figures.

Their full potential has not yet been realised and prime contractor General Atomics is now looking at the feasibility of using them for anti-submarine warfare. The company says this marinised version which will be called Sea Guardian, and it can be configured with cross-domain capabilities for a vast range of maritime surveillance operations, including:

- Anti-Surface Warfare (ASuW)
- Anti-Submarine Warfare (ASW)
- HA/DR – Humanitarian Assistance/Disaster Relief
- Search and Rescue
- Law Enforcement (Drug Trafficking, Illegal Immigration, Piracy)
- OMSI – (Oceanic Maritime Security Initiative)
- Airborne Counter Mine Capability (Developmental)

The Australian aircraft are not yet under contract, which is still some way off. A noteworthy feature of the Force Structure Plan is a graphic showing that they will be purchased from the mid-2020s all the way to 2040, which seems unusual. Defence explained:

"Defence is now developing the acquisition proposal for up to 12 aircraft, which is scheduled for government consideration in 2021-22. (Second Pass). Noting that the MQ-9B acquisition proposal is still under development and there will be more fidelity as the project matures, it is correct that the Sky Guardians will continue to be acquired through to 2040."

Another feature of the aircraft is that it is going through the very demanding process of being certified to be operated in civil airspace. This process is a regulatory nightmare because of safety issues on the ground and other airspace users. While this is yet to be completed, this will enable unrestricted operations in Australian domestic airspace. These matters—regulatory compliance, aviation safety and airworthiness— will be addressed well ahead of achieving initial operating capability, which is currently scheduled for the mid-2020s. Defence has been working with the United Kingdom regarding Sky Guardian and has crews and other personnel

The costs for Triton are within budget, and Defence will continue to work with the United States as part of the Cooperative Program to refine sustainment costs.

BOEING COMPLETES GROUND-BREAKING AUTONOMOUS TEAMING FLIGHTS

– AUSTRALIA, DEC 2, 2020 –

Boeing recently completed flight tests with five high-performance surrogate jets operating autonomously in a team at the new Queensland Flight Test Range in Cloncurry, Australia.

Boeing’s advanced autonomy technology, including on-board command and control and data sharing capabilities, were tested using the 3.4-meter (11-foot) aircraft.

"The tests demonstrated our success in applying artificial intelligence algorithms to ‘teach’ the aircraft’s brain to understand what is required of it,” said Emily Hughes, director of Phantom Works International.

"The data link capabilities enabled the aircraft to communicate with the other platforms so that they could collaborate to achieve a mission."

Testing lasted 10 days, with aircraft incrementally added until the five operated together. During testing, the aircraft reached speeds of 270 kilometers (167 miles) per hour.

“With the size, number and speed of aircraft used in the test, this is a very significant step for Boeing and industry in the progress of autonomous mission systems technology,” Hughes said.

The activity was the final milestone delivered in partnership with the Queensland government as part of Boeing’s Advanced Queensland Autonomous Systems Platform Technology Project. During the project, Boeing has worked with over 90 personnel from a number of small-to-medium enterprises including RFDesigns, Amber Technology Ltd., Premier Box, McDermott Aviation and Five Rings Aerospace. Technology and capabilities proven under this program will form part of the Boeing Airpower Teaming System and future Boeing autonomous platforms.
Maritime Strike
Surface-to-Surface Fires

- 5th generation precision strike missile
- Low observable
- Long range
- Designed to attack heavily defended maritime and land targets in a congested and contested environment
GA-ASI continues to make strong progress towards its goal of earning global authorization to fly its remotely piloted aircraft (RPA) safely and routinely in civil airspace alongside manned aircraft. Through partnerships with NASA and other global airspace authorities, GA-ASI RPA have been tested and have proven that remote pilots can use the same, or even better, technology to operate RPA safely in all classes of airspace.

“As with any new advancement in aviation, we recognize that achieving this goal will take time, effort and buy-in to prove its ultimate safety and utility. GA-ASI is committed to this goal and leading the global aviation community forward with our standards-based RPA design and innovative Detect and Avoid System (DAAS). No other RPA and DAAS solution is as advanced as GA-ASI’s.”

While the aircraft will be built in the US, all support will be undertaken in Australia at what is emerging as a UAV industry cluster association with RAAF Base Edinburgh. This will be the centre of Australia’s airborne ISR assets, including the P8-A; MQ-4C; MQ-9B and also the MC-55A Peregrine electronic support jet fleets. From this comes the theoretical possibility that Australia could become the regional support centre for all Sky Guardian & Sea Guardian platforms – of which there could be dozens.

Asked about this, the company replied obliquely:

“As the world leader in Remotely Piloted Aircraft Systems (RPAS), General Atomics Aeronautical Systems, Inc. (GA-ASI) takes a global approach to sustainment. In October, GA-ASI opened a new customer service center in Dresden, Germany. The center provides sustainment capabilities for MQ-9 fleets in and near Europe, providing customer convenience while expanding opportunities for European aerospace suppliers.

“With new customers coming online in other parts of the world (including Australia), GA-ASI is putting together plans for customers to maximize system availability, commonality, and access to crew training. Services will include fleet management planning, sustainment services, asset management, component repair, and training for full product life cycle.

“GA-ASI strives to provide affordable and predictable sustainment for all customers.”

‘LOYAL WINGMAN’ TEAMING AIR VEHICLE

Known by prime contractor Boeing Australia as the Airpower Teaming System, this radical concept is to develop a jet powered uninhabited aircraft with the approximate performance characteristics of a light fighter. The first of three 11.6 metre prototypes is about to start test flights within days. Boeing will not disclose the location, but the logical place would be at Woomera. This is where the RAAF undertakes most of their trials of aircraft and weapons because the facilities are first class and the surrounding huge area of vacant land is an advantage should anything go awry.

Asked to describe the nature of the early trials, Dr Shane Arnott, program director, Boeing Airpower Teaming System said:

“The aircraft is undergoing ground and flight testing. The process ensures the functionality of the aircraft’s hardware, software and systems. The graduation from the factory involves taxi testing at different speeds, and then onto first flight. The objective of the first flight is to validate the aircraft’s basic flight functions and operations with the ground control station.

“Our second aircraft is currently in development and we plan to complete a series of flight trials in 2021.”

The company would not be drawn on when flight tests with payloads will begin, other than to say they won’t be part of the forthcoming trials.

If successful, these aircraft will revolutionise air combat, allowing them to conduct dangerous missions such as suppression of enemy air defences (SEAD) either operating autonomously or as part of a manned-unmanned team (MUM-T). A theoretical possibility would be for an aircraft such as a Super Hornet to be accompanied on a mission by three or four of these drones, possibly controlled from the rear seat of the manned jet. As they enter enemy airspace, they could be dispatched to perform missions including electronic and kinetic attack and then linking up with the parent aircraft on the way out – assuming that they have survived.

The potential of the system is vast and transformative. It looks like Australia has made an early start in this direction and has a number of well credentialled companies involved, including BAE Systems (see separate story on Autonomy). If the technology can be proven, the export market is considerable – particularly to Five Eyes countries.

Loyal Wingman is the first combat aircraft designed and manufactured in Australia since the Second World War.
AUTONOMOUS SYSTEMS BECOMING INCREASINGLY IMPORTANT FOR ALL THREE SERVICES

Without going through the entire history of the technology of warfare, autonomous systems have been around for a while. Minefields are a kind of autonomous system, but more relevant are things such as close-in weapon systems that emerged during the 1970s including the RAN’s Phalanx, which once switched on will fire at an incoming target that meets certain parameters without human intervention. Various fire-and-forget missiles are in the same category and now the technology is surging ahead, much of it due to Artificial Intelligence (AI) and machine learning.

An example of an autonomous platform – albeit one operated by humans - are submarines, with only rare communication with other platforms and home base. Once instructed to leave port and carry out a mission it would often do so with no further input – or only through a Very Low Frequency signal to receive a message to fire its missiles at a predetermined target. However, truly autonomous systems are those that do not have people onboard, only computers.

The Defence Science & Technology Group is coordinating research into this area, explaining:

“Autonomy, by definition, is the ability to self-govern. It endows a robotic platform with the smarts to be more than an automated enabler; it gives a robot the ability to become a teammate and work with human operators and other robotic systems. Achieving such a capability would be incredibly beneficial, but its realisation remains elusive.

However, DSTG believes that there is still some way to go because current solutions are not smart enough or robust enough for military missions and consequently are not sufficiently trusted by operators. This is different from robotics – or the new word teleoperations – where the system is still being controlled by a human, but at some distance from it. Such a concept – such as RAAF’s fondness for Remotely Piloted Vehicles – has a person sitting at a control station sometimes many thousands of kilometres from the aircraft nevertheless “flying” it by sending instructions via a datalink. In the view of many, this is a waste of a good pilot – particularly for tedious missions such as broad area maritime surveillance.

To be really effective, what is needed is Trusted Autonomy, so that the algorithms operating the platform are well proven and stable - not requiring constant human monitoring, which tends to defeat the purpose of the system in the first place. A recent example was the Northrop Grumman X-47B, which was able to carry out tasks even daunting to the most skilled of human pilots such as landing on aircraft carriers at sea. For a variety of largely non-technical reasons – such as resistance from the Naval Fighter Pilots Club – the further development of this remarkable aircraft seems to have stalled.

A prominent defence industry thinker on the topic is BAE Systems Australia Chief Technology Officer, Brad Yelland, with whom APDR discussed

"A truly smart system should be able to observe and make sense of its environment, and work by itself or with others to achieve goals. To address this, Defence is undertaking research in areas including contextual awareness, active perception, path planning, multi-agent system control and swarming.”

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AUTONOMY

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the topic – appropriately speaking remotely. He explained that the company had come into the domain of autonomy through its guided weapons work, which as we mentioned is an early example of an autonomous system.

“Our interest grew out of moving from an unmanned weapon involving guidance and control technologies - which by its very nature is autonomous in nature – to unmanned aircraft. We didn’t go from a manned platform down into autonomy, like many others have. The wider company is interested in autonomy in all domains – not just air. It is a capability that is increasingly being seen as useful by our defence customers.”

Autonomy is classed as a disruptive technology, potentially allowing quite small military organisations to achieve major effects – for example by using autonomous swarms of small, cheap drones to launch an attack on large conventional platforms. A classic force multiplier, such systems are attractive for defence planners because of their ability to be generationally ahead of a less adaptive opponent.

A significant activity in Australia involves the use of Army’s obsolescent but still mechanically sound Vietnam War era M-113 armoured personnel carriers. BAE Systems is integrating autonomous solutions into these tracked 12 tonne platforms as a convenient test platform for various experiments being conducted by the Army. This is to help Army better understand what robotics can and can’t deliver. This is a stepping-stone towards a future autonomous vehicle – or probably a fleet of them – that according to the 2020 Force Structure Plan will see an investment in the range of $7.4 - $11.1 billion in the early 2030s.

The idea behind the M-113s is to operate them in five groups of four vehicles each, experimenting with autonomous teaming and collaboration. They have three modes of operation – fully autonomous; remote controlled; or operated by humans. Different variants of the vehicles are used depending on the nature of the operation – and Army personnel are involved to examine their utility for various missions. Obviously, one would not want the M-113s autonomously running over pieces of equipment during experiments – let alone our soldiers – so the question is: how mature is the technology controlling them? Brad Yelland explained:

“There’s a very complex answer to this because there are a number of elements of autonomy at different stages of maturity. When it comes to the core autonomy providing control to the vehicle, that is super mature. It is exactly the same as has been used already for systems such as Taranis – a jet powered UCAV prototype – and which is going into Loyal Wingman. It has flown eight different UAVs and has been used in a couple of UGVs. It is very mature technology – and its pedigree goes back to Evolved Sea Sparrow Missile guidance and control; NULKA guidance and control – so it already has a long and proven history.

“As you go out from that into the other loops of autonomy there are other elements. Our navigation systems are also very mature. This could be way-point navigation where the vehicle travels relative to defined features or whether you give it a geographic objective and let it figure out its own route – we have proven solutions for those.

“We also have very accurate solutions for navigation without the aid of GPS. We can achieve levels of accuracy as good or better than what can be achieved even with precision guided weapons.’

Asked if he was talking about inertial navigation systems, he said:

“No, we actually call it ‘All Source’. Basically, it uses anything at all that is available. This might be information coming in from the sensors, where we can use objects to navigate by. The example I use is if I have to get up in the night and don’t want to switch the lights on, I have an alarm clock that glows – and just knowing where that is allows me to navigate safely around objects. Technically it’s known as SLAM – simultaneous localisation and mapping.”

Clearly, Mr Yelland does not own a large black cat that sleeps at random places on the floor at night and reacts violently to being stepped on.

“What it allows you to do is use advanced triangulation that allows you – and this is a very simplified explanation – to use a single object to locate yourself and then navigate around that point. You achieve the triangulation by looking at that point – which doesn’t have to be visible, it could be an RF signal – as long as it has consistency in location or direction. Using SLAM algorithms you can generate your location.”

This could be the sun; stars; or tufts of grass on the ground; rocks – basically anything that either isn’t moving or moving at a rate that will not impact
the accuracy of the solution. You also need to be able to detect it multiple times.

“If a GPS is there we will use that; if not then it’s the next best thing available. This all happens automatically – and we have flown multiple hours proving that we are as accurate as GPS. Platforms also have an inertial navigation system – but they have built in errors. We have proven the accuracy of our system by flying one of our little Kingfisher UAVs with a very inaccurate, unreliable INS that after two hours of flight basically said we were in another country – but using SLAM algorithms for the same mission we achieved accuracy of less than half a meter.”

Returning to practicalities, the most obvious use of an autonomous vehicle is for missions where you don’t want your own people being killed, such as attacking a fortified complex or clearing a minefield. However, Brad Yelland believes it goes far beyond that and might include various other tasks. He described an activity with the Royal Air Force in Afghanistan around the detection of Improvised Explosive Devices:

“The advantage we had with an autonomous solution – we used our HERTI UAV, which is a powered glider – carrying a high definition camera able to take pictures of the ground underneath. We flew repeatedly over the same area and used differential photography techniques to examine images taken on different days at exactly the same spot at the same time.

“This is much harder to do with a manned aircraft simply because of pilot error, but can be replicated using a machine with great precision. It’s a simple example of the pilot not being in harm’s way – just not being able to do as good a job. The system was so precise we could tell even if a pebble had been moved – allowing us to see where insurgents had dug a trench to bury a detonation cable. This would have been impossible to do with the naked eye.”

There are other activities such as resupply that fall into the category of why waste a human on doing a particular task if a machine can do it adequately. Rather than a soldier walking to and from the frontline carrying supplies, far better to let an autonomous vehicle do it leaving the human to concentrate on demanding combat-related tasks. The mantra is to use robots for the dull, dirty and dangerous missions – and also those where high levels of accuracy and reliability are needed.

The BAE Systems approach is to be platform agnostic and domain agnostic, so the autonomous vehicle management system remains the same – though with some tailoring when required.
Kym Bergmann: You’ve been doing some work with the Australian space industry. How would you describe the Australian space industry? Is it a coherent mass of companies or are we looking at something that’s much more scattered than that?

Stephane Marouani: I think it’s in its infancy, it’s a mix at the moment. It’s clearly a very innovative mix of companies and industries. I think the starting signal was the creation of the Space Agency in 2018. Definitely I think that sent the right signal to entrepreneurs to invest in that field and take the risks, but also the investment from the defence industry and specifically from the Defence Science and Technology Group in that field as well. I mean, there’s a clear sign from the defence industry that it wants to go to space. There’s a lot of collaboration in there. I think there’s a clear understanding that Australia will probably not send big rockets with humans to the moon and Mars. But smaller payloads, more smart systems. Australia will play more of the smart than the big, if I can say it like that.

Kym Bergmann: Absolutely. In the area that I and my readers work in - which is more government contracting, more defence related stuff - there’s been a lot of discussion in the last several years about the importance of developing sovereign capabilities in various domains. What are your views of the importance of doing that in the space sector? Is that something you’d regard as important or can we just continue to rely on an international mix of technologies and projects?

Stephane Marouani: I think it will be a mix. I think we’re not going to get out of the Five Eyes partnership and relying on some of the technologies from our partners, but definitely considering the current geopolitical environment, it will be important for Australia to develop its own capability, especially the communication sector and the defence. And we have the right skills. We have the right knowledge. I mean, we have some of the best engineers in the world, so there’s no reason why we can’t do that. Will we be able to develop the entire capability of a space defence system? I don’t think so. It requires way more than a small economy type of budget - but definitely bringing the smarts is something that we can do.

Kym Bergmann: Could you just expand on some of those niches where you think Australia does have particular skills that we could build on?

Stephane Marouani: We have a lot of skills in the telecommunication sector - from the defence space, from CSIRO and a university standpoint, but also from engineers coming from the telecommunication space as well. Defence has been partnering with Optus, for example, to put satellites, telecommunication satellites out there. There is a strong knowledge base here in Australia I think, in telecommunications, but also the other domains I see a strong knowledge in robotics and autonomous systems. So that’s where I think the partnerships between defence and universities and research will become more and more important. We can certainly see that from our angle as well.

Kym Bergmann: The signature defence project is JP 9102 - it’s not the only space activity, but it’s really the biggest of them. And one very important component of that looks to be an interest in developing an Australian sovereign constellation of communications satellites. How feasible do you think that vision is? And are there any missing ingredients?

Stephane Marouani: I think we have all the components. First, we’re not talking about sending a constellation of satellites. We’re talking about micro or nano satellites.
Kym Bergmann: Okay.
Stephane Marouani: So literally small size. We do have start-ups and companies here in Australia that are developing technologies. For example Fleet Space Technologies in South Australia are developing nano satellites. https://fleetspace.com/. We have companies, start-ups or growing start-ups, like Gilmour Space https://www.gspacetech.com/ and Rocket Lab in New Zealand https://www.rocketlabusa.com/launch/launch-sites/ capable of sending mid-size rockets with micro payloads into space. Supplying the bird, we can do it, developing the satellites, we can do it, and we’re certainly seeing growth there. And we have a long history of the logistics behind it, back to the Apollo mission. Certainly, from a command-and-control example, we have a long history in Australia around that. I think we have all the confidence to do that, I guess the question is how is the government and defence industry and the Department of Defence going to fuel that innovation and development in the next few years.

Kym Bergmann: It certainly looks like there’s going to be sufficient funding involved.
Stephane Marouani: At the moment yes.

Kym Bergmann: I don’t really understand the amounts of money that are required for this sort of technology, but you mentioned low earth and nano satellites. So presumably they are at the lower end of the expenditure range?
Stephane Marouani: That’s what is interesting. That’s what we see from my angle. Now you can develop a satellite, a micro nano satellite, that packs a lot of hi-tech punch in a small size, which was not possible even 10 years ago. But also, at a much lower cost so the access costs to hardware and indeed developing these complex systems is much lower. You don’t need to spend billions of dollars before sending a system into space. And I think that plays well for Australia because we’re smart and we can do things on the cheap.

Kym Bergmann: I’ll just backtrack a little bit, because I’m also interested in sort of the cultural issue of why it is that when we think of Australian capability, as we think about mining and maybe about agriculture, but from my recollection, Australia was actually about the fourth or fifth country on earth to put a satellite into orbit. It was a very small experimental thing that some of our defence scientists did, but in the late 1960s, on the back of the cancelled British Blue Streak program, we actually had a really thriving sector. It seems to me that it never completely vanished, but it’s virtually unknown. I just wonder if you have any thoughts on why that’s the case. Is it just an accident of history or is it because we have a culture that pays more attention to sports or something like that?
Stephane Marouani: Look, it’s interesting. It’s an interesting question. I think again, we have a longer story. I think the Apollo mission was actually creating the buzz and Australia was at the forefront and we’re proud of it. I mean, again, I wasn’t in Australia at that time, but from my reading and conversations, clearly there was a buzz. And as you said, even though we continue to support the NASA mission until today; it vanished out of the eye of the public. But also from a funding standpoint, we move more from a defence and space program to more academic research into space.

Kym Bergmann: Here’s a little fact from history, just a tiny one that in 1975, which was a year of great political turmoil in Australia, Arianespace had not really finalised their launch site. And they proposed to the Australian science minister of the day to look at Cape York Peninsula. But the idea just got lost in the political chaos. Imagine what it would be like if that had gone ahead.
Stephane Marouani: That would be great. But I think it’s going back. I mean, clearly we have a unique geographic position in the world and climate for that matter, and I think the idea is going to come back. If you look at a company like Southern Launch in South Australia. They literally started a year ago and now have the largest private test range on land in the world, because you can send something into space without touching any city because there is a lot of room for hundreds of kilometres.

Rocket Lab in New Zealand, the same. So I think it will come back.

Kym Bergmann: Have you, out of curiosity, been to Woomera? I mean that used to be a fantastic facility. And again, physically it still exists.
Stephane Marouani: No, I haven’t. I was planning to, but COVID.

Kym Bergmann: It interferes with so many plans.
Stephane Marouani: It interfered with that.

Kym Bergmann: Okay. Getting back to the structure of the Australian industrial sector, again when I’m thinking of satellite technology, I guess I’m just a traditionalist, so I think of the big American companies, I think of Boeing I think of Arianespace, whereas here, our companies are two or three orders of magnitude smaller. So again, I’m just wondering about your optimism and your vision, how that can be translated into a practical formula for undertaking these sorts of complex ventures?
Stephane Marouani: Yes. I’m definitely optimistic. I think we’ll see a hybrid of a company like Boeing or Lockheed Martin. They have a presence in Australia and employ many, many Australian engineers. What we start to see is these larger OEMs begin to engage with the smaller, smarter start-ups to work together with the godfathering of the Department of Defence or the Australian Space Agencies. So I think they will grow. And I think they will work together with the big agencies. For example, a lot of start-ups are leveraging the partnership between the ASA and NASA pouring $150 million on the logistics support for the NASA mission to the moon and Mars.

Kym Bergmann: I think it’s a French engineering expression though, which translates as something like, rather than trying to harness 1000 mice, just buy a horse. That attracts me to the simplicity of rather than having a myriad of small entities working on a project, wouldn’t it be simpler to just have one giant taking the lead for all of this?

Stephane Marouani: When I say simple, it still was complex - it’s still complex - to fly a bird, develop a multi domain type of engineering and R&D. If you look at it, we’re moving from the bird navigation system type of problems, putting satellites into orbit, then re-entry, to a more diverse set of knowledge, skills and development. In the clear communication goal, in robotics and potentially in the next 10 to 20 years in mining, at some point we will have to think, well, how do we extract water or iron from the moon if the moon is the launching base to Mars. From my end we see this very diverse, but very healthy set of small organisations building this multi domain type of capability. Whether there will be consolidation, probably, but I’m not sure.

Kym Bergmann: You’re not yourself into mergers and acquisitions and that sort of thing. I won’t go through the list of companies, but there are some in Australia that are larger than others. I have already seen some signs, particularly using JP 9102 as a catalyst that they’re starting to come together to think collectively about how it might be possible to address the issues.

Stephane Marouani: Yes, absolutely. I think it’s a natural progression for start-ups to be acquired by large organisations. I think that will happen. I hope that we can still maintain this foundation of innovation starting from academia to commercialization before they get acquired and hopefully stay in Australia because the problem is a lot of innovation happens in Australia. They start commercialising and then they move to the US which means we’re losing IP and people.

Kym Bergmann: Do you have any sort of concluding thoughts about the way forward or any particular technologies. We’ve touched on it a bit, but are there any standouts from your point of view that that Australia can be proud of?

Stephane Marouani: I think Australia can be proud of, again, the micro rocket space. I mean, we’re a very smart set of engineers, starting from students. We have students winning international rocket competitions, so clearly we are developing a really smart set of engineers to develop space systems. Clearly, we see more use of advanced technologies, especially artificial intelligence, machine learning, robotics for space. Again as space systems move from the traditional to more advanced systems, and there’s a strong foundation in Australia as well for that, especially the machine learning and robotics space.
During the next decade around $7 billion will be invested not only on satellite hardware – which is trending down in cost and weight – but also a number of other capabilities, including the critical ground infrastructure that will be controlling the flow of data. According to the 2020 Defence Force Structure Plan, this will significantly expand Australia’s capabilities. Satellite communications is a key part of this – though when pressed for details Defence says that the project has not yet been approved by Government and that consultation with industry is continuing.

Other capabilities that will be acquired through to 2040 are: Terrestrial Operations in Contested Space ($1.4-$2 billion); Space Situational Awareness ($1.3-$2 billion) and an assurance program for the communications satellite system ($1.7-$2.5 billion). This is a departure from previous Defence policy and constitutes a significant expansion into the space domain.

Previously Australia lacked a sovereign communications capability and for regional and international coverage has been dependent on systems such as the US WGS constellation. Australia paid $1 billion under JP 2008 in 2007 as the nominal cost of a single satellite to gain access to the entire network – but the US has always made it clear that the system is under their control and every part of it belongs to them. Apart from the fact that WGS is entering its obsolescence phase concern has always been there that in the event of a major crisis the US would prioritise their needs ahead of other users – including Australia – and the ADF could either be shut out completely or be a very low priority. This is a significant – potentially deadly - sovereign risk, especially for Australian forces that might be deployed offshore.

The original WGS decision was not without controversy on the basis of a cost-benefit analysis. Additionally, the task of constructing two ground station “anchors” was fraught since it transpired that for certification purposes they have to be constructed precisely as the US directed – a costly and time-consuming exercise with the facility in WA only just reaching full operational capability 11 years after contract award. A second east coast ground station near Wagga Wagga is scheduled to be operational in 2022.

According to Mr Luke Brown, Assistant Secretary Space & Communications, Department of Defence, the intention behind JP 9102 is for Australia to increase its worldwide capacity through enhanced allied and commercial arrangements, as well as providing a sovereign satellite capability through our own constellation and ground stations. This will be focussed on the Indo-Pacific region and will add to self-reliance and resilience, providing assured access to satellites when needed. This represents a shift from a broad aspiration to an actual strategic intent.

This formal guidance apparently gives the Department the “riding instructions” to move ahead with getting better information to understand how Australia could develop our own constellation. Future activities have three key components:

1. The sovereign communications satellite component. Australia’s own high-capacity satellites controlled through our own ground


This is an important philosophical change, with Australia wanting to be a contributor to the international satellite and space architecture with our coalition partners – and less of a consumer.
Workers prepare the Air Force's third Advanced Extremely High Frequency satellite for launch Sept. 12, 2013, near Cape Canaveral Air Force Station, Fla. AEHF is a joint-service system that provides survivable, near worldwide, secure, protected, and jam-resistant communications for high-priority national military operations.

Credit: Lockheed Martin

system, run by Australian personnel to provide SATCOM over the Indo-Pacific region.

2. Rest-of-the-world military coverage, which is achieved via various international agreements – of which Australia has several. These provide shared access to satellites today. This component will be looking at next generation military constellations that might be part of the future mix, such as the US Advanced Extremely High Frequency network made up of six geostationary satellites. It is possible that the Australian sovereign network of the future will be able to share capacity with allied systems. This is an important philosophical change, with Australia wanting to be a contributor to the international satellite and space architecture with our coalition partners – and less of a consumer.

3. Supplementing and complementing the above, is the use of commercial SATCOM. Australia already has quite a lot of capacity provided by commercial partners, for example Optus whose three satellites carry military as well as civil payloads. This will always be an important component in overall capability because investment in commercial R&D is orders of magnitude greater than what Governments are spending.

Commercial networks can provide surge capacity and access to frequencies that Australia will not necessarily build into its sovereign constellation. This provides a broader and more flexible series of options also capable of rapidly expanding capacity. This means that commercial SATCOM will always be part of Australia’s capability, particularly because of complementarity regarding frequencies and global coverage.

Turning to Australia’s high-level needs, fundamentally these have not changed with access to capacity and coverage. The need for capacity is growing – and Australia is becoming more specific about coverage, with priority now given to the Indo-Pacific.

To this can be added connectivity – both within the ADF and externally, particularly to allied systems. Related to this is interoperability within the joint force and also particularly to US-led coalitions. In essence, the vision is that Australia will be able to gain access to other sovereign networks in exchange for allowing reciprocal access to ours.

NORTHROP GRUMMAN AND GILMOUR SPACE TECHNOLOGIES WORK TO GROW SOVEREIGN CAPABILITIES IN AUSTRALIA

25 NOVEMBER 2020, CANBERRA, AUSTRALIA

Northrop Grumman Corporation (NYSE: NOC) announced it signed a Memorandum of Understanding (MOU) with Queensland-based rocket company, Gilmour Space Technologies, to support the development of Australian sovereign space capabilities.

Northrop Grumman aims to lead industry support in developing Australian sovereign space capabilities to help meet the needs of defence and realise the Australian Space Agency vision,” said Chris Deeble, chief executive, Northrop Grumman Australia. “Our approach is consistent with the Australian government’s recently announced Modern Manufacturing Strategy, to make space hardware in Australia while securing sovereign capabilities in priority areas that includes defence and space.”

As an initial task under the MOU, Northrop Grumman will join Gilmour Space as an industry partner on a previously announced Cooperative Research Centre Project (CRC-P) to develop composite rocket tanks for low cost space transport.

The CRC-P, which includes Griffith University and Etamex Engineering, will manufacture composite tanks up to two metres in diameter and trial them in rocket flights, in an effort to reduce weight and increase reliability.

Gilmour Space CEO Adam Gilmour said the company is excited to work with Northrop Grumman on this opportunity. “It is great to gain the support of Northrop Grumman who, through this investment, have further demonstrated their commitment to grow Australian space capability.”

Northrop Grumman recently sought expressions of interest from a range of Australian and New Zealand industry members, through the Industry Capability Network Gateway Portal, which included small businesses, with the goal to identify and collaborate with industry to develop Australian space capabilities.

Northrop Grumman remains committed to enhancing its business and geographic footprint in the Commonwealth of Australia as a key contributor to the Australian Space industry. The company has a strong customer base in Australia where it has been supporting numerous defence and civil programs for more than 20 years.

Northrop Grumman solves the toughest problems in space, aeronautics, defence and cyberspace to meet the ever-evolving needs of our customers worldwide. Our 90,000 employees define possible every day using science, technology and engineering to create and deliver advanced systems, products and services.
This means that Australian ground terminals will need to be able to work with our satellites and also those of partner nations. The need to support the sovereign network is another new capability that needs to be developed. The Department of Defence has been involved in SATCOM for some time – but operating our own constellation is new. Building and maintaining this capacity is a key ingredient of JP 9102.

Once launched, the Australian satellites will need to be resilient because they will face a number of threats that – if ignored – might be able to deny or degrade their performance. A key to this is intelligence and an awareness of emerging dangers. This means that the system will need frequency agility as well as having the ability to move spot beams rapidly to users and between them. It might be possible to harden the satellites and manoeuvre them in orbit. They will need features such as beam shaping and advanced wave form selection. It will also be necessary to modify the systems as threats change and evolve, including having diversified ground elements.

All of these features need to be combined to make a robust system that is also interoperable when required. This is especially so in the area of “peak force interest” which is a huge northward-facing slab from just off the east coast to west of Christmas Island. This zone includes all of south facing slab from just off the east coast to west of “peak force interest” which is a huge northward-when required. This is especially so in the area of make a robust system that is also interoperable including having diversified ground elements.

Of this area.
Communications satellites come in two basic types. The first and oldest method is to place a large satellite in geostationary orbit some 36,000km away. This has the advantage that the satellite remains exactly above the same point on earth as the planet rotates, meaning that a country’s ground terminals and those of allied nations can be in constant contact with it. This is how the big, secure military constellations such as WGS and AEHF work. However, getting a satellite up that high requires a lot of energy – meaning a big, heavy, expensive rocket.

A newer method is to use a number of low orbiting satellites to achieve similar coverage. While these are small, cheap and light enough to put into orbit comparatively easily, their disadvantage is that they whizz around above the earth’s surface at high speed and therefore a large number of them are needed for continuous coverage. An early example of this is the Iridium network, which has 95 satellites travelling at 27,000kmh – with 85 more to come – that are in various orbits 780km away.

Because of the speed at which they are travelling, a user on earth only has line-of-sight to each Iridium satellite for about 10 minutes as it appears over the horizon, passes overhead and vanishes. However, with enough satellites working in coordination, just as one is disappearing from view, the next arrives and continues the coverage. If you have enough low earth orbiting satellites, they can also provide continuous coverage.

Officially, Defence is agnostic about the way ahead – though undoubtedly some old timers would be attracted to the large geostationary bird sitting directly above Canberra forever and launched by the USAF. More innovative thinkers will be attracted to the idea of large numbers of low earth orbiting satellites – which Australian industry can build and launch. Depending on how the discussion goes during the next few years it is even possible to look at a combined solution involving both low earth and geostationary orbits.

To achieve all of this, Defence is looking for a partnership with industry not only for the sovereign capability element but also access to and use of commercial SATCOM. International agreements will also be vital and says we must integrate even more closely with the US. Other partner countries listed are: Canada; Germany; France; New Zealand; and the UK. Along with the US, they make up the Combined Space Operations Initiative. According to US Space Command:

“Initially signed in 2014, the CSpO initiative brought together the United States, Australia, Canada and the United Kingdom in a more coordinated space domain awareness effort. New Zealand was a signatory to the initiative in 2015.

“Focus areas for CSpO include space domain awareness, force support, launch and reentry assessment and contingency operations.”

France and Germany joined in February 2020 with the aim of further developing multilateral space collaboration.

MOMENTUS ANNOUNCES NEW LAUNCH AND TRANSPORTATION SERVICE WITH AUSTRALIA’S GILMOUR SPACE

30 NOVEMBER 2020, SANTA CLARA, CA

Momentum Inc. (“Momentum” or the “Company”), a commercial space company offering in-space infrastructure services, and Gilmour Space Technologies, a leading hybrid rocket company based in Queensland, Australia, today announced a new agreement for launch and orbital transport services.

Under the agreement, Momentus will gain access to low inclination and equatorial orbits using Gilmour Space’s Eris launch services. With Momentus’ Vigoride transportation service, Gilmour Space will have the capability to expand the flight domain of the Eris rockets (the company has several larger models planned coming to market beginning in 2023) and enable constellation deployments and missions beyond low Earth orbit (LEO). Gilmour Space has the option to book up to three Vigoride charter missions for orbital transfer services from Momentus over the 2023-2025 period, while Momentus will purchase one dedicated Eris launch service from an Australian launch site.

“Momentum is proud to announce another partnership with the Australian space industry, shortly after sealing an agreement to launch Skykraft’s satellite in 2021,” said Mikhail Kokorich, CEO of Momentus. “We are looking forward to supporting ambitious projects in partnership with Gilmour Space, such as flagship missions with the Australian Space Agency and development of sovereign space capabilities with the local industry.”

Gilmour Space is a venture-backed rocket company in Queensland, Australia that is developing new launch vehicles powered by lower-cost hybrid propulsion technologies. The Eris launch vehicle will debut its services in 2022 and offer lift-off capability to LEO in the 300kg class. A more capable variant, Eris Heavy, is intended to be commercially available in 2025 with a lift off capacity up to two tons. The Eris family of launch vehicles will launch from Australian and international launch sites, offering access to low inclination as well as Sun-synchronous orbits.

“This is the first international contract we’ve announced this year, and a great example of how innovative companies are coming together to accelerate development and provide new access to space,” said Gilmour Space CEO, Adam Gilmour, who is looking to raise a round of venture capital funding early next year.

The news comes at a time of growing support from the Federal government to develop Australia’s sovereign space industry capability in Defence and Manufacturing. “With two rockets sold and a number of launches being negotiated now with other customers, I see this as further evidence that we can have a commercial space launch business in Australia.”

Asia Pacific Defence Reporter DEC-JAN 2021 39
ANZAC FRIGATE SYSTEMS UPGRADE PROGRESS

HMNZS Te Kaha left Esquimalt Harbour, Canada in September under her own power for the beginning of her sea trials.

Since 2018, Te Kaha – followed by HMNZS Te Mana – has been undergoing its upgrade by Lockheed Martin Canada. Very evident in this aerial image are the new fore and aft masts, boasting new radars, electronic detection equipment, laser warning system and aircraft identification system.

The sea trials focussed on getting Te Kaha’s plant, including two diesels and a gas turbine engine, operating smoothly, as well as some testing and calibration of some of the new electronics systems.

In total, Te Kaha has undertaken seven weeks at sea conducting trials, which increased in complexity as the ship put all its new hardware to the test. The latest has been working with a jet aircraft to verify tracking sensors and the firing of the ship's main armament, her MK45 five-inch gun.

NZDF ARTILLERY FIRE CONTROL SYSTEM

The NZDF has issued a Request for Proposal (RFP) for procurement of a Fire Control System (FCS) to direct and manage indirect joint fires missions. Systems offered must be proven for use in 105mm L119 Light Guns and L16/M8R 81mm mortar fire missions. A typical Battery will have 24 tablets and eight computers running the FCS plus other tablets and computers in the Joint Fires and Effects Coordination Centre. The key outcomes for NZDF are a proven, effective and safe system that is fully supported for an estimated Life of Type of at least 15 years.

The NZDF team has had over a year to study responses to their Request for Information which closed in September 2019, with their RFP closing on December 7. They expect to have a shortlist for system evaluation trials by February 2021 and to start contract negotiations by May 2021.

The User Requirements in the RFP document are extensive and detailed. APDR noted the importance attached to the chosen FCS in not only meeting all the NZ Army requirements, but also integrating with American, British, Canadian, Australian and New Zealand (ABCANZ) coalition partners’ standards. New Zealand joined ABCANZ as an observer from 1965, with full membership in 2006.

NZ SPACE LAUNCHES IN 2020

The first commercial launch of an Electron rocket from Rocket Labs Launch Pad 1 on New Zealand’s Mahia Peninsula took place on 11 November 2018, putting seven small satellites into low earth orbit.

At the time of writing, 95 small satellites have been safely delivered into orbit since the start of commercial launches in 2018, with another launch planned for December 2020.

The November 20 ‘Return to Sender’ mission successfully launched and its first-stage was successfully retrieved after parachuting back to Earth some 12 minutes after lift off. The Auckland University student satellite, Gnome Chompsi and 29 other small satellites for commercial customers successfully made it to low earth orbit.

Next up for Rocket Lab is a dedicated launch in the U.S. for the United States Space Force in partnership with the Department of Defense’s Space Test Program and the Space and Missile Systems Center’s Small Launch and Targets Division.
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