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20 February 2015

COMMITTEE SECRETARIAT
Foreign Affairs, Defence and Trade Committee
Department of the Senate
PO Box 6100
Parliament House
Canberra ACT 2600

Figure 1: Computer Generated Image of the USV Bonefish in surveillance mode

RE: THE POTENTIAL USE BY THE AUSTRALIAN DEFENCE FORCE OF UNMANNED AIR, MARITIME AND LAND PLATFORMS.

Dear Committee

Saab has had a long association with the development of unmanned platforms, from our investment in Australia in the early start-up Aerosonde to the development of modern sophisticated rotary, underwater and surface unmanned systems for international markets.

We believe that unmanned platforms provide a number of potential benefits in both defence and civilian applications including:

- Cost effectiveness in operations of a repetitive nature where the expensive human pilot/driver/navigator can be removed. Examples include harbour protection, pipeline checking, supply and Sea Qualification Trials.

- Ability to operate in hazardous conditions where human safety need not be compromised. Examples include mine hunting and disposal, remote firefighting at sea and on land, interdiction of suspect ships, and anti-piracy operations.
- Cost effectiveness in applications that require persistence covert and/or long endurance surveillance.

In addition, when integrated with modern defence command and control systems, unmanned platforms allow for both range extension and force multiplier options that provide for enhanced operational capability.

Other authors[i] [ii] [iii] [iv] [v] [vi] [vii] [viii] have provided at times good summaries of the uses of unmanned surface vessels, their application, typical capabilities, and operational manning requirements[ix]. Information about the size of the market for USV has also been discussed by several authors[x] with estimates ranging from USD 2.3 billion[xi] for USV and up to USD 14 billion[xii] for unmanned systems by 2019. In October 2014, Textron was awarded a USD $33.8 million contract by the US Navy for a common unmanned surface vessel[xiii].

While many will also discuss the legal and ethical issues associated with weaponised unmanned systems there is not always a need to weaponise such systems to be effective in a number of operational scenarios. The ability to shadow, loiter, picket, record video evidence and standoff may be a valuable deterrent in anti-piracy operations for example.

The Saab Centre of Excellence in Unmanned Surface Vessels

While much of the focus of Australian Defence Force interest is in relation to UAVs, and there is reasonable familiarity with UUVs, USVs are an emerging technology. The first commercial USV, Protector[xiv], was developed by Rafael (Israel) in conjunction with a number of partners, and has since been sold to the Singaporean Navy. ASV (United Kingdom)[xv] is also an emergent company developing a suite of USVs for the oil and gas industry primarily around survey. The same operational use of USV is applicable to Navy in terms of hydrographic and oceanographic survey or Rapid Environmental Assessment (REA). A trimaran[xvi] similar to the USV Bonefish of Saab has also been trialled with the United States Navy along with swarm technology to counter asymmetric threats, one of the key uses of USVs behind mine counter measures and anti-submarine warfare.

In recognition of the growing importance and utility of unmanned platforms, the Chief Executive Officer of Saab decided, in 2013, to establish a Global Centre of Excellence in Autonomous Surface Vessels in Saab Australia. Autonomous Surface Vessels are also termed Unmanned Surface Vessels (USV) or drone boats.

Saab Australia, headquartered in Adelaide, employs over 300 people around Australia and for the past 25 years has been involved in the design and development of the 9LV Combat Management System (CMS)[xvii] deployed on the ANZAC Frigates and more recently on the new Amphibious Assault (LHD) ships. The latest iteration of the Saab 9LV CMS is a key element of the Anti-ship Missile Defence (ASMD) upgrade of the ANZAC frigates which has demonstrated the ability of Australian industry to design and develop world leading ship defence capability.

In the underwater domain, Saab is the designer of the Integrated Ship Control Management and Monitoring System (ISCMMS)[xviii] for the Collins Class submarines and has supplied the Double Eagle[xix] Remote Operating Vehicle (ROV) which has been in service with the RANs Huon Class Mine Hunter Coastal

ships for over 10 years. Our SeaEye[xx] ROV product range is suited to many applications in both defence and civilian (especially oil and gas) industries.

In the air domain, Saab has developed the Skeldar[xxi] rotary Unmanned Aerial Vehicle (UAV), a medium-range UAV system that can hover for hours while providing real-time information to a control station or remote video terminal. Skeldar is fully autonomous, commanded by high-level-commands such as "Point and Fly" and "Point and Look", and designed for a range of land, maritime and civil applications.

In 2014 Saab acquired Kockums who brought to the portfolio the SAM3[xxii] mine-countermeasures USV, which was deployed during the Gulf War and some exciting research in ad hoc networking technology for swarms[xxiii] of USV – that is multiple USV that are controlled by a single operator and work collaboratively. Saab Kockums is also active as a member of the Safety and Regulations for Unmanned Maritime Systems (SARUMS) working group of the European Defence Association[xxiv].

The Australian Centre of Excellence in Autonomous Surface Vessels seeks to harness the skills developed in Saab in support of the RAN surface fleet and leverage the sophisticated unmanned platform technology developed in Saab worldwide to provide an incubator for the development of novel applications for unmanned surface platforms.

Figure 2: Saab Kockums' SAM3 Unmanned Surface Vessel detonating a mine

Since the establishment of the Centre, the team here has developed a 12 metre multiple mission concept design USV, named Bonefish, a mockup of which was shown at IndoDefence[xxv] in November 2014.

Figure 3: Mockup of the USV Bonefish on display at IndoDefence November 2014

To support the platform, the group has also developed an innovative scalable and flexible Mission System that provides a number of capabilities not found in the few other commercially available USV systems.

Figure 2: Part of Saab's USV Bonefish Mission System Laboratory in Adelaide, Australia

The Mission System is adaptable to any hull and engine combination and uses to the maximum extent possible Commercial off the Shelf (COTS) products. The use of COTS products significantly lowers the capital cost compared to bespoke systems and the architecture allows easy overall upgrade as COTS vendors upgrade their systems.

Figure 3: Illustration of the deployable Control Station that is part of the flexible Mission Management System for USV control

The Centre of Excellence also provides a focus for bringing together key researchers and suppliers in the USV field. At a recent (December 2014) workshop, experts form Saab Australia and Saab Kockums organised a workshop with:

- Associate Professor Karl Samut[xxvi] of Flinders University, whose team competed in the RobotX (USV) trials in Singapore and leads a program of research into a number of different aspects of USV;
- Professor Anthony Finn[xxvii] of the University of South Australia, who leads a team in the area of Autonomous Systems;
- Associate Professor Amir Anvar[xxviii] of the University of Adelaide, who works in the area of USV;
- Scientists of the Defence Science and Technology Organisation (DSTO) in both Adelaide and Sydney who are involved in USV and also have involvement with UAV and UUV.

Associate Professor Dale Stephens[xxix] of the University of Adelaide, ex Royal Australian Navy, also focusses on the International Law aspects of USVs.

One of the key areas of investigation of the Centre of Excellence will be the integration of USVs with other platforms. While USV providers focus on standalone unmanned systems it is the integration of unmanned systems into defence operations that is most critical to their success[1]. Saab Australia is very well placed in this regard with our expertise in the 9LV CMS, which sits at the heart of a ship's warfighting capability. Recently, under their Strategic Alliance, Saab and DSTO approved Phase 1 of an activity to conduct Research and Development (R&D) into the integration of the Bonefish USV Mission System with the 9LV CMS. The results of this integration work are expected to be applicable to the future integration of UAVs and UUVs with the CMS, realising the true benefit of these systems as deployable sensors. When combined with Saab Kockums Piraya (swarm USV) technology referred to above, where one person can control multiple boats, the economics of unmanned systems suddenly become very favourable, offering force multiplier effects in terms of surveillance and protection.

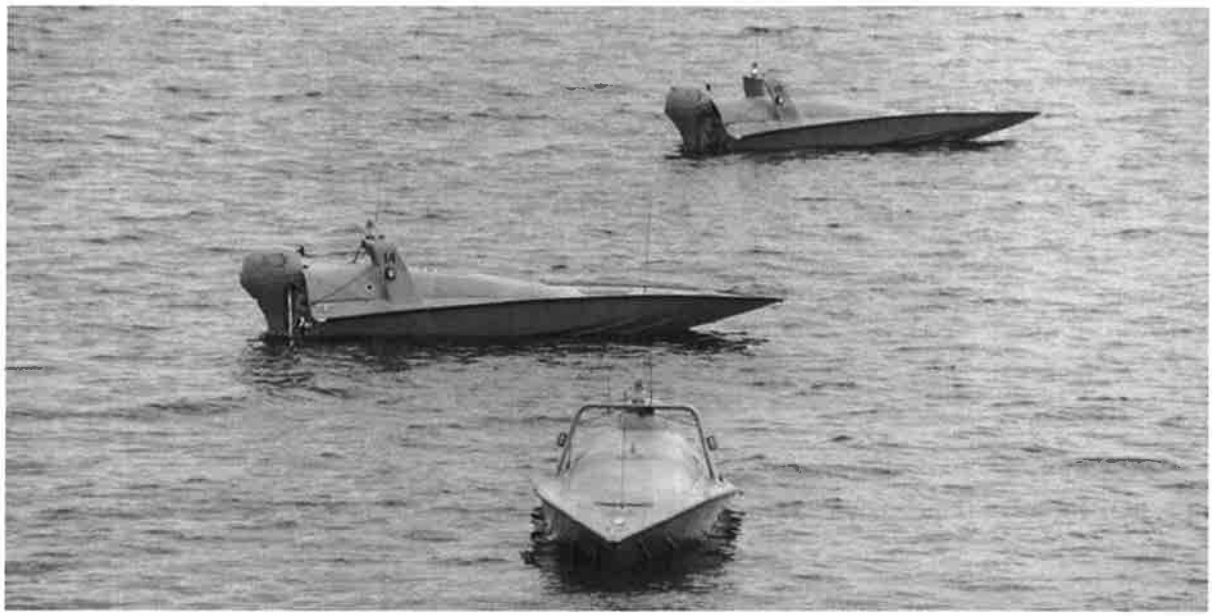

Figure 3: Saab Kockums' Piraya (swarm) Unmanned Surface Vessels

The Royal Navy (United Kingdom) has initiated exercise Joint Warrior in 2016[xxx] to acquire information on unmanned systems with the intent that in the future that they will be used to fight and win. A study was also commenced this year in the UK to investigate generic USV and generic CMS integration to provide input to future standards[2]; similar to the Saab-DSTO Activity referred to above. A key difference though is

[1] In the past Saab has collaborated with DSTO and their Virtual Ship Maritime Architecture (VSMA) to determine the viability of the ASMD concept and then help guide and validate the design. In this and other situations Saab and DSTO conducted a number of Human in the Loop (HIL) studies to understand the impact on operator workload and design the solutions accordingly.

[2] Early work in standards for Unmanned Control System (UCS) Unmanned Aerial Vehicle (UAV) interoperability include STANAG 4586 (NATO Standardization Agreement 4586). A similar standard will need to be developed for USV.

that the Saab Australia team has already been able to achieve some basic integration of the 9LV CMS with the USV Bonefish Mission System setting up the opportunity for the Royal Australian Navy (RAN) to leapfrog others in this space. Future R&D of the Saab Australia team could also integrate unmanned vehicle mission systems with the battlefield management systems of land-based forces where USV may be used for Special Forces deployment and recovery, operation in riverine environments, or for surveillance.

With our USV R&D though, the Saab team is very cognisant of designing in safety and workload considerations and we leverage among others on the experience of the Saab Kockums' team.

Ability of Australian Industry to Support the Introduction of USVs into the ADF

Unmanned Surface Vessels are truly an emerging opportunity and one Australian Industry can take an active and world leading role in, leveraging the skills of our Publicly Funded Research Organisations (PFRO) in collaboration with key Electronics and Information Technology (ICT) industry players and skilled boat and ship builders.

There is nothing fundamental that limits the ability of Australian industry[3] to be successful in the USV space especially with innovative COTS–based multiple mission solutions such as the USV Bonefish that can apply to a wide variety of hulls from the very stable trimarans for surveillance, through to monohulls for search and rescue. The solution also serves as a good basis for the inclusion of some of the cutting edge R&D of for example Professor Finn, and Associate Professor's Samut and Anvar along with research groups other around Australia, the DSTO and the CSIRO.

There will be a place for all unmanned systems – UAV, USV, UUV and Unmanned Ground Vehicles (UGV) with crossovers between defence and other industries such as Oil and Gas, Mining, Customs and Border Protection, Remote Surveillance, and Agriculture and Fishing. There will be a place for different levels of autonomy with unmanned systems - trusted autonomy to borrow the words of Professor Anthony Finn. The real skill is in applying each possible solution to the appropriate problem and integrating unmanned systems with other defence systems and operational procedures – this requires close collaboration between Defence and Industry.

To this author, these are exciting times, and Saab looks forward to helping the Senate Committee in any way we can in better understanding the potential use and integration by the ADF of unmanned air, maritime and land platforms.

Yours sincerely,

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[3] A relevant precedent for this, for example, is the success of Austal with their innovations in regard to Aluminium ship construction.

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[ii] "Unmanned Maritime Vehicles: Core Capabilities & Market Background", Association for Unmanned Vehicle Systems International, available at http://higherlogicdownload.s3.amazonaws.com/AUVSI/f28f661a-e248-4687-b21d-34342433abdb/UploadedFiles/AUVSIUMVCoreCapabilities08-08-13.pdf

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[iv] Rodriguez D., Franklin M., Byrne C., "A Study of the Feasibility of Autonomous Surface Vessels", available at http://www.skibstekniskselskab.dk/public/dokumenter/Skibsteknisk/Download%20materiale/2008/10%20marts%2008/USVsurvey_DTU.pdf

[v] Kessel R., Pastore T., Bryan K, Strode C., "Asymmetrical Warfare: Turning the Tide", available at http://www.naval-technology.com/features/feature106366/

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[ix] Richter M., "Operational manning considerations for Spartan Scout and Sea Fox Unmanned Surface Vehicles (USV)", Naval Postgraduate School, available at http://calhoun.nps.edu/bitstream/handle/10945/2616/06sep_richter.pdf?sequence=1

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[xi] Shaker S., "Preparing for the Future of: Unmanned Undersea/ Surface Vehicles" available at http://www.slideshare.net/sshaker/future-uuv-usv-aug-2013

[xii] "Mobile Robotics Market Worth US$14,202.2 million by 2019: Transparency Market Research", Transparency Market Research, available at http://globenewswire.com/news-release/2014/10/22/675241/10103825/en/Mobile-Robotics-Market-Worth-US-14-202-2-million-by-2019-Transparency-Market-Research.html

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[xiv] http://www.rafael.co.il/Marketing/288-1037-en/Marketing.aspx with video available at https://www.youtube.com/watch?v=hUPY5YZhT1Q

[xv] http://www.asvglobal.com/

[xvi] http://www.darpa.mil/Our_Work/TTO/Programs/Anti-Submarine_Warfare_(ASW)_Continuous_Trail_Unmanned_Vessel_(ACTUV).aspx and http://www.unmannedsystemstechnology.com/2014/11/leidos-completes-at-sea-testing-of-prototype-unmanned-surface-vessel/

[xvii] http://www.saabgroup.com/en/Naval/Precision-Engagement/Weapon_Control_Systems/9LV_CMS_Combat_Management_System/

[xviii] http://www.saabgroup.com/en/Markets/Saab-Australia/Naval/ISCMMS/

[xix] http://www.saabgroup.com/en/Naval/Underwater-Security/Remotely-Operated-Vehicles/ROV-Double_Eagle_MkII_III/

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[xxv] http://www.janes.com/article/45417/bonefish-usv-breaks-cover-id14d2 with video available at https://www.youtube.com/watch?v=jhQcrHHTa5E

[xxvi] http://www.flinders.edu.au/people/karl.sammut

[xxvii] http://www.unisanet.unisa.edu.au/staff/homepage.asp?name=anthony.finn

[xxviii] http://www.adelaide.edu.au/directory/amir.anvar

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