# NAVIGATION

Newsletter of the Australian Institute of Navigation Inc

Volume 16, No 87 January 2020

Fellows and Members,

I wish all members and friends of the Institute best wishes for the new year. I am pleased that the AIN was able to recognise high performing individuals on the RAN and RAAF navigation-related courses that graduated late in 2019. Unfortunately my work had me at sea for much of the period, but I know that the Secretary, Kym Osley was able to congratulate the Dux and graduating classes at both HMAS Watson and RAAF Base East Sale.

Since the last AIN Newsletter notable is the contrast from the month of August last year where we were celebrating the AIN's 70th Anniversary in conjunction with the RAN Navigators Black Tie Dinner aboard HMAS Adelaide to the traditional summer break which was anything but for many in dealing with the bush fire emergency.

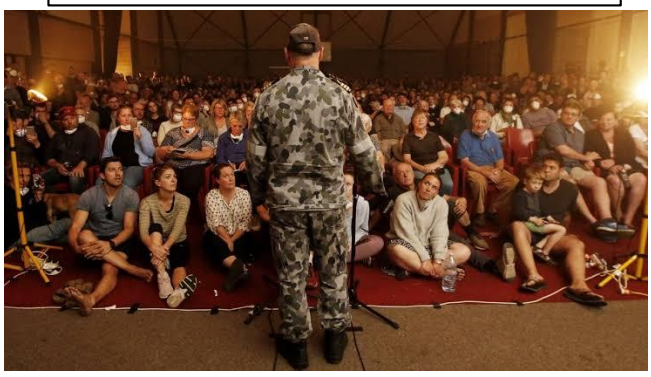
HMAS Adelaide, HMAS Choules and HMAS Sycamore were deployed to southern NSW and Victoria for the crucial evacuation and provisioning of distressed communities. A reminder to all of the vital lifesaving role the ADF including our Navigators perform in peace time operations. Thank you to all and of course the volunteers who contributed so much.

I look forward to meeting the newest graduates at HMAS Watson from the School of Navigation Warfare through 2020 and continuing to present the Dux award to the deserving candidates.

Coming up in February is the International Global Navigation Satellite Systems Conference in Sydney at the University of NSW, 5-7 February 2020. I represented the AIN at the last conference in 2018, which two of our members spoke at. It was an excellent event, and I thoroughly recommend it to practitioners or those interested in satellite navigation.

***Captain Gavin Permain, FAIN***
***President - AIN***
***January 2020***


BZ to the Navy, Army and Air Force members who helped during the December 2019/January 2020 bushfire crisis!!



## Notice of AIN Annual General Meeting, to be followed by the normal monthly presentation/dinner – Wednesday 12th February 2020

The next AIN **Annual General Meeting** is planned for 1715hrs to 1800 hrs, immediately preceding the 'normal' combined monthly dinner/presentation of the Australian Institute of Navigation, Nautical Institute and Company of Master Mariners.

- 1715-1800 hrs – AIN Annual General Meeting
- 1800 for 1830 – arrival drinks for the monthly dinner/presentation
- 1830-1945 hrs – dinner
- 1945-2100 hrs – presentation by guest speaker

The venue (as always!) is the Occidental Hotel, 43 York St & corner of Erskine St. in the Fairmont Restaurant on level 1. Cost for the dinner is $45, (note the modest increase from 2019) paid on arrival.

The speaker for the evening will be advised by email in due course.

Please RSVP by 1200 Monday 10th February 2020 to Capt Frank Pickering, who coordinates the RSVPs for all three organisations. He can be contacted on fpickering6@bigpond.com or if at late notice then through his mobile on 0418 499 166.

Also please include the Secretary (Kym Osley) as an info addressee for the RSVP **to the AGM** on kym.osley1@gmail.com. Partners and friends/colleagues as always are very welcome.

The Agenda for the meeting and a revised Constitution for the AIN will be sent out to Fellows and Members in the near future.

## International Global Navigation Satellite Systems Conference – 5-7 February 2020 at UNSW, Sydney

The most recent IGNSS Conference was held in February 2018, and the IGNSS conference for 2020 will once again be held in Sydney, at UNSW campus, running from 5-7 February 2020. The Conference is mainly held in the Colombo Theatre, High Street, Kensington, NSW.

IGNSS2020 is Australasia's premier conference and exhibit for technology, products and services in Positioning Navigation and Timing, including GNSS. The Conference will showcase topics such as the role of PNT in an era of increasing automation in transport and machinery, and the increasing threats in jamming, spoofing and cybersecurity. A feature of IGNSS2020 will be a showcase of demonstrator projects undertaken during the SBAS Test-bed and the next steps in the Government's Positioning Australia program.

Sessions will cover the following topics and more:

- Autonomy on land, air and sea
- Positioning Infrastructure
- GNSS Vulnerability, Resilience and Risk
- Interference Detection and Mitigation
- Policies and Standards
- SBAS and Other Augmentations
- Datums and Geodesy
- National and International GNSS Developments
- Embracing the Multi-GNSS Era
- Cyber Security in PNT Applications and Infrastructure
- Alternative PNT
- GNSS Aiding and Sensor Fusion
- Positioning in GNSS Denied Environments
- Development of GNSS Receiver Hardware and Firmware
- Precise position using Smartphones

The Program for IGNSS 2020 is as follows:

| *Wednesday, February 5th* |
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| 09:00-10:30 Session 1: Keynotes |

This session will include discussions on GNSS integrity, GNSS for automated vehicles, and downstream opportunities powered by European GNSS (Galileo and EGNOS).

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| **10:30-11:00** Tea Break |

**11:00-12:30** Session 2: System Providers

Updates on Australian SBAS, ROSCOSMOS, QZSS, GPS, and Galileo,

**12:30-13:30** Trade Exhibition & Lunch

**13:30-15:00** Session 3A: Positioning Infrastructure 1

Presentations include:

- Assessment of AUSPOS Performance in New South Wales, Australia
- Reference Frame, Uncertainty and Reliability of AUSPOS Solution
- The National Positioning Infrastructure Capability Project – The Now
- Victoria's Positioning Infrastructure - Now and Into The Future
- The application of GNSS surveying in the delivery of the Australian Geospatial Reference System
- The Australian Geospatial Reference System

**13:30-15:00** Session 3B: Autonomous and Cooperative Systems

- Simultaneous Localization and Mapping (SLAM) for Autonomous Driving
- Positioning integrity analysis for connected vehicle safety applications from the field operational tests
- Enable lane-level positioning for connected vehicles with low-cost dual frequency receivers
- Positioning challenges for cooperative vehicles, the Queensland experience
- Evaluation of integrity availability based on WLS RAIM in different urban environments for stand alone GPS and cooperative solution
- Suppressing Interference to Detect Very Far Field Signals using a Collaborative Phased Arrays

**13:30-15:00** Session 3C: GNSS Relectometry

- Application of super-resolution in GNSS Reflectometry
- Detectability of Ocean Surface Targets using GNSS-Reflectometry in Backscattering Configuration
- Raw Data Simulator for GNSS Reflectometry
- GPS-Reflectometry Using Kea GPS
- Receivers Determination on the sea surface height using ship-borne GPS

**15:00-15:30** Tea Break

**15:30-16:30** Session 4: Industry Pitch Session

**16:30-18:00** Trade Exhibition & Drinks

*Thursday, February 6th*

**09:00-10:30** Session 5: Keynotes

- The need for Robust, High Accuracy, High Integrity GNSS Services
- Prospects for quantum augmentation of inertial measurement units

**10:30-11:00** Tea Break

**11:00-12:30** Session 6: SBAS Panel

**12:30-13:30** Trade Exhibition & Lunch

**13:30-15:00** Session 7A: SBAS

**13:30-15:00** Session 7B: Alternative Positioning and Navigation Solutions

**13:30-15:00** Session 7C: Quantum Sensing and Integrated Systems

**15:00-15:30** Tea Break

**15:30-16:45** Session 8: PPP Panel

**19:00-22:30** Gala Dinner Harbour Cruise

*Friday, February 7th*

**09:30-11:00** Session 9A: Positioning Infrastructure 2

**09:30-11:00** Session 9B: Multi GNSS

**09:30-11:00** Session 9C: Precise Positioning

**11:00-11:30** Tea Break

**11:30-13:00** Session 10: Keynotes

**13:00-14:00** BBQ & Drinks

## Vice-Regal Patronage for the Australian Institute of Navigation

His Excellency General the Honourable David John Hurley AC DSC (Retd), Governor General of Australia has kindly agreed to be the Patron of the Australian Institute of Navigation. This continues a precedent started in the 1950s when the Governor General at the time first agreed to be Patron.

General David Hurley, AC, DSC, FTSE (born 26 August 1953) is a former senior officer in the Australian Army who is the 27th Governor-General of Australia, in office since 1 July 2019. He was previously the 38th Governor of New South Wales, serving from 2014 to 2019.

In a 42-year military career, Hurley deployed on Operation Solace in Somalia in 1993, commanded the 1st Brigade (1999–2000), was the inaugural Chief of Capability Development Group (2003–2007) and Chief of Joint Operations (2007–2008) and served as Vice Chief of the Defence Force (2008–2011). His career culminated with his appointment as Chief of the Defence Force on 4 July 2011, in succession to Air Chief Marshal Angus Houston. Hurley retired from the army in June 2014, and succeeded Dame Marie Bashir as Governor of New South Wales on 2 October 2014.

**Our Patron: His Excellency General the Honourable David John Hurley AC DSC (Retd), Governor General of Australia**

By coincidence, the current Secretary of the AIN, Kym Osley, worked direct to General David Hurley for several years when General Hurley was the Chief of capability Development group in the Australian Department of Defence.

CAPT David Pyett, representing the AIN, attended the Governor General's Chjristmas Drinks in Canberra on 12 December 2019 and was able to meet with General Hurley and his wife Linda.

## Does Australia Suffer From 'Sea-blindness'?

CAPT Peter Martin, a Councillor of the AIN has written on the subject of 'Sea-Blindness' in Australia – or the lack of widespread appreciation within the Australian community of maritime commercial and military capabilities and activities. His paper is accessible at https://www.tandfonline.com/doi/full/10.1080/18366503.2019.1686196 or from the author.

The abstract for the paper, titled '*The strategic implications of 'sea blindness' in the Australian LNG trade dynamic*' notes that '…in this Maritime Century, the notion of 'sea blindness' is an interesting development. There is a perception that Australia has long experienced a 'sea blindness', where the sense of the sea and surroundings is not generally apparent in Australians…'. This leads to a corresponding lack of strategic focus on maritime capabilities such as commercial strategic sea lift.

The paper notes that an analysis of the Australian and regional shipping circumstance highlights a decline in Australian flagged shipping and a significant increase in Asian shipping operations in the region. The paper uses the ship carriage of LNG as an example, which Australia commercial maritime industry has largely relinquished to other nations and particularly those from East Asia. The paper explores the strategic ramifications to national soft and hard power of 'sea-blindness' – the lack of investment over decades in a 'strategic' fleet of commercial shipping for the sea-lift of key resources, such as LNG.

## AIN Past-President to be President of the International Union for Geodesy and GeoPhysics

Professor Chris Rizos, past President of the AIN, was voted in as President-Elect of the International Union for Geodesy and Geophysics (IUGG) during the General Assembly on 16 July 2019. The IUGG is a non-profit global organisation dedicated to promoting international cooperation in earth sciences.

Through his new role, Professor Rizos hopes to raise visibility of IUGG and communicate its continued relevance for global science, as well as increase engagement with early-career scientists in developing countries. Professor Elaine Sadler AO FAA, the Academy's Foreign Secretary, commended Professor Rizos on his election and its impact on science in Australia.

Professor Rizos is the second Australian President in the union's 100-year history. Our congratulations go out to Chris on his selection for this prestigious position.

## The Emerging Importance of Space and Assurance of Space Capabilities in Australia – Military and Commercial

The next 20 years will see dramatic changes in the way we regard space-based systems that currently support positioning, navigation and timing (PNT). For the first 50 years of the 'space age', the use of space has been relatively benign with cooperation between the international players. However, if we cast forward the next 20 years, there will be a dramatic change and the space environment, or 'domain', will be increasingly contested, congested and competitive.

### Defence

Since the early 2000s, Defence has engaged in activities to assure access to key position, navigation and timing (PNT) capabilities derived from space-based systems. However, in recent years the threat to getting access to assured PNT for both military and commercial applications has increased exponentially. For a few hundred dollars or less, GNSS jamming systems can be bought 'on-line' and there are an increasing number of instances of PNT being jammed or disrupted both deliberately and unintentionally.
At a higher level, there is a much more significant threat posed by space denial capabilities that are now appearing more routinely in the armed forces of major powers, including those of China and Russia. In the future we can expect many, if not most, Defence forces to have at least some capacity to jam or interrupt access to space-based systems in order to gain an 'information' advantage over potential adversaries.

Of greatest concern militarily is the development of 'soft kill' type capabilities for space-based PNT capabilities. These counter-space weapon systems do not rely on 'overt' anti-satellite missiles that where plausible deniability is not possible, and there is also the inherent risk of self-damaging space debris. The new capabilities are based on technologies such as electronic warfare, jamming and spoofing, laser-dazzling and cyber, and can be deployed and 'hidden' behind non-military space activities and commercial space launches.

The Australian Defence Force has recognised this challenge to its use of space, and in addition to various projects and activities implemented in recent years to make their PNT supported systems on ships and aircraft more resilient, the Australian Department of Defence has also progressed Joint Project 9380 "Assured PNT in a Contested Environment". This project will consider upgrades to platform systems, training, concepts of operation and test capabilities to ensure war-fighters have adequate and protected PNT capability in all environments.

The Defence Science Technology organisation is assisting Defence in examining technologies that might be procured under this project, as well quantifying the ADF's PNT requirements. DST carries this out through a combination of laboratory testing, analysis and field-trials Through our research program and collaboration with international partners, including the US, under the Navigation Warfare (NAVWAR) memorandum of understanding (MOU).

After several years of relatively slow progress, JP9380 appears to be back on the priority list and

Defence is actively engaging with industry and academia about potential solutions.

**Commercial**

Australia has a number of initiatives underway or planned, which while not yet representing a comprehensive plan to assure freedom of access to space for our national interests and to support our armed forces, does represent some nascent steps towards this goal.

The Space Based Augmentation System (SBAS) trial of 2017 to the present should ultimately lead to more accurate and better assured PNT over the Australian region for both commercial and Defence users. Of note, Australia has implemented SBAS quite late – well after systems were available over Europe, the US/Canada, East Asia/Japan and Africa.

The establishment of an Australia Space Agency in 2018, followed by various funding streams in 2019 to promote rapid development of space capabilities in Australia is also a step forward.

We are also entering a new paradigm where the cost of space access is dropping and commercial entities are most likely to be the most cost-effective way to develop future space-based capabilities. In Australia, given our natural advantages for particular orbits, we can expect the commercialisation of space to result in one or more commercial 'space bases' to be established in Australia and space business to expand dramatically.

The Australian Space Agency says it wants to treble the nation's $3.9b space economy in a few years. In Queensland, Gilmour Space Technologies and BlackSky Aerospace have been progressing with trial launches and initial commercial payloads into lower space. These two companies have opined that rocket launches will be a monthly occurrence within five years in Australia! However, Queensland is competing with South Australia and the Northern Territory for space business.

Only a few months ago the South Australian Government and the Southern L Company announced that a rocket range on Eyre's Peninsula would be established with work starting in 2020. The multi-user rocket launch facility will allow micro- and small-lift rocket manufacturers to launch satellites into polar orbits. The 1190-hectare site sits at the bottom of Eyre Peninsula, about 35 minutes' drive from the regional centre of Port Lincoln. The complex is 500km south of Woomera, the historic rocket launch site that is restricted to military use.

**Way Ahead?**

Australia could take a more proactive role, rather than being a 'land lord'/real estate host and minor supporting partner in Allied space capability developments. Several commentators have suggested that this role could include counter-space capabilities, although there would be legal and policy challenges to ensure that any developments do not contravene international law. Space could be a place where Australia because of its real estate, technology and security advantages would be seen as a very valued Allied partner.

Additionally, in coming years Australia can be expected to establish its own satellite constellations, most likely at a technology level that supplements rather than replaces the higher end military capabilities of the US and other Allied constellations.

An indication of the world wide importance being attributed to space by the major powers is that the US on 20 December 2019 re-designated Space Command as the United States Space Force to stand up a new sixth service branch of the United States Armed Forces responsible for space warfare. If we fast forward to 2040, it would not be unreasonable to expect that there is a fourth arm of the Australian military – the Royal Australian Space Force!

## Graduation of the Intermediate Navigation Course at HMAS Watson – 29th November 2019

The Secretary, Kym Osley AM, CSC FAIN, accompanied by his wife Debbie Osley, had the pleasure of attending the graduation ceremony for the candidates of Intermediate Navigation Course - Session 66 on Friday 29th November 2019 at the School of Navigation Warfare, HMAS Watson.

The graduation represented the culmination of nine weeks of theory and sea assessment, which included long sessions in the Bridge Simulator and several practical sessions aboard the RAN vessel 'Mercator' around Sydney Harbour.

The graduating class had eight Australian officers, and also included a larger than normal international group, including members from Brunei, Bahrain, Philippines and Fiji.

The Dux of the course was LEUT Dean Gilbert, who the Secretary AIN congratulated and presented with the AIN Prize.

**LEUT Dean Gilbert, Dux of No 66 Intermediate Navigation Course**

## Graduation of the Mission Air Specialist Courses at East Sale – 12th December 2019

The Commanding Officer of the RAAF Air Mission Training School at East Sale invited the Secretary, Kym Osley, to attend the graduation parade for No 43 Mission Aircrew Course, No 44 Mission Aircrew Course and No 77 Aviation Warfare Officer Course (Navy) on 12th December 2019. The reviewing Officer for the parade was the Deputy Chief of Air Force, AVM Steve Meredith who trained as a navigator on C-130 aircraft and then F-111 aircraft early in his career.

The Air Mission Training School (AMTS) was renamed in December 2018 to reflect the needs and air power challenges of the future. Originally AMTS was known as the School of Air Navigation (from 1946 to 2008). In 2008 it was named the School of Air Warfare. However, with the advent of the RAAF Air Warfare centre a few years ago, the named was changed again to No 1 Flying Training School. However, the formation of the Air Academy at East Sale precipitated another name change to the current AMTS!

While the name keeps changing, the standard of the graduates is universally consistent and high! The Secretary was pleased to present the AIN Award for highest academic assessment to PLTOFF Mike Chalmers. By coincidence, the Secretary had only 12 months before presented Mike with the beufort Prize on his graduation from ADFA. Mike will undergo hawk training at Williamtown before doing conversion training onto the F-18F at RAAF Amberley.

**Kym Osley, Secretary AIN and PLTOFF Mike Chalmers, Winner of the AIN Award, 44 MAC**

The Secretary also congratulated PLTOFF Alannah Kreidl for gaining the AIN Award for academic excellence on No 43 Mission Aircrew Course. Allanah is posted to fly on P-8 Poisidon aircraft at RAAF Edinburgh.

**Kym Osley, Secretary AIN and PLTOFF Alannah Kreidl, Winner of the AIN Award, 43 MAC**

## Payment of Subscriptions for 2019/20

Just a reminder that subscriptions for 2019/20 were due on 1 Jul 2019. The prime method for paying Subscriptions for the AIN is by direct deposit through BPay:

**Bank**: Commonwealth Bank of Australia
**Account Name**: The Australian Institute of Navigation
**BSB**: 062001
**Bank Account number**: 00918322
Please include a clear identification name of the member when making the bank deposit.

The subscription fees are:

- Patron, Life Members, Honorary Members (eg Chiefs of the Military Services) – no cost
- Senior Members (any Member or Fellow 60 years old or older) - $50.00
- Full Members/Fellows - $75.00
- Recent Graduates from RAN or RAAF 'navigation-related courses' – Free for the first year

*If you require a tax receipt then please send an email that you have made payment (and the amount) to the Secretary below.*

## AIN Webpage

Please send any items of general interest to the Secretary that you may have. The website is at www.ain.org.au.

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