The sixth meeting of the Resilient PNT Forum took place in Glasgow, prior to the Royal Institute of Navigation’s (RIN) International Navigation Conference (INC). Martin Bransby (GLA R&RNAV) chaired the meeting, which drew approximately 50 participants.

Captain Peter Chapman-Andrews, RIN Director, welcomed delegates to the venue and gave a short overview of the conference for those staying on.

The Resilient PNT forum is sponsored by the IAIN, EUGIN1 and IALA2.

An address of welcome was given by Professor Yasou Arai (IAIN President). Martin Bransby read statements from Professor Bertrand Merminod (Chairman of EUGIN) and Michael Card (IALA Deputy Secretary General). The welcoming comments emphasised the need for resilient PNT and that it requires cooperation to succeed, not just cooperation in working together to promote resilience, but also between different navigation and timing systems.

Professor Charles Curry (Chronos Technology Limited) provided the keynote address with a focus on timing. He explained that time can be defined many ways, which lead to multiple concurrent references of time which, in turn, can lead to confusion. Professor Curry explained how time and timing is used almost everywhere, with the required level of timing accuracy ranging depending on how it is used. He stated that most sources of time used commercially rely on GPS.

He explained that any interference, signal jamming or spoofing, can cause significant issues to these users and provided several case studies. Professor Curry explained how the reliance on GPS for time was highlighted in January 2016 when GPS time was affected by an anomalous time offset on some satellites. He explained how the offset was detected and measured in Chronos-supported systems, along with some of the problems it caused. He concluded that time is essential to everyday life and that diversity in its source is required.

Mitch Narins (formally chief systems engineer for navigation, US Federal Aviation Authority (FAA)), gave a presentation on the FAA’s performance-
based navigation (PBN) strategy, which he worked on shortly before leaving office.

The strategy aims to divide airports across the US into six categories, based on the technology available at each airport and on those aircraft looking to operate from it. The strategy focuses on the need for resilience, but aims to provide flexibility where possible in terms of the routes taken by commercial and general aviation. Such an approach would require all aircraft to maintain accurate speed and timing information, and hence the continued need for resilient PNT.

Narins reported that aviation users have resilience currently through the use of Distance Measuring Equipment (DME) and VHF Omnidirectional Range (VOR) in addition to GNSS and that GNSS/WAAS has not been considered as sole means for navigation among the aviation community. He commented that within the United States, DMEs will be retained and potentially added too, while VORs are likely to be reduced. DME to DME navigation is being developed further through a two-stage approach, considering en route and terminal navigation separately; encoding data on DME transmissions is being investigated.

Bob Cockshott (Knowledge Transfer Network) gave an overview of the UK position on quantum science and positioning. He explained that the UK Government launched a programme two years ago to commercialise quantum technology. Science and technology have moved forward and extremely cold atoms can be made to move very slowly, from which gravity and motion can be determined. It was proposed that such developments, if accomplished on a suitable scale to make them usable in practise, could lead to quantum internal systems in the future with drift rate in the region of one meter each month. Cockshott explained that there is a long way to go before the approach would be of a suitable size and power to enable its commercial use. He also commented that there are many sceptics and that only time will tell what can be achieved.

Following the presentations, the floor was opened for discussion, during which there were many questions. A summary is provided here:

- How reliant is the finance community on GPS for timing?
- How are GPS and Galileo aligned to UTC?
- Why do we still need leap seconds?
- What approach should be taken to raise awareness of the need for resilience outside the forum, as it is “preaching to the converted”? 

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• Does the community need an open approach to sharing GPS denial/jamming/spoofing attacks – along the lines of the responsible disclosure approach used in IT?

• Would it help expedite the development of resilient PNT if insurance companies were aware and treated it as a significant risk?

During the discussion of these questions, it was noted that a leap second was due to be added at the end of 2016, which may affect some receivers. In addition, some receivers could be affected by a GPS week roll over event in 2019, where the date and time representation in bytes may be larger than the allocated amount of memory, which may lead to an irrevocable error condition in the receiver.

Captain James Taylor, RIN President, commented that the UK Government is now more aware of the need for resilient PNT but there is more to be done to ensure decisions are made and solutions developed and adopted. He encouraged participants in the forum to make their voices heard and to continue the push for resilience.

Bransby closed the meeting by thanking participants for their involvement and by asking whether they felt the forum had been of benefit and worthwhile. A unanimous show of hands provided the answer and the next meeting of the Resilient PNT Forum will be arranged in due course.

1 European Group of Institutes of Navigation: www.eugin.info
2 International Association of Marine Aids to Navigation and Lighthouse Authorities: www.iala-aim.org