Report on Munich Satellite Navigation Summit 2008

February 2008

Matt Higgins
Principal Survey Advisor, Queensland Department of Natural Resources and Water
and Vice President FIG

Summit Program

The Munich Satellite Summit really is a "Summit", in that it deals with the latest developments but does so with a focus on the policy aspects. As such the Summit is a quite unique format. It also has the advantage of attracting senior decision makers, making it an ideal event for high level networking. The Sessions in the Summit are structured as "Panels" where speakers give short explanations of the status of their topic and then form a panel that is questioned by the Session Chair. This format works well as a way of drawing out issues that need to be explained and which may need some attention in terms of policy and planning.

In the Summit program, there were many excellent presentations on latest status and policy developments relating to all the major providers of GNSS, including the EU, USA, Russia, India, Japan and China. There were also presentations on applications, products, services and issues ranging from the expected performance of next generation systems through education, research and certification to the current world-wide boom in personal navigation devices. The Summit program was as follows (see www.munich-satellite-navigation-summit.org):

- Tuesday 19 February:
  - Opening Plenary
- Wednesday 20 February:
  - Session 1: GNSS Program Updates
  - Session 2: Munich Flashlights - News from Bavaria
  - Session 3: Galileo Guarantees of Service and Certification
  - Session 4: Boom in Personal Navigation and GNSS Handheld Devices - Without Galileo?
  - Session 5: Education, Research & Innovation in Satellite Naigation in Europe
  - Session 6: New GNSS Product and Service Announcements
- Thursday 21 February:
  - Session 7: GNSS Activities of the Asian Pacific Rim
  - Session 8: GPS Activities in North America - View on Galileo from over the Atlantic
  - Session 9: Directions for the Galileo Evolution
  - Session 10: Galileo On Track Again - Presentation and Discussion
  - Session 11: What Characteristics, Quality of Data & Service Can We Expect from Next Generation of GNSS Satellites?

It is not intended to go into detail on each session in this report but a few highlights are worth mentioning. Note that all presentations from the Summit are now available on the web site but usernames and passwords have been issued to attendees to limit access to the full presentations.

The Opening Plenary Session - Galileo Back on Track

The dominant issue at last year's Summit was the problem with the Public Private Partnership for Galileo, which is Europe's Global Navigation Satellite Systems (GNSS). This year the mood was much more optimistic with the clear message being that Galileo is back on track. The delivery of that message began in the opening Plenary Session of the Summit.

Paul Verhoef, the Head of the Galileo Unit in the European Commission (EC) gave a very "straight talking' speech acknowledging that Galileo had been through a difficult phase with the failure of the PPP approach but also pointing out that it was now getting back on track. A significant aspect of the renewed approach to developing Galileo is that the European Space Agency (ESA) will build the system from In-Orbit Validation (IOV) through Deployment Phase (commencing in 2009) until Full Operational Capability (FOC) is reached in 2013. It might be that at that time a private partner is found to operate the system.

Another issue is that there is considerable speculation over the need for the GNSS Supervisory Authority in its present form, given that a significant part of its purpose was management of the now abandoned PPP.

Paul made a point of saying that the 3.4 billion Euros being allocated is all that will be available for the period from 2009 to 2013. It will need to cover the procurement of Galileo system components, the space based augmentation systems EGNOS, the fees for ESA and the operational costs for the EC. It is expected that the European Parliament will pass the Galileo regulation in April that will give the legal framework allowing Galileo to proceed. The procurement of Galileo will be in six work packages: satellites, launches, ground mission, ground control, operations and systems support. It has also been decided that any given company can only take part in two of the six work packages.

Paul also commented that the EC felt that international relations in GNSS needed to focus on compatibility and interoperability and that the UN International Committee on GNSS (UN ICG) was a good forum for that.

Etelka Barsi-Pataky (Member of the European Parliament's Committee on Transport and Tourism and Rapporteur for Galileo) also spoke in the Opening Plenary and supported Paul's comments on the need to ensure that the funding is properly managed now that it has been secured. She commented on the fact that Galileo is a major community infrastructure and needs common will across the EU. Another issue outlined was that once the potential private partners formed one consortium the Parliament was not able to agree to a PPP that was effectively a monopoly. She also commented that such a high technology project as Galileo brought significant risk and so it was no surprise that all other major GNSS are publicly funded.

Session 1 GNSS Program Updates

This session gave an always welcome update on the latest status of each of the GNSS sub-systems, with the following speakers. It was good to see the UN ICG also on the programme for this session.

- EGNOS and Galileo Status
  Sylvain Loddo, System, Ground Segment and Operations Manager ESA Navigation Programmes, European Space Agency (ESA), Paris, France
- GPS Status and Modernization
  Lt Col Harold Martin, US Air Force Space Command, USA
- GLONASS: Status and Progress
  Sergey G. Revnivykh, Deputy Head of Mission Control Center, Moscow, Russia
- Overview of Compass/Beidou Navigation Satellite System
  Dr. Jing Guifei, Head of Navigation Division of National Remote Sensing Center of China, Ministry of Science and Technology, Beijing, China
- Quasi-Zenith Satellite System (QZSS) Update
  Satoshi Kogure, Associate Senior Engineer, Japan Aerospace Exploration Agency, Tsukuba, Japan
- International Committee on Global Navigation Satellite Systems (ICG): A System of Systems
  Sharafat Gadimova, Office for Outer Space Affairs, United Nations Office at Vienna, Austria

For GPS, three launches are planned in March, June and September 2008 and they will be the sixth, seventh and eighth Block IIR (modernised) satellites. The launch in June will carry a payload to demonstrate the L5 signal.

For GLONASS, a recommendation has been made to move from frequency division to code division multiple access (CDMA) based signals, probably in the GLONASS-K series of satellites. Sergey said that approval for that recommendation was expected in the weeks following the Munich Summit and hoped that it can be officially announced at the GNSS Conference in Moscow in April.

Jing Guifei gave one of the most comprehensive presentations on Compass I have seen in a public forum. It included the administrative aspects of the civilian side of COMPASS and also showed the planned signals. Jing also showed the frequencies for COMPASS as B1, B1-2, B2 and B3 (the "B" designator comes from Beidou, the Chinese word for compass). He showed the location of those bands relative to other GNSS and

by way of comparison, those frequencies are close to Galileo's E2, E1, E5b and E6 respectively. COMPASS already has several satellites in geostationary orbit (GEOs). The first medium earth orbit (MEO) COMPASS satellite was launched in April 07. The MEO orbit is similar in configuration to GPS, GLONASS and Galileo. Jing also mentioned that the MEO satellite represented the start of the IOV phase and also helped to secure China's frequency filings in the ITU. The system is eventually planned to have 5 GEOs and 30 MEOs with two services, the "Open Service" and the "Authorized Service". Jing concluded his presentation by outlining areas for international cooperation with China on COMPASS:

- Compatibility and Interoperability (with other GNSS);
- Satellite POD, global monitor stations, International COMPASS Service (like IGS);
- Satellite Laser Ranging;
- Applications;
- International Standards.

The presentation on QZSS by Satoshi Kogure, showed the Canberra monitor station established in cooperation with Geoscience Australia. He also showed Australia as always having one satellite above 10 degrees elevation and a significant amount of time with one satellite above 60 degrees. The first QZSS satellite is planned to be launched before March 2010 (before the end of Japanese financial year 2009).

Session 4 Boom in Personal Navigation and GNSS Handheld Devices

- Boom in Personal Navigation and GNSS Handheld Devices – Without Galileo?
  Herbert Blaser, Vice President Marketing, u-blox AG, Thalwill, Switzerland
- Boom in Personal Navigation - The Global Locate experience
  Frank van Diggelen, Technical Director, GPS Systems, Broadcom Corporation, San Francisco, USA
- Gizmos, Answers and Markets
  F. Michael Swiek, Executive Director, U.S. GPS Industry Council, Washington, DC, USA
- Location and Beyond
  Li Lei Tsien, European Director of Marketing, SiRF Technologies, Inc., Brussels, Belgium

This session included three major players supplying GNSS chips into mass market devices. One interesting outcome from the discussion session was that it seems most mass market chips will be single frequency chips to keep costs down for the highly price sensitive mobile phone market. It might be that there will be low cost single frequency chips (for L1, L5 and perhaps L2) but they will still need to be combined in receivers built for specialised market segments such as high precision positioning.

Session 6: New GNSS Product and Service Announcements

- Septentrio - New GNSS Products and Service Announcements
  Peter A. Grognard, Founder and Managing Director, Septentrio nv, Leuven, Belgium
- NavCom Technology, Inc. - New Product Offerings
  Ronald Hatch, Director of Navigation Systems Engineering, Principal and Co-founder of NavCom Technology, Inc., Torrance, USA
- NavX®-NCS - Navigation Constellation Simulator
  Dr. Guenter Heinrichs, Director of Customer Applications and Support, IFEN GmbH, Poing, Germany
- Dynamics in the Satellite Information Business
  Rainer Horn, Managing Partner, Spacetec Capital Partners AG, Munich Germany
- Trimble GNSS Receiver Products and Services
  Dr. Herbert Landau, Managing Director, Trimble Terrasat GmbH, Hoehenkirchen, Germany
- Xsens Technologies
  Henk Luinge, Research Manager, Xsens Technologies b. V. Enschede, The Netherlands
- NovAtel - New Product Announcements
  Neil Gerein, Senior GNSS Systems Engineer, NovAtel Inc., Calgary, Canada
- GNSS Value Added Services - ascos provided by AXIO-NET GmbH
  Dr. Stefan Sassen, Director Navigation Services, EADS Astrium Services, Ottobrunn, Germany

As well as some good overviews of new products and services, there was a presentation from Rainer Horn from the perspective of investment and venture capital, which is not typical of presentations at GNSS conferences. Rainer gave a good summary of recent rationalisations going on in the GNSS Industry, noting that "non-space giants have discovered this integrated applications space". He mentioned the increasing interest in this applications space from companies like Google and Microsoft. He also highlighted the recent mergers and acquisitions such as *hardware* companies like Nokia and Tom Tom taking an interest in *content* companies like Teleatlas and Navteq.

The final presentation represented a significant development for the precise positioning community because it spelt the entry into real time centimetre accuracy services by a major European aerospace company, EADS. EADS is Europe's equivalent to Boeing. EADS Astrium, the space services part of EADS, has taken over from Eon Ruhrgas as a major partner in Germany's commercial precise positioning service known as Ascos. The involvement of EADS Astrium in the new Ascos service delivery company called Axio-Net, includes global aspirations and is a significant new development in the precise positioning market.

Session 7: GNSS activities of the Asian Pacific Rim

This session grew out of discussions between the Summit organiser, Prof. Günter Hein, and the organisers of the IGNSS conference in Australia. Günter has agreed that at future IGNSS conferences he will coordinate a session on GNSS in Europe and in return the IGNSS Society will coordinate a session involving Australia at future Munich Summits.

For this year's Summit we decided to extend the session beyond Australia and included speakers from across the Asia Pacific:

- Korea satellite navigation system development plan
  Dr. Gi Wook Nam, Director of GNSS Research Division, Korean Aerospace Research Institute, Daejon, South Korea
- China - EU Cooperation on Galileo
  Yin Jun, Director European Office, Ministry of Science and Technology, Beijing, China
- The Applications of GNSS in Malaysia: Current State and the Way Forward
  Dr. Mustafa Din Subari, Deputy Director General, National Space Agency of Malaysia
- A "System of Systems" Agenda: R&D Outcomes that Benefit Australian Users
  Dr. Chris Rizos, Professor & Head School of Surveying & Spatial Information Systems, The University of New South Wales, Sydney, Australia
- GNSS Infrastructure in Australia: From Local to Regional to Global
  Matt Higgins, Principal Survey Advisor, Land Information and Titles Department of Natural Resources and Water, Queensland, Australia, FIG Vice-President

The session was Chaired by Eero Ailio, Head of International Relations in the Galileo Unit of the European Commission in Brussels, which was very appropriate given both the location and the focus of the session.

In my presentation entitled "GNSS Infrastructure in Australia: From Local to Regional to Global", I presented a framework setting out the various components of a GNSS Infrastructure and what specific activities might be involved in those components when considered from the Local, Regional and Global perspectives. This approach, which is shown in the table below, seemed to be well received and will be further explored in a research publication now under development.

	Local	National/Regional	Global
Underlying Systems	• Local Augmentations (GNSS and Non-GNSS)	• Regional Augmentations	• Space Segment • Control Segment • Ground Segment
Capacity Building	• Schools • Universities • Professional Associations • In-House Training • Local Seminars and Workshops	• National and Regional Conferences	• International Conferences • Assistance to Developing Countries
Research and Development	• Universities • Government Research Institutes • SME R&D	• National Groupings of Researchers	• International Cooperation in R&D Projects
Industry Development	• Local Industry Clusters • Industry Development Agencies	• National Industry Bodies	• International Exhibitions (eg at Conferences) • International Business Networks
Institutional Arrangements	• Local Working Groups and User Groups	• National Policies • Space Agencies • Mechanisms to Coordinate Local Activities	• United Nations International Committee on GNSS • Bi-Lateral Agreements
Standards	• Local By-Laws • Project Specifications	• Legislation • National Standards and Guidelines	• International Standards • GNSS System Standards (eg for Geodesy or Timing) • Application Specifics (eg ICAO) • Data Formats (eg RTCM)
User Access	• Local Delivery Mechanisms	• National Communications Networks	• Civil Signals • Downlinks such as planned for Galileo

Table 1 - A Proposed Framework for GNSS Infrastructure

UN Mandated International Committee on GNSS (ICG)

I also met out of session with Ruth Neilan (Director of the International GNSS Service (IGS) - based at NASA in California) and Chris Rizos (Vice President of the International Association of Geodesy – based at University of New South Wales). The meeting was to discuss Working Group D of the UN mandated International Committee on GNSS (ICG). Working Group D on "*Interaction with national and regional authorities and relevant international organizations*" is Co-Chaired by John Dow and Ruth (for IGS/IAG) and by me (for FIG). The Working Group is charged with tasks such as standards for GNSS reference stations, investigating mitigation of radio interference and multi-path at such stations and fostering the rejuvenation of geodetic reference frames in developing countries (like the AFREF project in Africa). It is likely that Ruth and I will meet again at the FIG Working Week in Stockholm in June 2008. We will then take a progress report and any follow up recommended actions to the next meeting of the full ICG, which is to be hosted by Ruth at NASA's Jet Propulsion Lab in Pasadena, California in December 2008.