

## Pre-Symposium Workshops

### Tuesday 18 July 2006

(not included in IGNSS 2006 symposium registration fee, prices below are per person, per workshop)

To complement this symposium, the following series of specialist workshops are available.

Workshop delegates can register via the IGNSS 2006 registration form.

#### Registration fees are as follows:

2-hour workshops – Symposium registered delegates	\$195 per workshop
3-hour workshop – Symposium registered delegates	\$295 per workshop
2-hour workshops – Symposium non-registered delegates	\$295 per workshop
3-hour workshop – Symposium non-registered delegates	\$395 per workshop

## Pre-Symposium Workshops Preliminary Program

0900 - 1200	<b>Workshop 1:</b> Design and Development of the European Satellite Navigation System Galileo <b>Dr Guenter Hein</b> Director, Institute of Geodesy & Navigation, University FAF Munich, Germany	
1200 – 1230	Lunch	
1230 – 1430	<b>Workshop 2:</b> Modelling and Real Time Simulation of GNSS Environmental Vulnerability Issues <b>Graeme Hooper</b> Managing Director & <b>Joe Fleming</b> Software Manager, GPSat Systems Australia, Vic, Australia	OR <b>Workshop 3:</b> Alternatives to GNSS for Outdoor & Indoor Positioning <b>Dr Joel Barnes &amp; Professor Chris Rizos</b> , School of Surveying & Spatial Information Systems, The University of New South Wales, NSW, Australia
1430 – 1445	Afternoon Tea	
1445 - 1645	<b>Workshop 4:</b> GBAS/ GRAS for Global Use in Aviation <b>Keith McPherson</b> Manager GNSS, Airservices Australia, ACT, Australia	OR <b>Workshop 5:</b> Integration of GPS & INS - Principle, Implementation & Applications <b>Dr Jinling Wang &amp; Dr Yong Li</b> School of Surveying & Spatial Information Systems, The University of New South Wales, NSW, Australia

### Workshop 1: 0900 - 1200

#### Title:

Design and Development of the European Satellite Navigation System Galileo

#### Instructor:

Dr Guenter Hein Director, Institute of Geodesy and Navigation, University of FAF Munich, Germany

#### Instructor's Biography:

Dr Guenter W. Hein is Director of the Institute of Geodesy and Navigation at the University FAF Munich. He is member of the EC Galileo Signal Task Force and received the prestigious Johannes Kepler Award of the US Institute of Navigation in 2002 – the highest award worldwide in satellite navigation.

#### Workshop Synopsis:

0900 - 1000	1000 - 1100	1100 - 1200
<b>Overall Architecture, Services and Expected Performance</b> <ul style="list-style-type: none"> <li>Galileo Architecture Drivers</li> <li>Galileo Space Segment and Satellite Payload</li> <li>Giove-A, B and In-Orbit Validation (IOV)</li> <li>Galileo Services and Expected Performance</li> </ul>	<b>Galileo Signal-In-Space Definition and Interoperability</b> <ul style="list-style-type: none"> <li>Frequency and Signal Drivers</li> <li>Frequency and Signal Plan, Codes and Message Structure</li> <li>Compatibility Issues</li> <li>Interoperability Galileo-GPS (SIS, Time &amp; Coordinate Reference Frame)</li> </ul>	<b>Galileo Integrity</b> <ul style="list-style-type: none"> <li>Integrity Definition and User Requirements</li> <li>Integrity Chain in Galileo Architecture</li> <li>Integrity Concept and Integrity Algorithm</li> <li>Decision at User Level</li> </ul>

## Workshop 2: 1230 - 1430

### **Title:**

Modelling and Real Time Simulation of GNSS Environmental Vulnerability Issues

### **Instructors:**

Mr Graeme Hooper Managing Director & Joe Fleming Software Manager, GPSat Systems Australia, Vic, Australia

### **Instructors' Biographies:**

Graeme Hooper graduated from Monash University in Electrical Engineering 1980, Graeme has been employed as Systems Engineer on many defence projects with several companies through the 1980's. In 1987, after joining Rockwell International (Aust), he spent several years contributing to military GPS integrations and receiver development in both the USA and Australia. In 1993 Graeme formed GPSat Systems P/L, an engineering company solely focused on industrial satellite navigation products and services and continues to work in this profession today.

Joe Fleming graduated from University of Calgary 2000 in Geomatics Engineering. In 2001, Joe joined NovAtel as a Geomatics Test Engineer responsible for developing various programs for analysing GPS receiver performance. In 2001 Joe joined the team at GPSat Systems assuming the role of Geomatics Engineer while also assuming responsibility for all R&D software development. Today, Joe continues to apply his geomatic skills supporting many clients both locally and internationally while also continuing to technically manage the ever growing software development team.

### **Workshop Synopsis:**

All GNSS Receivers are vulnerable in varying degrees to external environmental conditions outside their control. How GNSS Receivers cope with the big four, "CAMI" (constellation, atmospheric, multipath and interference) ultimately defines both quality and performance for intended applications.

This workshop briefly introduces the CAMI topics with discussion on, the effects themselves, the different strategies employed by equipment manufacturers to cope, and then in real time, simulations / demonstrations of that effect using a GNSS Signal simulator exercising several different leading receiver varieties.

This workshop is targeted to those GNSS integrators wishing to both gain some insight into GNSS receiver vulnerability issues, how these CAMI effects manifest themselves on different receivers, and the use of real time GNSS signal simulation in a laboratory environment. It's anticipated that products from Spirent, NovAtel, NordNav, SIRF and others will be demonstrated during the workshop.

## Workshop 3: 1230 - 1430

### **Title:**

Alternatives to GNSS for Outdoor & Indoor Positioning

### **Instructors:**

Dr Joel Barnes & Professor Chris Rizos School Of Surveying & Spatial Information Systems, The University of New South Wales, NSW, Australia

### **Instructor's Biographies:**

Chris Rizos is a Professor and Head of the School of Surveying & Spatial Information Systems, at the University of New South Wales (UNSW). He obtained a Bachelor of Surveying and a Doctor of Philosophy both from the UNSW. Chris has been researching the technology and high precision applications of GPS since 1985. Prof Rizos is a Fellow of the Australian Institute of Navigation, a member of the Executive of the Satellite Division of the U.S. ION, a Fellow of the IAG, a member of the Governing Board of the IGS, and is currently President of the IAG's Commission 4 "Positioning and Applications".

Dr Joel Barnes is one of the senior researchers within the Satellite Navigation and Positioning (SNAP) group, at the School of Surveying & SIS, the University of New South Wales (UNSW) in Sydney, Australia. He obtained a Doctor of Philosophy in satellite geodesy from the University of Newcastle upon Tyne, UK. Joel has assisted in the development of the Locata receiver and testing of the Locata technology. Other current research interests include pseudolites, GPS receiver firmware customisation and high precision kinematic GPS positioning.

### **Workshop Synopsis:**

For positioning and navigation applications GNSS is the first choice technology today. However for many everyday environments such as urban and indoors GNSS cannot provide the positioning requirements because satellite signals are easily obstructed.

This workshop will outline and discuss the latest developments in terrestrial-based positioning technology solutions for challenging GNSS applications, including: WiFi, RFID, UWB, Locata and others.

## Workshop 4: 1445 - 1645

### **Title:**

GBAS/ GRAS for Global Use in Aviation

### **Instructor:**

Mr Keith McPherson, Manager GNSS, Airservices Australia, ACT, Australia

### **Instructor's Biography:**

Keith McPherson is the Manager GNSS for Airservices Australia. He spent 21 years in the RAAF as a navigator and flight test navigator responsible for GPS testing. He was assigned to the USAF GPS Joint Program Office at Los Angeles AFB 1990-92, finishing as Chief of GPS Integration & Test. He won the US Air Force Association's (Los Angeles) Program Manager of the Year 1992 and the US Air Force Meritorious Service Medal for his work on GPS integrations. He was the 2004 recipient of the Royal Aeronautical Society's Sir Charles Kingsford Smith Memorial Medallion. He was selected by the Deputy Prime Minister of Australia to be an inaugural member of the government's Australian GNSS Coordination Committee and is presently the President of the International GNSS Society.

### **Workshop Synopsis:**

This workshop will cover the theory behind applications of GBAS and GRAS. It will also cover the international standards of both systems. The workshop will cover the GBAS Category I application at Sydney International Airport and lessons learned. How GRAS integrates into a total navigation solution and also ADS-B will be covered.

## Workshop 5: 1445 - 1645

### **Title:**

Integration of GPS and INS – principle, implementation, and applications

### **Instructors':**

Dr Jinling Wang & Dr Yong Li, School of Surveying & Spatial Information Systems, The University of New South Wales, NSW, Australia

### **Instructors' Biographies:**

Jinling Wang is a senior lecturer in the School of Surveying & Spatial Information System at the University of New South Wales. He is a member of the editorial board for the international journal GPS SOLUTIONS, and Chairman of the international study group on pseudolite applications in positioning and navigation within the International Association of Geodesy's Commission 4. He was 2004 President of the International Association of Chinese Professionals in Global Positioning Systems (CPGPS). He holds a PhD in GPS/Geodesy from Curtin University of Technology, Australia.

Yong Li is a Research Fellow at the School of Surveying & Spatial Information Systems, the University of New South Wales (UNSW). Yong obtained a Doctor of Philosophy in flight dynamics in 1997. From 2000 to 2002 he was a STA Fellow at the Japanese Aerospace Exploration Agency (JAXA, formerly the National Aerospace Laboratory). Yong worked at the Beijing Institute of Control Engineering for GPS space applications from 1997 to 2000. His current research interests include integration of GPS and INS, GPS receiver architectures, GPS-based attitude determination, and optimal estimation/filtering theory and applications.

### **Workshop Synopsis:**

The integration of GPS and INS has been widely used for a variety of positioning, navigation, and geo-referencing applications, benefiting from the complementary characteristics of the two systems. Depending on type of applications and other factors, GPS/INS integration can be developed in three modes, i.e., loose, tight, and ultra-tight integrations. The integration Kalman filter is at the heart of integrated GPS/INS systems. The widely used integration Kalman filter is based on the INS error dynamic model, including both navigation states and sensor error states. Precise GPS measurements are used to estimate the INS errors and thus the calibrated INS can provide precise position, velocity and attitude information for the user platform.

This workshop will 1) introduce the principles of GPS and INS, including various coordinate frames used in GPS and INS; GPS/INS measurements and error sources; position/navigation solution computations; 2) discuss fundamentals of Kalman filter; GPS/INS integration strategies, system performance measures; and 3) demonstrate the operations of integrated GPS/INS systems through the real data analysis with both commercial system and in-house software packages developed at the University of New South Wales.

