

- Session 4 - Session 4 - Session 4 - Session 4 - Session 4 - Session 4 - Session 4 -

## SAFETY OF LIFE: REALIZING THE VISION?



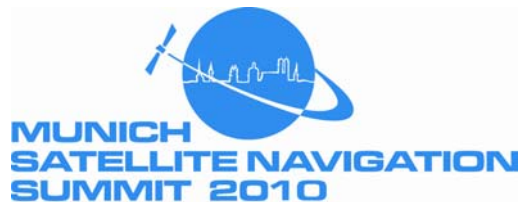
With the success of satellite navigation came also the dream of aviation based on GNSS. This panel discussed the role of GNSS and its augmentations in safety critical applications. Can we still believe that GNSS will someday guide airplanes safely through all the phases of flight?

**Michael E. Shaw**, Director of Navigation Systems Global Business Development of Lockheed Martin

Space Systems opened the session and introduced the first panelist Dr. Blomenhofer.

**Dr. Helmut Blomenhofer**, Head of Space Business Development & Studies, Thales Germany - Air Systems, introduced the three different integrity concepts to the audience. The first one is dedicated to the user level and is well-known as Receiver Autonomous Integrity Monitoring (RAIM). This user level concept can be applied globally. System level integrity concepts can currently be applied only regionally – in case of a Satellite Based Augmentation System (SBAS) as e.g. EGNOS – or locally – in case of a Ground Based Augmentation System (GBAS). Blomenhofer explained in detail the combination of signals in order to realize the different integrity concepts. He mentioned that the Automatic Dependent Surveillance Broadcast (ADS-B) is based on the RAIM concept which is able to provide integrity for horizontal en-route operations and non-precision approaches. Besides, GBAS progresses are ongoing to meet CAT-I landing requirements in the near future. He pointed out the advantages of GBAS compared to Instrument Landing Systems (ILS), in particular with respect to environmental, capacity and accuracy aspects. In terms of SBAS Blomenhofer reminded that EGNOS is operable since October 2009 and will be certified for safety critical operation later this year. It can be used for vertical navigation and approaches. Giving an outlook to the future, he mentioned that the new Galileo integrity risk concept will provide system level integrity even in the global scale. Nevertheless, he is convinced that in 20 years ILS will still be part of the backbone for landing operations on large airports.

Following contribution of **Francisco Salabert**, NAV infrastructure and GNSS activities manager at Eurocontrol in Brussels depicted the vision of the role of positioning and timing service in safety of life applications. Eurocontrol believes the way is the gradual reliance on GNSS in all phases of flight using multi-constellation receivers. But why should be multi-constellation solution so important? According to Mr. Salabert, better performance, higher robustness against vulnerabilities and interoperability especially in augmentation systems are the key features of multi-constellation receiver important in the field of global aviation. He spoke about



specialties of aviation market where the lifetime of a receiver is very long in contrast to e.g. telecommunication, around 10 years. Also time to market is much longer due to long validation and verification phase. Implementation of transition to GNSS is the next issue. Mr. Salabert spoke about the projects of the Eurocontrol in the field of aviation, among others the development of a multi-constellation receiver for purposes of aviation.

**Bill Stone**, Avionics Product Manager at Garmin, affirmed that GNSS equipment and especially certified GNSS - possibly combined with augmentation system capabilities - have increased the safety in aviation during the last decades. Apart from these improvements in the field of developing these devices he gave an outlook on other assistance systems that may help a pilot in order to further increase safety. In particular, he reflected upon detailed moving maps on the flight deck providing unprecedented situational awareness, terrain awareness combined with warning systems, and synthetic vision on a primary flight display.

**Dr. A.J. Van Dierendonck**, AJ Systems, Los Altos, CA, USA Chair of the Executive Committee of the Satellite Division of the U.S. Institute of Navigation presented the view of GNSS in aviation based on results from a paper published by Stanford University at ION-NTM-2010. The results showed that adding a 2nd frequency improves SBAS Coverage tremendously and adding a 2nd constellation (i.e., Galileo) also improves SBAS Coverage due to improved geometry. The improvement goes from 9% cover in case of single frequency up to 92.65% in case of dual frequency-dual constellation SBAS with expanded network.

**Rocky Stone**, Chief Technical Pilot of United Airlines, explained that the application of GNSS in aviation allows increasing the number of aircraft in space. The flexibility combined with accuracy that GNSS offers will reduce fuel burn and greenhouse gas emission caused by airplanes. He investigated by tests that it is possible to save up to 1600 lbs of fuel and two metric tons of CO<sub>2</sub> in one single approach. This can be achieved by optimum profile descents with very accurate descent rates of the aircraft. He presented visually the trajectories of flight approaches confirming that GNSS approaches were much more accurate. GNSS will also contribute to a higher precision in flight operations due to GNSS timing and to higher weather independence.

The session continued with a contribution of **John Wilde**, Director and CEO at DW International in Winchfield, Hampshire, United Kingdom. He mentioned the humorous fact that navigators ask themselves "Quo Vadis?", "Where are you going". He mentioned that it had taken over 15 years to capitalize on the ICAO standards in the case of GNSS. He continued by stressing the importance of cooperation and back-work to implement innovative ideas swiftly and to profit on the GNSS progress in aviation.