IBAC Technical Report Summary

Subject: Global Navigation Satellite System

Meeting: Navigation Satellite Panel (NSP) Meeting, 24 May – 4 June 2004
IBAC File: Navigation

Reported by: Capt. H. Lichius

Summary: The NSP Working Group of the Whole (WGW) met in St. Petersburg, Russian Federation, from May 25th to June 4th, 2004. Separate meetings of Working Group I (WG1) and its subgroups, and Working Group II (WG2) also took place during the fortnight. The meeting was hosted jointly by the Russian Federal Space Agency and the Civil Aviation Agency.

A detailed report on the proceedings and outcome of the meeting is attached hereto.

Implication for Business Aviation:
IBAC's concern has been noted and will be taken in their consideration.

Decisions Required:
At this stage: none; but IBAC should be prepared to maintain their influence in future NSP WG and Panel Meetings.

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Mr. V.I. Kozlof, Chief of Department, Russian Federal Space Agency welcomed the participants to St.Petersburg. He noted that in-orbit tests of the first GLONASS – M satellites, which broadcasts a new civil signal, began in December of last year. Three more GLONASS-M satellites will be put in orbit this year and the plan is to complete the constellation in 2007. Also research on the new satellite GLONASS-K has began.
Mr. V.A. Korchagin, Chief of CNS, Civil Aviation Agency, Ministry of Transport and Panel Member nominated by Russia also welcomed the participants to St. Petersburg.

Mr Ross Bowie (CAN) acting as chairman of the WGW in the absence of Jim Lawson who could not attend this meeting thanked Mr Kozlov and Mr Korchagin for organizhing the meeting in St. Petersburg.

The Panel Secretary reviewed the work program agreed to at the GNSSP/4 and presented revised work programs for WG1 and WG2 that would take into account actions taken by the ANC since GNSSP/4 and included additional work items resulting from the 11th AN Conference.

Mr. Ian Mallett (AUS) presented a short resumé of the Australian Air Traffic Mnagement Strategic Plan. A new strategic plan for Australia was needed as a result of the corporatization of air traffic services. This plan was developed in cooperation with all relevant sectors of industry.

Mr. Ross Bowie described GNSS implementation in Canada. It was noted that GNSS was approved in Canada for en route, terminal and non-precision approach operations since 1993. Approximately 320 RNAV(GPS) approaches have been designed. NAV CANADA will continue to assess the use of complementary airborne technologies.

Gustavo Oliveira reported on developments in Brazil. Brazil had two GNSS training seminars to educate service providers and users on GNSS concepts. Several WAAS test bed stations were installed in Brazil and are now collecting data. Brazil has an ionosphere with strong features, which present difficulties to the development of an SBAS capable supporting APV operations.

Mr. Ken Ashton (CAA-UK) provided information on the status of EGBOS. Currently 30 out of planned 34 reference stations have been deployed. All 4 master stations have also been deployed, and they are now undergoing testing. EGNOS has been broadcasting a signal based on a reduced network since 2003. A contract review is planned for the 3rd quarter of 2004 and a performance review for the 4th quarter of 2004. It is expected that EGNOS will achieve qualification in 2005; it will the cease broadcasting Message Type 0.

Mr Joe Fee (FAA/US) presented a short report on WAAS. WAAS has performed well since its commissioning in July 2003, and its integrity was maintained during a recent severe ionospheric storm (October 29-31, 2003). The LAAS program, on the other hand, has seen its funding recently zeroed out, and FAA is now in the process of reorganizing the program. The main issues in this case are financial.

Mr Vladimir Korchagin (RUS) presented a short report on GLONASS. GPS receivers are in use in Russia. In the next few years GPS receivers will be in use on aircraft. There is a plan to install 85 GBAS stations in the largest airports in Russia. At first, GPS receivers will be used, but there is also a plan to replace them with new Russian receivers that process GLONASS-M satellite signals as well as GPS signals.

Mr Jun Imamura (JAP) presented a short report on MSAS. He noted that significant events have slowed the progress of MSAS since GNSSP/4. One is the bankruptcy of MT-SAT manufacturer, which led to extensive re-negotiations with this manufacturer. Another was a second launch failure due to the rocket that

was planned to launch MT-SAT**.** It is now expected that MT-SAT will be launched at the end of this year or at the beginning of next year.

Mr Keith McPherson (AUS) presented a report on GRAS. He noted that steps are being taken within RTCA for the development of GRAS MOPS and that the GRAS program is pushing forward.

IATA's policies, which were recently adopted, were presented by Ms Andrea Kneeland. IATA supports the transition away from ground-based navigation solutions, but is concerned about strategies leading to multiple equipage requirements. The ANC met recently with industry to discuss the way forward in light of industry recommendations, and had agreed to develop a plan based on the IATA road map and submit this plan to ICAO by the end of this year.

The meeting noted that user charges are not within this scope of its work plan. It was also noted that EUROCAE had looked at cost effectiveness of equipping all aircraft in such a manner as to allow the decommissioning of VORs and has concluded that a business case could not be made. It was further pointed out that a number of smaller operators have to be taken into consideration also when developing a navaid decommissioning strategy.

Mr Michel Calvet (FRANCE) described the French experience with the implementation of GNSS approach procedures. However, teh views in the paper were coordinated with other European providers, namely Switzerland, Germany, Italy, Spain and Portugal. Criteria discussed in the paper are sdafety, airport accessibility and aircraft equipage.

Following the presentations, it was noted that the views expressed at this stage were the positions of the above mentioned service providers, although consultations with users were engaged and discussions with Eurocontrol were ongoing.

Mr Pringvanich (Thailand) reported on AEROTHAI's CNS implementation approach in Thailand. A steering committee was established in 2004 to oversee the development of a master plan in compliance with ICAO's Global Strategy. This State is participating in the APEC Regional Navigation Feasibility Study, which will provide estimates of GNSS service availability in tghe country and in the Asia Pacific Region.

A working paper, presented by Mr. Ken Ashton (UK) discussed the protection dates for DME, ILS, MLS and VOR and possible changes to them. Two options were offered for consideration by the meeting: (1) set a date for ground nav aids [e.g. 2015] or (2) define a notice period, [e.g. the 6 year notice for GNSS].
The Panel Secretary observed that the notion of protection date is often misinterpreted. The notion of protection date in Annex 10 means that the SARPs cannot be changed in a way that would require modifications to existing equipment before this date, and is sometimes misinterpreted as the date after which the service could be terminated. It was noted that the latter aspect is being addressed by ICAO provision to change the standard without consideration of protection date when the change was to address a safety-related issue.

Special attention should be given to the paper presented by Tim Murphy (ICCAIA) on „Feedback of Users regarding future GNSS approach capabilities“. This information paper presents inputs from several aviation stakeholders on the future of GNSS development. These inputs include responses to an inquiry from CANSO (chairman: Rick Eppich, NAV Canada) asking for the views of CANSO members and other organizations and an official statement from AEA, IATA, ERA and IOPA. These inputs show that there is a wide disparity of views with respect to the appropriate evolution of satellite navigation for aviation use. The vision of the service users appears to be very different than the vision of the service providers. Some highlights: e.g. EGNOS is a first generation European augmentation system to the American Global Position System (GPS) as well as the Russian GLONASS. EGNOS as a concept was first mentioned in a communication of the CEC of 14th June 1994. The development of EGNOS is based on a tripartite agreement between teh European Commission, European Space Agency (ESA) and Eurocontrol. The development of EGNOS has cost approximately 310 million Euro and its yearly operation costs are estimated to be approximately 33 million Euro. Thereafter, the European Union (EU) and the European

Space Agency (ESA) decided to develop and fund GALILEO, which is designed to be independent from, and compatible with GPS and scheduled to be operational by 2008.
The European Commission identified that the primary benefit of EGNOS is to speed-up the entry into service of GALILEO and as a consequence has now issued a Communication addressing the issue of integration of EGNOS into GALILEO. In the absence of demonstrated revenue streams for EGNOS, and in particularly from aviation, the European Commission is proposing to provide public funding (up to 33 million Euro per year) for the operations of EGNOS from 2004 until at least such moment in time when EGNOS will have been integrated into GALILEO (2008).
ISSUE: The airspace users have not been instrumental in requiring the EGNOS system, which has been predominantly developed for political reasons. Airspace users have long opposed paying for EGNOS, which has not satisfactorily demonstrated tangible operational benefits and for which all attempts to built a credible aviation business case have failed. With regard to funding, the airspace users have additionally been long opposed to pre-financing and to discrimination against aviation in favour of other modes of transport. Indeed despite the airspace users' opposition, a number of European Air Traffic Service Providers (as represented in the EGNOS Operations Infrastructure Group (EOIG) have, according to the Communication, invested approximately 100 million Euro in EGNOS. Through the current aeronautical charging system, part or all of those investments have already been, or will be, billed tgo the airspace users, unless public funding is provided to reimburse the EOIG for such amounts.
The airspace users welcome the fact that the European Commission acknowledges that public funding will have to be provided for the 33 million Euro annual operational costs of EGNOS and they do not expect to be charged for EGNOS operations in any future. Airspace users expect that further public money will be made available to reimburse the airspace users money that has already been committed by EGNOS in the development of EGNOS and has been recovered by user charges to the airspace users. This reimbursement is all the more important since airlines and other airspace users face one of the worst crisis in aviation history. Only then will airspace users feel comfortable that EGNOS is not developed and operated against their wishes and at their expense. As a consequence, the Council and the Parliament are requested to take action concerning EGNOS funding in order to rectify a situation unfair to aviation and to ensure that this situation will not be repeated in the future.

Back to GNSS: Mitigating the effects of GNSS outages.
There are three principal methods available to mitigate the effects of GNSS outages on aircraft operations when GNSS supports navigation services:

a) by taking advantage of:
   Existing on-board equipment such as inertial navigation systems;
   implementing advanced GNSS capabilities (application of multiple constellation and frequen cies, adaptive antennas etc) and GNSS receiver technologies

b) by employing procedural (pilot or ATC) methods, taking due regard to the workload and technical implications of the application of such mitigations in the applicable airspace.
   Particular issues that need to be considered include:
   The impact that the loss of navigation will have on other functions such as surveillance in an ADS environment;
   The potential for providing the necessary increase in aircraft route spacing and/or separation in the airspace under consideration; and

c)by taking advantage of terrestrial radio navigation aids used a a back-up to GNSS or integrated with GNSS. In identifying an appropriate terrestrial infrastructure due account should be taken of the following:
   Increase reliance is being placed upon the use of Aerea Navigation (RNAV) operations. DME provides the most appropriate navigation infrastructure for such operations, as it provides an input to multi-sensor navigation systems enabling continued RNAV operation both en-route and in the Terminal Airspace. This same capability can be used for RNAV approach operations if the DME coverage is sufficient.
   If it is determined that an alternate precision approach service is needed, Instrument Landing System (ILS) or Microwave Landing System (MLS) may be used. This would likely entail a minimum number of such systems at an airport or within an area under consideration.

NAV CANADA has completed a number of studies and flight trial using prototype GBAS ground stations and avionics (*Ground -based Augmentation System),* but has no active GBAS program. In view of the fact tha GBAS provides marginal operational benefits beyond that provided by ILS, NAV CANADA does not believe there is a strong business case for GBAS. NAV CANADA expects that, as described below, the next generation satellites will allow SBAS (*Satellite Based Augmentaion system)* to support CAT I without the need for ground systems at airports. It appears that the case for GBAS CAT II/III is problematic because such systems would tend to serve busy metropolitan airport where the threat of interference is higher and where ILS (or MLS) would be retained to ensure safety and minimum economic disruption. NAV CANADA is concerned with the slow pace of GBAS CAT I development, and is aware of the views of some technical experts (expressed in the 11th Air Navigation Conference paper on this subject) that GBAS CAT II/III will not be possible until the next generation core satellite constellations are fully operational after 2015. The NAV CANADA strategy is therefore to await developments before including GBASS in future plans.

The next generation core satellite constellations will all feature multiple frequencies, allowing receivers to eliminate the errors introduced as signals pass through the ionosphere. This will allow next generation SBAS to support CAT I precision approach with fewer ground stations. Multiple frequencies also virtually eliminate the threat of unintentional interference. Having multiple constellations under the control of separate agencies also provides institutional benefits. The key to taking advantage of the next generation satellites will be the development of standards for the most promising combination of elements. This work is underway in the Navigation System Panel.

Discussed were future work programmes and also the time and place of the next meeting.
This meeting will take place from 12th to the 22nd of October 2004 in Montreal.