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FAA Satellite Navigation Product Teams

SatNav News

Satellite Navigation Heats Up in Brazil

By Heather McLaughlin, GPS TAC

The Brazilian Satellite Navigation Program held a bilateral technical meeting from March 4th through March 8th, 2002 in Rio de Janeiro, Brazil, in conjunction with the Brazilian Department of Airspace Control (DECEA). Participants included representatives from the FAA's Office of Policy, Planning and International Aviation (API), the Office of Communications, Navigation, and Surveillance Systems (AND), and the International Research and Acquisitions Office (ASD-500), as well as representatives from the William J. Hughes Technical Center and Boston College.

The purpose of the weeklong program was to explore the benefit of cost savings from participation with Brazil on diverse areas such as flight data collection, potential equipment siting problems, and evaluating the potential implications of mixing vertical and commercial flight applications. During the course of the week there were several side meetings between FAA experts on satellite navigation systems and applications. Also, there were briefings to present the most current information on development status and the potential issues. Additionally, a series of open discussions was held to exchange ideas and solutions with the Brazilian DECEA.

The first day there was an ionospheric seminar in which the FAA made a presentation as well as members from U.S. academia. This seminar was a dialogue to help Brazil determine a solution for their unique ionospheric challenges, which could be of great potential value to the FAA and the global aviation community in future use of satellite systems.

The seminar continued through the second day with other meetings being held simultaneously. The objective of these meetings was to discuss issues such as the potential for cost

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sharing of a navigation payload on a future Brazilian geostationary satellite, as well as meeting the applications of air navigation through the use of multi-function satellite assets.

The third day included a detailed discussion on the use of Ground Based Augmentation Systems in Brazilian airspace, the limitations of our planned system, and how to effectively integrate the two technologies. There were also detailed discussions about siting restrictions and what limitations could be expected. It is intended to have Brazil conduct various system physical siting evaluations to determine what the degradation factors of performance are the further one moves away from the primary broadcast site. The test will also include the possibility of serving multiple airports with one system, what the limiting factors will be, and the performance drop-off curve.

The fourth day was a continuation of day three, adding in the reviewing of the data collection requirements that the FAA would like to have Brazil accomplish for complex approaches. Brazil has some very unique terrain and this task would accomplish many benefits for both the FAA and Brazil. It is intended to have Brazil and Brazilian Airlines conduct flights and collect specific information for the FAA to help develop policies and procedures for the use of curved approaches of both the radial and segmented concept. This also led to discussions about the mixed use of airspace and other CNS applications.

The fifth day was focused on the Brazilians programs and tests and their current status. This covered both the larger CAR/SAM Project, which the FAA has committed to support, and the Brazilian Test Bed, which the FAA has helped to develop and procure low cost hardware. The intent was to determine how the FAA could be of assistance, what the costs would be, what benefits could be derived, and what their future plans hold.

The Brazilians have moved forward at a very rapid pace in their effort to conduct tests and evaluations on the possible applications of satellite navigation and landing capabilities. Their support and dedication to the implementation of satellite navigation was clearly evident in the establishment of a state TestBed and beginning the analysis of ionospheric data. Through their work with the FAA and the International Civil Aviation Organization (ICAO), the DECEA has continuously displayed their dedication through various efforts and could easily be considered a model from which a country can acquire this exciting technology. These efforts include the development of an operational TestBed, tests on how to effectively and efficiently restructure airspace in the terminal environment, determining the most cost-effective solution for satellite signal broadcasting of corrections from the augmentation system, and the establishment of a physical operational center at the international airport.

In addition, they are conducting numerous tests as to the operational use and effects of the ionosphere on wide broadcasts. They have also developed a structure to quickly evaluate what approach they will pursue in SatNav operational implementation. At a recent stakeholders meeting with their user community, they have clearly identified their future path and asked for comments from the aviation industry as to how they can achieve the benefits more quickly.

Currently, the DECEA is scheduled to engage in several critical tests with the FAA starting in mid-2002 on Local Area Augmentation System (LAAS) siting issues and operational flight issues for redesign of the terminal area airspace and implementing advanced procedures. Other tasks, such as multiple airport coverage, signal degradation as a function of multi-path and distance, advanced approaches, and combined airspace use applications, will be part of the aggressive effort ongoing for both the Brazilian TestBed and the CAR/SAM Regional System effort. Brazil and South America have taken a very proactive approach to the implementation of satellite actions and are moving forward at a very rapid pace.

One particular aspect of this project will be an analysis of the ionospheric condition that exists in the Latin American region and how it will apply to the uses in other countries in the region. Data will be collected, analyzed and flight tests flown throughout the region. All of this research will present a clear picture of the ionospheric effects on WAAS and LAAS that states near the geomagnetic equator can expect. These states, and ultimately the region as a harmonious body, will then be able to make educated decisions on what levels of satellite navigation technologies are needed to meet all desired requirements.

Overall, the week was an enormous success with great strides in furthering implementation of satellite navigation in the Brazilian airspace. A Brazil Test Bed Program Plan was presented to and signed by the DECEA General Director. The DECEA has repeatedly shown their commitment to ushering their country into the 21st century through the utilization of GPS technology. The FAA looks forward to supporting them in this effort now and in the future.

SOIT Meets; Maps the Future

By Larry Oliver, GPS TAC (AFS-400)

The Satellite Operational Implementation Team (SOIT) spent a grueling week hammering out the details for future GPS operations. They commenced on March 4th and continued through the following Friday, March 8th. "The products of the meeting justified all of the time and effort," stated Hank Cabler, co-chair of the SOIT. "We had more than eighty people involved, planning and working to ensure a smooth transition to a satellite-based navigational system."

One major concern has been the vulnerability of the GPS signal to interference, so the team reviewed a recent incident and developed recommendations for the future. These recommendations included changes in both local and national operating procedures as well as hardware recommendations. The SOIT remained confident in the ability to both reduce problems associated with interference and provide a seamless backup system.

While GPS is clearly the future of the National Airspace System (NAS), the SOIT paid close attention to the development of the backup system. Currently there are one thousand VORs (Very High Frequency Omnidirectonal Range) operating in the United States as well as TACAN (Tactical Air Navigation), DME (Distance Measuring Equipment), ADF (Automatic Direction Finder), and Loran (Long Range Navigation System). While GPS will allow a major revision to the NAS, extreme care is being exercised to ensure a system that does not have a single-point failure. Over the next 10 years we will see a gradual phase-out of some VORs and ILSs (Instrument Landing System), but the system will maintain sufficient capability that, in the unlikely event of GPS failure, aircraft will not have to rely upon radar vectors to complete their flight. Jeff Williams of ATP-104 provided details on a simulation that will be key in defining requirements for the backup system. The simulation will incorporate three equipment-dependent scenarios, and use actual ARTCC (Air Route Traffic Control Center) controllers to determine workload conditions and operating limitations.

Several additional backup alternatives are under consideration, including the expanded use of the Loran signal. Since aircraft will have a dedicated GPS receiver, it may be cost-effective to include a Loran receiver as a backup system.

WAAS Ionospheric Research Update

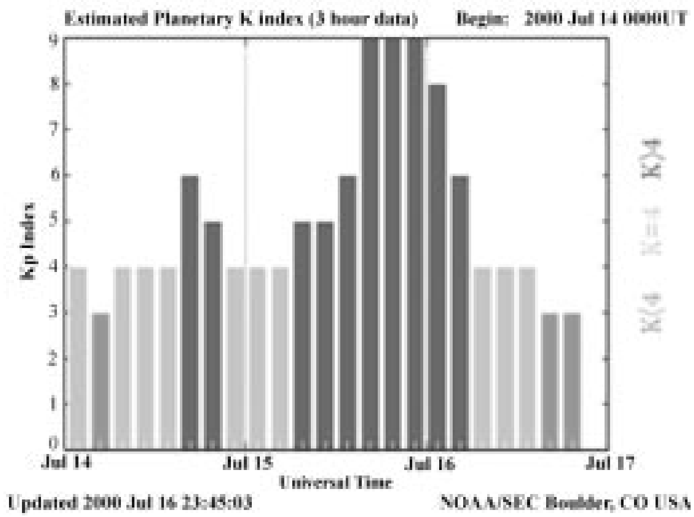
By Deane Bunce (AND-730)

Wide Area Augmentation System (WAAS) ionospheric Research and Development efforts have been ongoing now for approximately 5 years. Over that time much has been learned about how the ionosphere behaves. For the CONUS (Continental United States) WAAS, it's been determined that the ionosphere for the most part is very well behaved. There are exceptions, though, and they are very few. Over the last several years, in conjunction with the peak of the 11-year solar cycle, vast amounts of ionospheric data have been collected and analyzed. The majority of the data that has been collected was by means of the 25 WAAS reference stations. This data set is and will probably be the most useful set of data for ionospheric research in this portion of the world and spectrum. It has enabled the WAAS to identify the most severe degree of ionospheric activity for which the WAAS would have to account. A number of ionospheric storms were recorded by WAAS over this two-year period. The severity of a storm is measured by means of a planetary index (Kp), with the higher the number the more severe the storm. Figure 1 is the Index scale along with data recorded by the NOAA (National Ocedanic and Atmospheric Association) capturing the most severe storm seen by WAAS to date.

Kp **Index**

- Quiet Ionosphere- $0 \le Kp \le 4.0$
- Minor Storm- $4.3 \le Kp \le 5.0$
- Major Storm- $5.3 \le Kp \le 6.3$
- Severe Storm- $Kp \ge 6.7$

Figure 1



terize the effects of ionospheric scintillation around the geomagnetic equator, where scintillation effects are at their worst. This region includes a large portion of South America and Africa.

Scintillation can cause intermittent loss of SBAS (Satellite-Based Augmentation System) geostationary augmentation signals, as well as loss of GPS signals. This would affect availability and also cause degradation in position determination accuracy due to the unavailability of some GPS satellites. Figure 2 highlights those areas of the globe affected by this phenomenon.

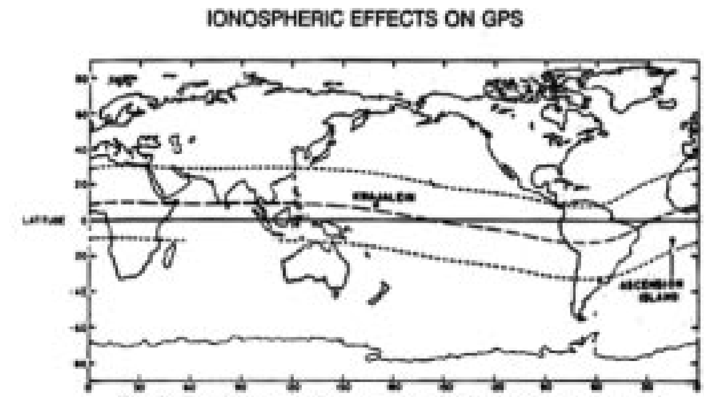


Fig 2. Regions maximum scintillation occur near and within the short dashed lines: Earth's magnetic equator is indicated by the long dashed line.

For WAAS to provide a reliable and useable service, ionospheric storms like the one shown above must be quickly detected and users notified as to whether or not the system is safe to use. WAAS performance has been evaluated during these storms like the one above, with the conclusion being that WAAS will provide sufficient integrity to support LNAV/VNAV (Lateral Navigation/Vertical Navigation) operations. The current WAAS, planned to become operational in 2003, has gone through an extensive analysis to insure with sufficient probability ($< 10^{-7}$) that the ionosphere would not result in a loss of integrity to a WAAS user.

WAAS ionospheric research has not just been limited to the CONUS. Efforts have been ongoing to accurately assess the effects of the ionosphere in both low (along the geomagnetic equator) and high (polar auroral zone) latitude areas. In particular, a great deal of effort is currently underway to charac-

At present, the WAAS is collecting data from a number of locations in South America through its R&D (Research and Development) team members. As this data is collected and then analyzed the intent is to determine what type of ionospheric model will address all possible ionospheric anomalies and thus support some level of WAAS service (LNAV/VNAV) in this area.

To insure that our research efforts are focused on the true issues at hand and to leverage as much information as possible from other research institutions, the WAAS program has been participating in the WAAS Ionospheric Working Group (WIWG) and the SBAS Ionospheric Working Group (SIWG). The WIWG is composed of WAAS R&D team members and the SIWG is composed of an international group of ionospheric experts. The next meetings of the WIWG and SIWG will be held in conjunction with the Ionospheric Effects Symposium (IES) being held in Alexandria, VA in May 2002. During these meetings, points for discussion will include the following:

1. Equatorial and low latitude scintillation and TEC (Total Electron Content) effects
2. Presentation(s) of scintillation results from data collected in South America
3. Effects of scintillation on GPS and WAAS message reception
4. SBAS performance levels possible in low latitude high TEC regions
5. How well is the TEC over Alaska specified
6. WAAS receiver operation in auroral region
7. Identification of ionospheric issues remaining for partial or full GPS L1/L5 constellation
8. EGNOS (European Geostationary Navigation Overlay Service), MSAS (Multi-function Transport Satellte (MTSAT) Satellite-Based Augmentation System) and Brazilian ionospheric research plans
9. Ionospheric estimation and storm detection schemes
10. Ionospheric threat model analysis and metrics

As one can see, there is a lot of work to be done to resolve all the topics noted above. But, with the continued efforts of the research team members and their organizations, we're confident answers to some of these concerns will be found.

For those interested in more details of our research plans, you can get a copy of the WAAS R&D Plan for FY02 from Deane Bunce (202-493-4725) or Bill Klepczynski (703-841-2669).

GPS Website Gets a Makeover

By Shelby Wheeler, GPS TAC

If you have visited the GPS website lately, you might have done a double take. The Federal Aviation Administration's Satellite Navigation Product Team website, http://gps.faa.gov, has undergone a remarkable transformation. With its new features and a fresh new look, the site is user friendly and better than ever.

Previously, the GPS website consisted of little over eighty pages, some of which were out-of-date. The website didn't contain many of the "extras", such as site search capabilities, with which most of us have become accustomed to having.

Enter Luba Chapman, who joined the SatNav team April 1st, 2001 and was given the task of developing a new version of the website. Luba was born in Moscow, Russia and has a background not only in web developing, which she has studied since the dawn of the internet age and has won the International Association of Web Masters and Designer's Golden Web Award in 2000, but also in geophysics, mathematics, science, and health care.

Luba's vision and efforts have resulted in a remarkable change to the GPS website. The new site consists of a new design, including 311 new images, fourteen Flash animation movies, and 138 new web pages.

According to the Access to Electronic and Information Technology Policy Statement, issued on June 14th 2001 by the Secretary of Transportation, Norman Y. Mineta, a recent amendment to section 508 of the U.S. Department of Transportation's rehabilitation act now requires that all of the Department's electronic and information technology (EIT) meet specific accessibility standards for people with disabilities. This amendment requires that employees and customers have access to the same information and benefits provided by EIT. To comply with this policy, an additional 138 web pages consisting of text only in a different and easier to read format was created to parallel the new site, and to convey the same information. This version of the site is accessible from the site Index page as well as the individual pages of the site.

The newly designed site also contains a site search feature, for users who are looking for information on a specific topic and do not want to navigate the entire site to find all the information given. Additionally, a Site Map page has been created, which, like the site search, is accessible from every page in the site. Information has been updated and added. Images have been redesigned and created. In short, the entire site has been expanded upon to better the information given and the presentation of the website. If you have not visited the new site yet, we encourage you to do so. We hope you like what you see.

To visit the newly designed GPS website, go to http://gps.faa.gov.
Tell us what you think! Please send any feedback on the new site to *Shelby.ctr.Wheeler@faa.gov*.

LAAS CAT II/III Status Update

By Navin G. Mathur, GPS TAC (AND-710)

Currently, one of the primary areas of focus for the Local Area Augmentation System (LAAS) program office is completing the process of the baselining of the CAT-I (Category I) LAAS Ground Facility (LGF) system specification and awarding contract for CAT-I LGF procurement. Along with these CAT-I related activities, the LAAS program office is also focusing on the CAT-II/III (Category II/III) aspects of LAAS development. It is proposed that out of all procured LAAS ground facilities, about 66% will support CAT-II/III operations and the rest will be able to support only CAT-I operations.

The underlying assumption in the development of LAAS CAT-II/III is that LAAS CAT-I ground facilities will be designed to be modular so that the system will support CAT-II/III operations by incorporating additional modules. The CAT-II/III system is assumed to be a superset of the CAT-I system with additional modules to accommodate orders of a magnitude increase in integrity and continuity, as compared to CAT-I. However, the program office needs to address the risk areas associated with achieving orders of magnitude integrity and continuity performance.

In the process of migration from CAT-I to CAT-II/III, all the risk areas (including lessons learned from CAT-I development) are being carefully studied by the technical advisors to the LAAS program office. A significant amount of risk for the CAT-II/III development is perceived in the areas associated with integrity requirement validation, continuity requirement validation, and availability requirement validation. Furthermore, it is noted that CAT-II/III Vertical Alert Limit (VAL) has significant impact of the level of risk for the risk areas seen below. For CAT-II/III, a VAL of 5.3 meters is mandated in the LAAS Minimum Aviation System Performance Standards (MASPS, RTCA/DO-245). Key performance parameters associated with CAT-II/II LAAS (as they currently exist in LAAS MASPS) are included in the table. [Note: In the Table Performance Type (PT) II includes CAT-II and CAT-IIIa and Performance Type III is equivalent to CAT-IIIb]

Performance Parameters	PT II	PT III
Integrity Risk	10^{-9}	10^{-9}
Vertical Alert Limit (VAL)	5.3 meters	5.3 meters
Lateral Alert Limit (LAL)	17.3 meters	15.5 meters
Signal-in-space Time To Alert (TTA)	1 Sec	1 Sec
Exposure Time	15 sec	Lateral 15 sec Vertical 30 sec
Continuity Risk	$4x10^{-6}$ / 15 sec	Lateral $2x10^{-6}$ / 15 sec Vertical $4x10^{-6}$ / 15 sec
Service Availability	0.99 to 0.99999	0.99 to 0.99999

In order to investigate the effect of VAL on the system performance, Boeing studied the auto-land performance of their commercial fleet (737 through 777) using their auto-land simulators and LAAS CAT-I ground facility performance parameters. This study was performed as a part of the CAT-II/III requirement development at ICAO (International Civil Aviation Organization). In this study, Boeing has argued that the CAT-II/III requirements are primarily derived from ILS requirements, which is flawed, given the inherent differences between the two systems. They have reported that touchdown dispersion performance for CAT-II/III, as outlined in AC 120-29, AC 120-28D, and AC 20-57A, is achievable for the Boeing Fleet using a CAT-I LGF. Based on these results (and results from previous flight test) it is concluded that CAT-I accuracy will be sufficient for CAT-II/III auto-land applications.

As mentioned previously, a VAL increase from 5.3 meters to 10 meters, if approved for CAT-II/III, would be a significant risk mitigator for the integrity, continuity and availability related risk areas. This change will not only help mitigate technical risks but also directly translate into cost savings for the FAA. RTCA Special Committee 159 is currently reviewing the LAAS MASPS and updating it to reflect recent technological advances in the area of LAAS. LAAS program office is actively participating in this effort at the RTCA and will actively pursue the issue of VAL increase both at the RTCA and ICAO levels. In addition to this, the program office is also pursuing development of Airport Pseudolites (APL) as other risk mitigation activity for the availability enhancement. The APL transmit a "GPS-like" signal from its installed location on the airport and hence can be strategically utilized to enhance service availability at any given airport.

FAA Implements WAAS Human Factors Improvements

By Amy Johns (AND-730)

The WAAS Human Factors Tiger Team (HFTT) recently convened at the NOCC (National Operations Control Center) in Herndon, VA to view a demonstration of the human-system interface improvements selected by Airway Facilities (AF) representatives and the WAAS Professional Airways Systems Specialists (PASS) Liaison for implementation in the Phase 1 design. The demonstration represented the culmination of HFTT efforts over the past year, and the team is quite pleased with the results.

Background

The HFTT, a collaborative FAA/Raytheon effort, was established in February 2001 to address operational usability issues identified in the Phase 1 Human Factors Assessment report. The FAA conducted the assessment in 1999 to identify human-system interface improvements needed to enhance system usability for Phase 2/3, when transition to organic support was originally planned. These plans later changed such that AF would assume responsibility for the WAAS at Phase 1. When the WAAS program subsequently suffered a major schedule slip, opportunity to address the risk associated with user acceptability at system commissioning was created, and the HFTT was formed.

System design improvements

Issues identified by the team were divided into five improvement categories: (1) Operator, (2) Technical Instruction Book (TIB), (3) Maintainer, (4) Second level engineering support, and (5) Hardware. Each item was assigned a weight within its respective category and system implementation proceeded in order of priority. Some examples of system enhancements implemented include:

- Improved operational displays through the addition of pertinent information and logical presentation
- New "work desk" display to better manage significant events
- Significant event text improvements designed for operators, not engineers
- TIB reorganization based on operational tasks, not alphabetical listings
- Reduction in procedural steps required to perform tasks
- Additional TIB information to benefit maintainers and trainers
- Additional network data to support second level engineering and performance monitoring

Though not all items identified by the HFTT were implemented due to program constraints, the human factors issues deemed most critical were addressed, and the benefits of these improvements are already being noticed. For well over a year now, Raytheon has been operating the WAAS from their facility in Fullerton, CA. During this time they've been tracking and recording their operator errors. Since implementing these design improvements, measurable reductions in operator errors have been observed.

SOIT Develops LPV Approach Concept

By Larry Oliver, GPS TAC (AFS-400)

During the Satellite Operational Implementation Team (SOIT) meetings, the week of March 4th, the future of GPS and the most recent development, LPV (Lateral Precision with Vertical Guidance) approaches was discussed.

LPV approaches incorporate the tighter satellite signal from the Wide Area Augmentation System (WAAS). This signal will allow operators to have lateral guidance with the accuracy of the typical ILS (Instrument Landing System) localizer. This degree of accuracy is a tremendous improvement over the usual non-precision approach, and will allow many IFR (Instrument Flight Rules) approaches to be flown to a height above touchdown of 250 feet. According to Hank Cabler, co-chairman of the SOIT, "LPV's most important benefit is not just improved minima, but the fact that it will bring new vertically-guided instrument procedures to several thousand new runways—runways that would normally not have an instrument approach." Many of these runways are at smaller airfields that are oriented toward the general aviation population.

MITRE Corporation developed a unique mathematical model, which considered local terrain, obstacles, existing airport infrastructure and other factors that influence approach and landing minima. The resultant findings highlighted the tremendous increase in instrument approaches that could be achieved through implementation of LPV. These procedures will have a direct effect upon flying safety, especially for general aviation. At the anticipated commissioning (in 2003), WAAS should cover 80 to 90 % of the NAS, and LPV approaches will become available at the same time.

Andrew Graham of NavCanada enthusiastically greeted LPV. He stated that Canada had fifty airports with GPS-only approaches, and they would have more in the future. "Canada has placed great reliance upon GPS, and LPV is an added value," said Graham. Canada is currently analyzing the use of GPS-only airfields as acceptable alternates. If this becomes a reality, it will provide operators a tremendous increase in flexibility and mission-planning range.

LPV has two distinct features. First is the fact that it will be ready for commissioning next year. Second is that it doesn't require any equipment beyond standard WAAS equipment—for the FAA, Department of Defense (DOD) or the operators! It takes advantage of intrinsic features and exploits them to a higher degree.

Cabler stated, "It's not often that the FAA can achieve such a dramatic capability without the assumption of technical risk. LPV is one of those unique opportunities, and the user-community is in for a tremendous leap forward."

WAAS Performance

By Bill Wanner (ACT-360)

The Navigation Branch (ACT-360) at the William J. Hughes Technical Center is responsible for evaluating WAAS Signal in Space (SIS) performance. ACT-360 accomplishes this mission using a variety of tools developed in house. The key tool is the Minimum Operational Performance Standards (MOPS) user position tool. This tool accepts data from either a WAAS or a National Satellite Test Bed (NSTB) location and calculates the position using the methods described in the WAAS MOPS (RTCA document number DO-229C). This article is a summary of the WAAS performance during the last quarter of 2001 with some additional observations from the first two months of 2002. The focus is the effect of a software change on WAAS performance.

During the last quarter of 2001, a software change was completed for the WAAS that had a dramatic impact on SIS performance. The new software (known as the Grid Ionospheric Vertical Error (GIVE) Monitor) changed the way WAAS calculates the ionospheric delay of a GPS signal. The effect of this change was that the WAAS was available to a larger portion of the CONUS, with better accuracy, and different VPL (Vertical Protection Level) values, depending on the location of the receiver used in the calculation.

Before the GIVE Monitor software was installed (during the period of October 1, 2001 to November 26, 2001), the WAAS was available in 60% of CONUS. After the GIVE Monitor software was installed (November 27, 2001 to December 31, 2001), the WAAS was available to 96% of CONUS. Please note that availability in this analysis is defined as how often is the VPL less than 50 meters, 95% of the time. This value of 96% of CONUS has been consistent with the results analyzed in January and February 2002.

Though the availability of WAAS was dramatic, the accuracy also improved, especially for sites at the edges of CONUS. For example, before the GIVE Monitor was installed, the horizontal accuracy in Atlantic City was 2.1 meters. After installation of the GIVE Monitor, the horizontal accuracy dropped to 0.9 meters. In the vertical dimension, the accuracy dropped from 2.8 meters during the pre-GIVE Monitor period to 1.8 meters in the post-GIVE Monitor period. Once again, these results are consistent through February 2002.

VPL is an important measure of the integrity of the data transmitted by WAAS. This value is calculated every second by a user. As long as the VPL is higher than the calculated vertical position error, a user is assured that the information transmitted by WAAS is safe to use. The same is true in the horizontal dimension when comparing the HPL (Horizontal Protection Level) and horizontal position error. Getting back to VPL, one of the critical values in calculating VPL is the GIVE transmitted by WAAS. With the new GIVE Monitor software, the value of the GIVE's transmitted by WAAS are higher, which means the VPL is also higher. For example, prior to the GIVE Monitor, the VPL in Kansas City was less than 15.4 meters 95% of the time. With the GIVE Monitor, the VPL was less than 22.8 meters 95% of the time. However, for sites near the edges of CONUS, the value of the VPL decreased. In Billings, MT during the pre-GIVE Monitor period, the VPL was less than 71.5 meters 95% of the time. But, in the post-GIVE Monitor period, the VPL was less than 26.7 meters 95% of the time. The characteristic of the GIVE Monitor is that sites toward the center of CONUS (like Kansas City) have a higher VPL value and the sites toward the edges of CONUS (like Billings) have a lower VPL value, when compared to the pre-GIVE period. Results analyzed from January and February 2002 data show similar results.

ACT-360 evaluates WAAS performance daily from many sites in CONUS and Alaska. The results of these analyses and other WAAS analyses are documented in a quarterly report. The report can be found on the Internet at: http://www.nstb.tc.faa.gov/.

Latin America GNSS Update

By David Burkholder (ASD-500)

The past year has been an active one for the FAA and Caribbean and South American (CAR/SAM) States participating in the FAA-supported ICAO Regional Project for Latin America, RLA/00/009.

RLA/00/009 is a cooperative regional initiative organized within ICAO under the United Nations Development Programme to establish a Global Navigation Satellite System (GNSS) Augmentation Test Bed, called the CSTB, throughout Latin America to support and facilitate research, development, acquisition, and implementation of an operational satellite navigation capability. The FAA team, comprised of the Navigation Branch (ACT-360) of the Communications, Navigation, and Surveillance Engineering Division at the FAA's William J. Hughes Technical Center, the International Research and Acquisitions Office (ASD-500), and the Navigation Integrated Product Team (AND-700) has been actively involved in the project. Specifically, ACT-360 has played a critical role in developing project plans, loaning, shipping and installing equipment, and training and advising regional representatives on the multiple aspects of establishing and operating a satellite test bed system. As a direct result of ACT-360's success in establishing the CSTB, a similar effort is being initialized in the South East Asia region that will mirror the Latin American program.

Much progress has been realized since the project document was officially approved in June 2001 by ICAO and thirteen participating States and Organizations. ACT-360 configured, tested, and shipped five CSTB Reference Stations (TRSs) to Argentina, Bolivia, Peru, Colombia, and Honduras in September 2001. These stations supplemented existing test bed installations that the FAA assisted with in Chile (3 TRSs and 1 CSTB Master Station, or TMS) and Brazil (5 TRSs and 1 TMS). Three FAA-provided TRSs have been installed in Mexico and are already on-line and waiting to be used in the execution of regional testing. Panama also will bring one FAA-provided TRS on-line in the next couple of months.

The next step in the project was to train regional representatives on the installation requirements and procedures so that each State could complete its own TRS installation. To accomplish this, a FAA team (ACT-360/ASD-500) traveled to Argentina in December 2001 to conduct a weeklong training course in an effort to allow States to complete their installations by the end of the year.

The conclusion of this training had the Argentina TRS installed but awaiting the communications line to be finished between the Chile TMS. The Lima, Peru TRS has also been successfully installed and is currently broadcasting GPS correction data to the TMS in Chile. TRSs installations in Colombia, Honduras, and Bolivia are expected to be completed by the end of March 2002. At this time, the entire CSTB architecture will be in place and operational – a major accomplishment for a regional cooperation project considering the short amount of time that has expired since project approval.

In another related development, ACT-360 coordinated and conducted ionospheric flight tests from January 14-24, 2002 in the Rio de Janeiro, Brazil area using navigation information from the Brazilian Test Bed (BTB) architecture. The data collected, both from the TRSs and the airborne equipment onboard the FAA B727 aircraft, will be invaluable to the future analyses and operational conclusions that will be reached within the RLA/00/009 project. The goal of these flight tests was to gather detailed information about the geographic ionospheric challenges that the CAR/SAM region must address and solve for when planning for and implementing an operational satellite navigation system.

Lastly, project representatives from nine States and ICAO visited the FAA William J. Hughes Technical Center from February 18-22, 2002. ACT-360 administered a weeklong training course to develop a regional action plan to conduct data collection, analysis, and flight tests in support of desired regional and State performance levels. This training program continued the positive momentum of this regional project, and produced more detailed objectives and timelines for flight tests and data analysis that will start in late April 2002 and run through the end of the year.

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