volume 27, Fall 2005

FAA Satellite Navigation Product Teams

SatNav News

LAAS Update

by Dieter Guenter GPS TAC/FAA ATO-W

The Local Area Augmentation System (LAAS) remains a research & development (R&D) project. However, the Federal Aviation Administration (FAA) continues to make progress by resolving the integrity risks that have plagued the program for many years. By September 2006, the Ground Based Augmentation System (GBAS) Office expects to complete the integrity analysis and implement an approved set of integrity monitoring algorithms in a prototype LAAS at Memphis, TN. The prototype at Memphis will not meet all of the requirements for a Standards and Recommended Practices (SARPs) compliant facility, but the majority of technical risk will have been resolved. The FAA does not intend to resume development of a federal LAAS facility, but other service providers have shown interest in obtaining their own approvals for a SARPs compliant Category I LAAS, based on the Memphis prototype. The FAA is discussing potential cooperative arrangements with other service providers who are interested in investing their own funds and leveraging FAA's investment in LAAS to complete the development activities necessary to provide a SARPs compliant system. If a cooperative agreement is reached, FAA might be able to upgrade the Memphis prototype and complete a SARPs compliant approval as well.

In parallel to those R&D activities, the GBAS team is working on a LAAS vulnerability assessment, a regulatory approval process for the implementation of International Civil Aviation Organization SARPS compliant LAAS Category I into the National Airspace System (NAS), and an analysis of LAAS as a cost effective alternative for precision approach service. These evaluations and analysis efforts combined with the Honeywell prototype activities will lead to a comprehensive update on how LAAS will meet required performance standards, how it can be implemented into the NAS, and how cost effective LAAS can be.

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The **SATNAV News** is produced by the Navigation Services (ATO-W) branch of the Federal Aviation Administration (FAA). This newsletter provides information on the Wide Area Augmentation System (WAAS) and the Local Area Augmentation System (LAAS), and initiatives associated with the implementation of satellite navigation into the National Airspace System (NAS).

New WAAS International Reference Stations Installed in Mexico and Canada

by Wally Peterson, GPS TAC/FAA ATO-W

The Wide Area Augmentation System (WAAS) program passed another milestone recently. During the week of 8 August, another international WAAS wide area reference station (WRS) was installed

Building Housing WRS in Goose Bay, Canada

and tested. This latest WRS was installed in Mexico on the property of the Mexico City International Airport. The WRS is housed in facilities maintained by SENEAM (Servicios a la

Building Housing WRS in Mexico City, Mexico

Navegacion en el Espacio Aereo Mexicano). This is the second international WRS installed and completes one of the Administrator's goals for fiscal year (FY) 2005. The first international WRS was installed in Gander, Canada in June 2005. During the week of 26 September, another international WRS was installed in Goose Bay, Canada. Future installations are planned to be complete by the end of October at the airports in Puerto Vallarta and Merida in Mexico.

Satellites Carrying WAAS Payloads Successfully Launched

by Mary Ann Davis, GPS TAC/FAA ATO-W

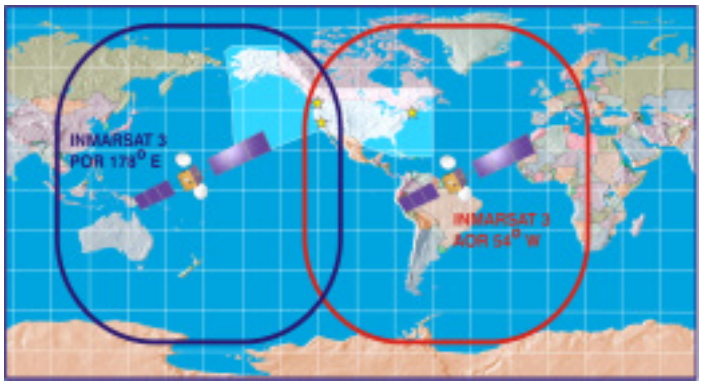
On Thursday, September 8th, members of the FAA's WAAS team and industry partners gathered in McLean, Virginia to watch a live broadcast of the Telesat Anik F1R geostationary satellite (GEO) launch, carrying the first of two WAAS L1/L5 navigation payloads into orbit. The launch took place from Baikonur Cosmodrome in the Republic of Kazakhstan on Friday, September 9th, at 3:53 AM local time. A clip of the actual launch can be viewed at http://www.ilslaunch.com/stories/Current_Campaigns/#. On Thursday, October 13th, a second satellite carrying another WAAS payload was deployed by PanAmSat. The PanAmSat Galaxy 15 satellite was launched from Kourou, French Guiana. These launches were the culmination of several years of work by members of the FAA and their industry partners, and marked a significant milestone toward the achievement of future enhancements for WAAS services.

The FAA WAAS team has been working since 1998 to identify a solution for improved WAAS GEO coverage and in 2002 received authorization from Congress to begin the acquisition of additional satellites. At that time, the team began working toward the goal of procuring a third GEO to supplement the two existing WAAS INMARSAT GEOs. After initial industry inquiry regarding the procurement of this third GEO, the FAA learned of the long lead times needed to obtain these services. At that point, the FAA changed their initial approach of procuring only a third GEO. Instead, the FAA switched to a strategy that would focus on a total GEO solution, including the replacement of the existing INMARSAT GEOs. These INMARSAT GEOs were not optimally positioned to best serve WAAS as it was, creating the need for the third GEO in the first

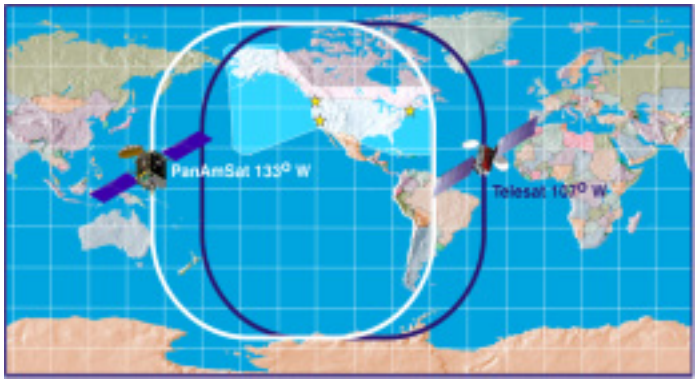
place. Additionally, the leases for the INMARSATs were set to expire in a few years providing the opportunity to switch to a more advantageous GEO solution.

As the WAAS team of technical experts worked closely with industry to identify a more optimal WAAS GEO solution, they found that the most technically and economically advantageous solutions came with longer lease commitments than those supported by existing FAA procurement policy. The FAA policy limited commitment to financial obligation to no longer than five years. The optimal leasing period was ten years. The team did not let this situation deter them. Skilled contracts personnel on the WAAS team joined the effort and worked closely with FAA procurement officials to employ the FAA's Pilot Program authority. This authority enabled the procurement of satellite leases that extended to the desired ten year period. As a result, the vendor was able to offer reduced operations and maintenance costs. This approach saved the FAA over $50 million dollars on the fixed price of the lease and reduced termination liability by $17M. A Lockheed Martin-led team supported the FAA in the procurement of these new GEO services under the Geostationary Communication and Control Segment (GCCS) contract that had been awarded in March 2003. The combination of technical skill, contracts expertise, and close coordination with industry helped to execute a favorable technical solution that also resulted in significant cost savings to the FAA.

The excitement felt on the launch days was not just about what had been accomplished, but also about the future. The coverage and services provided by these new GEOs will provide a critical cornerstone for WAAS enhancements. The Telesat and PanAmSat GEOs will begin broadcasting an operational WAAS signal in 2006, just in time to ensure continuity of the WAAS broadcast when the leases for the WAAS INMARSAT GEOs expire. Additionally, the position of these new GEOs will provide more optimal coverage than did the original pair of WAAS INMARSAT GEOs. The existing INMARSAT satellites overlap only over a small portion of the U.S. A failure in the easternmost INMARSAT satellite would result in loss of service to the majority of the U.S. A failure in the westernmost INMARSAT satellite would render Alaska without service until it was restored. The future coverage to be provided by the Telesat and PanAmSat is much more robust. Each of the new GEOs footprints will cover the entire U.S. If an outage should occur in one satellite, the other will be able to provide sustained coverage for the entire U.S. service area. Additionally, Alaska will have much more complete WAAS coverage than provided by the position of the INMARSAT GEOs. The Telesat and PanAmSat GEO services provided to the FAA under the new lease agreement will provide service through 2016.



Current WAAS GEO Coverage
Provided by INMARSAT



New WAAS GEO Coverage to be
Provided by Telesat and PanAmSat

LPV Defined

by Larry Oliver, GPS TAC/FAA ATO-W

Up until this time, the term "LPV" had been an undefined acronym. It represented a WAAS instrument approach with vertical guidance. The letters were an adaptation of the International Civil Aviation Organization (ICAO) acronym "APV" meaning Approach with Vertical Guidance. Since the FAA variant did not readily fit into the ICAO classification, the FAA adopted LPV as a means of avoiding confusion in the international arena. The August 4th, 2005 change to the Aeronautical Information Manual has now cleared up what the letters "LPV" represent. LPV is Localizer Performance with Vertical Guidance. This is an accurate description of the WAAS LPV approach, since the horizontal accuracy of the signal has proven to be in the 2 meter range, and the vertical accuracy is nearly as good. There are now 263 LPV approaches, with the FAA expecting to add 300 more in the next fiscal year. Approach ceiling minimums are generally 250', with visibility minimums of 3/4 or 1/2 mile (depending upon runway lighting and markings).

LPV Approach Procedure Development Accelerating

by Mary Ann Davis, GPS TAC/FAA ATO-W

The number of LPV approaches available throughout the U.S. continues to grow. This accelerated growth is due to FAA's aggressive efforts to meet the strong demand for these approaches. As you may have read in our last edition of the SATNAV News, LPV approaches provide a number of benefits to the pilots and to the airports they serve. As a result, demand for these approaches has been staggering.

To meet this demand, the FAA is rapidly producing new LPVs. Traditionally, new procedures are published every 56 days. However, to meet the demand, the FAA has been publishing new procedures on a monthly basis. Since mid-summer, the FAA has published 169 new LPVs. This includes 44 on July 7th, 26 on August 4th, 76 on September 1st, and another 23 on September 29th. This brings the total number of LPVs within the U.S. to 263 as of September 29th.

If you are interested in keeping up with where these new approaches are becoming available, please select the "GPS/WAAS Approaches" button from the front page of our website (http://gps.faa.gov). There you will find the most recent list of LPVs by publication date. Additionally, you can find other information and statistics on WAAS-related procedure development. We hope you find this information helpful and get the opportunity to fly an LPV soon.

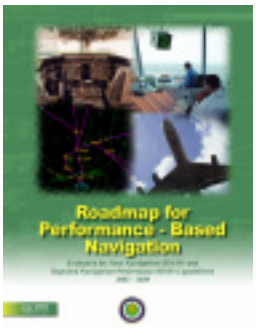
Performance-Based Navigation

by Jeff Williams, Manager, ATO RNAV/RNP Group

The FAA, in cooperation with aviation stakeholders, is implementing performance-based navigation in the National Airspace System (NAS). Two key components of performance-based navigation are Area Navigation (RNAV) and Required Navigation Performance (RNP). Each includes lateral navigation standards for performance, functionality, and capability. These standards allow the flexibility to design more efficient airspace and instrument procedures that collectively improve safety, access, capacity and efficiency, and minimize environmental impacts.

RNAV is a method of navigation that enables aircraft to fly on any desired flight path within the coverage of referenced NAVAIDS, within the limits of self-contained systems, or a combination of these capabilities. The safety of an RNAV route or procedure is achieved through a combined use of aircraft navigation accuracy, air traffic radar monitoring and communications, and route separation.

RNP uses RNAV for navigation, with the addition of on-board navigation containment monitoring and pilot alerting when the required performance level in not sufficient for the route or procedure flown. This on-board performance monitoring and alerting reduces reliance on air traffic control intervention and pilot/controller communications, providing safety benefits and allowing more efficient procedure and route design.



The FAA *Roadmap for Performance-Based Navigation* describes RNAV and RNP concepts and operational goals for the en route, arrival/departure and approach phases of flight for the near term through 2006, mid term through 2012, and the far term through 2020. Approximately 90% of the U.S. carrier fleet is RNAV capable and about 30% is RNP capable. As these numbers increase, the *Roadmap* provides a strategy to leverage advances in communication, navigation and surveillance to derive benefits in capacity, efficiency and environmental goals.

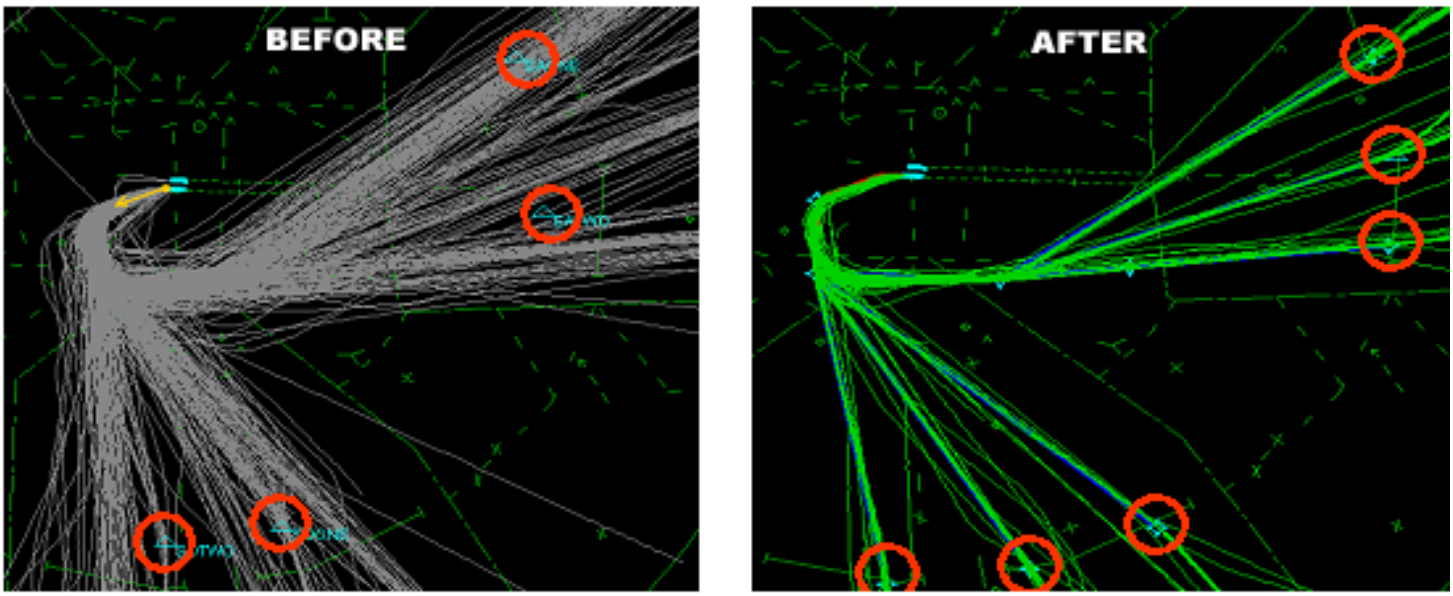
Performance-based navigation resulted in development of RNAV "Q" routes in the en route environment. The routes, designed for use above FL180, can be flown using GPS or DME/DME/IRU. Q-routes require navigation track keeping accuracy of ±2 nautical miles. Twenty routes have been published and 23 more are under development. Q-routes provide capacity and efficiency gains by allowing qualified traffic to be taken off crowded conventional routes.

Below FL180, RNAV IFR Terminal Transition Routes (RITTRs), called "T" routes, allow improved access to Class B and Class C airspace for GPS-equipped general aviation aircraft. The T-routes segregate aircraft transiting airspace from arrivals/departures at the primary airport. The first T-routes were charted in the Charlotte, NC, in September 2005. Additional routes are under development for Cincinnati, OH, and Jacksonville, FL.

Terminal RNAV development includes Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs). The FAA published 36 RNAV SIDs and 16 RNAV STARs in FY 2005, including 13 SIDs at Atlanta, GA, and 16 SIDs at Dallas-Ft. Worth, TX.

Immediate, tangible benefits have been noted. Controller/pilot transmissions are reduced over 30 percent, there is a significant reduction in track dispersion, and the more efficient procedure designs reduce flight distances resulting in fuel savings for the airlines.

RNAV approach procedures have been used since 1969. One *Roadmap* focus is on the benefits to be gained from RNP applications in the approach arena. The FAA, in concert with the joint FAA/industry Performance Based Operations Aviation Rulemaking Committee (PARC), has developed design criteria, aircraft and operator requirements for RNP approaches with values ranging from RNP 0.3 to RNP 0.1 - i.e.



Hartsfield-Jackson Atlanta International Airport (ATL) RNAV Standard Instrument Departures

3/10 to 1/10 of a nautical mile navigation accuracy. A variety of aircraft system capabilities are employed to achieve lower minima while maintaining safety.

A category of RNP approach procedure, the "Special Aircraft and Aircrew Authorization Required", or RNP SAAAR, may be developed by individual airlines and approved by the FAA to take advantage of specific equipment configurations, aircrew qualifications and operating procedures. RNP SAAAR procedures are in development with airlines at Palm Springs, CA; Portland OR; Houston, TX; and New York, NY airports.

The FAA has refined SAAAR approach procedure criteria and recently published public-use RNP SAAAR criteria. The associated operator approval and aircraft performance requirements are also ready for publication. The first public RNP SAAAR approach was published for Reagan Washington National (DCA) in September 2005, and Alaska Airlines is expected to be the first carrier approved for the new procedure. Production of RNP SAAAR procedures for other locations will begin in October 2005.

Performance-based navigation made significant advances in NAS operations in FY 2005, and FY 2006 promises to be even more dynamic. The combined FAA and aviation stakeholder partnership will continue development of RNAV/RNP en route, arrival/departure and approach routes and procedures, and will jointly pursue the communication, navigation and surveillance advances projected in the *Roadmap for Performance-Based Navigation.*

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