

### GAGAN: The FAA and India Take Initial Steps

By Navin Mathur, GPS TAC/AND-710 and Heather McLaughlin, GPS TAC



To affirm India's commitment to future Communications Navigation and Surveillance/Air Traffic Management (CNS/ATM) developments, initial steps have been taken towards the development of India's regional Satellite Based Augmentation System (SBAS) called GAGAN (The Sky). The Indian Space and Research Organization (ISRO) along with the Airport Authority of India (AAI) is working toward establishing ground and space segments for attaining APV 1.5 or Category-1 (CAT-1) capability, similar to the US Wide Area Augmentation System (WAAS). India plans to use the SBAS system initially in 40 candidate airports that will require CAT-1 or close to CAT-1 capability in the near future.

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To further facilitate these goals, the FAA, in conjunction with ISRO and AAI, held a five-day SBAS training seminar in Bangalore, India, and a two-day GNSS Conference in New Delhi, India.

#### Part-I SBAS Training, Bangalore

The SBAS training course was arranged by the US Trade and Development Agency (TDA), in association with the FAA and the AAI, with the intent to train the Indian scientists on the technical developments, achievements and lessons learned related to the FAA WAAS. The training was held at the ISRO Headquarters in Bangalore, India from April 22 through April 26, 2002.





The US delegation included various repres e n t a t i v e s within the FAA, including the AND-730 team, the International Office, and the Will-

iam J. Hughes Technical Center. In addition, the delegation included industry and academia experts such as Boeing, Raytheon, Lockheed Martin, AMTI, MIT and Stanford University. The Indian delegation included scientists from the ISRO, engineers from AAI, Hindustan Aeronautical Limited, and academia.

Data was shown by the FAA Technical Center to caution the scientists that due to India's near equatorial location, modeling of the ionispheric delay (a threat to SBAS integrity) over the Indian subcontinent will be challenging in comparison to the US or Europe. A trip to the Indian Satellite Center (a satellite manufacturing facility) was also arranged as a part of the five-day training seminar. Overall, the seminar was a great success and the folks at ISRO were excited about the opportunity, according to Dan Hanlon, the FAA WAAS Program Manager.

#### Part-II GNSS Conference, New Delhi



The second half of the meetings took place in New Delhi, India, from April 29 through April 30, 2002. The intent of this part of the conference was to

provide the Indian civil aviation authorities with insight in regard to advancements in the CNS/ATM arena, with specific recommendations to guide them on their path forward.

The US delegation in New Delhi included representatives of the Department of Transportation (DOT), representatives from the FAA including the AND-730 team, and the FAA International Office. The US Consulate general in India along with higher FAA officials supporting Far-East operations also attended. Representatives from industry and academia included Boeing, Raytheon, Lockheed Martin Corporation, AMTI, ISI, and Hi-Tec Corporation.

Indian participants included the Secretary of Aviation, GNSS Lead Engineers, upper management staff of ISRO, and AAI. Total conference attendance exceeded one hundred officials.

As a result of this conference, Indian participants have an abundant amount of data and information to review, which will guide them in their future CNS/ATM-related decisions.

### Western-Pacific Region Implements VFR Waypoints on San Francisco Terminal Area Chart

By Bob Brekke, GPS TAC/AWP-520



On September 5th, the Western-Pacific Region will implement Visual Flight Rules (VFR) Waypoints on the San Francisco Terminal Area Chart (TAC).

The Government/Industry Aeronautical Charting Forum, with support of the Air Traffic RNAV Implementation Office, ATP-104, conducted a national program to

test the feasibility of putting VFR Waypoints on VFR navigation charts at the request of the Aircraft Owners and Pilots Association (AOPA). The purpose of the depiction of VFR Waypoints on charts is to enhance safety and reduce deviations. The program was highly successful and is ready for national implementation.

The VFR Waypoint Chart Program was established to provide pilots with a supplemental tool to assist with position

awareness while navigating visually in aircraft equipped with area navigation (RNAV) receivers. The programs purpose will also provide navigation aids for pilots unfamiliar with an area in or around Class B, Class C, and Special Use Airspace.

The Western-Pacific Region Air Traffic Division, working in conjunction with AOPA and the Northern California Airspace User Group developed VFR Waypoints for the San Francisco TAC.

The next efforts will be directed toward putting VFR Waypoints on the Phoenix and Las Vegas Terminal Area Charts.

## LAAS Status Update

By Dieter Guenter, GPS TAC/AND-710



I raditionally, LAAS activities range from Government Industry Partnership (GIP) activities, to LAAS CAT I Acquisition activities and LAAS CAT II/III R&D efforts.

These activities are expressed in the following three phases: Phase I (April 1999 - September 2005)

GIP to Develop Non-Fed CAT I System Under FAA Type Acceptance (TA) Process (Honeywell, Raytheon, Thales)

#### Phase II (September 2002 - September 2005)

FAA Full-Scale Development (FSD) and Production of Fed CAT I Systems and Development of Advanced Procedures

#### Phase III (October 2002 - September 2004)

Research & Development (R&D) to Mitigate Technical Design Risk (CAT II/III)

The LAAS team has achieved major milestones in all three areas. However, the team's main focus has been the LAAS CAT I acquisition activities. For the LAAS CAT I acquisition, a number of activities had to be finalized in order for the Request for Offer (RFO) to be released. The LAAS CAT I System Specification had to be finalized and baselined, and the Integrated Program Plan (IPP) and Acquisition Strategy Paper (ASP) approved by the Integrated Management Team (IMT).

The Final RFO for CAT I Development/Production Contract was released April 26, 2002. While Industry works on the RFO, the team will start preparing the required Source Selection Activities, which include finishing the Source Selection Evaluation Plan and setting up the infrastructure to be able to perform all Source Selection Activities in an orderly manner. Replies from industry to the RFO are expected on June 17, 2002. After Source Selection Activities are completed the LAAS team expects the LAAS CAT I Contract Award by September 30, 2002.

The contract will basically include LAAS CAT I Complete System Design and Documentation and a procurement of ten Limited Rate of Initial Production (LRIP) systems— four for direct FAA support and six at different airports in the NAS to support OT&E activities and promote user involvement. After the successful commissioning of the first LAAS site, the FAA will make a decision for further "Priced Production Options" (15-40 systems/year).

For the six LRIP sites/airports, the team looked at many different criteria including:

- · AIR 21 Request /Proposal
- · Diverse Geographical Locations
- · Diverse FAA Regions
- Diverse Siting Conditions
- · Existing GIP Installations
- · Airport/Region Support
- · Airline Support
- · Close Proximity to Aircraft Manufacturer
- · Close Proximity to Avionics Manufacturer
- Good Mix of large and small airports, Cat I and CAT II/III airports
- · Minimal Environmental Impact Study Requirements

Based on criteria discussions, the sites that are currently under consideration are (in alphabetical order) Chicago O'Hare, Houston, Memphis, Phoenix, Seattle, and Juneau.

Parallel to those activities, the LAAS team decided to update LAAS Benefit Categories (User and Service Provider),

which had not been addressed since the Investment Analysis performed for LAAS and WAAS in 1999. WAAS LPV implementation and LAAS user requirements and expectations mandate an Update/Revalidation of LAAS Benefits (Maximum Quantification), which will address aviation community plans for LAAS and give an updated list of airports to receive LAAS CAT I and CAT II/III Systems. Study participants include Aircraft Manufacturers, Airports, DoD, FAA, GIP teams, MITRE, and User Groups. A Preliminary Report is expected in September 2002, and the Final Report in August 2003.

A major item in the LAAS Benefit discussions will be LAAS Advanced Procedures (curved/segmented approaches). These types of procedures are strongly requested by the Aviation Community and were included in the FY02 LAAS Appropriation Language, specifically the LAAS Development of a Data Collection Plan and Initiation of Flight Evaluations for Development of Complex LAAS Approaches (curved, segmented, and offset). The LAAS team works with Aviation Community to determine exact industry requirements, validate industry requirements, assess feasibility for LAAS or other technology/systems providing those capabilities, and develop cost and schedule estimates.

Above and beyond all those activities, the LAAS team is looking one step further into the future with CAT II/III R&D efforts commencing. A major meeting concerning those R&D efforts was conducted at MITRE May 22-23, 2002. Technical design and schedule mitigation efforts are to be completed over the next 2-3 years.

### "GOERS"- Ready To Go

By Mike Dodd, GPS TAC/ATP-104

ATS-1 and Associates directed in 1999 that a GPS Outage En Route Simulation (GOERS) study be conducted to address air traffic needs based on current NAS evolution strategy. Later that same year, the initial meeting of the GOERS Working Group was convened. The team consists of representatives from ATP-104, ATP-110, ASD-140, ACB-330, NATCA, NAATS, MITRE, Titan Systems and AMTI. The primary purpose of the study is to provide an initial examination of the workload and operational issues associated with a controller's ability to manage a GPS outage situation under the simulated conditions. Using the "human in the loop" approach, these conditions represent today's environment and include several reduced Ground-Based Navigational Aids (GBNA) and mixed avionics environments.

An issue of primary importance in formalizing a meaningful simulation study was the finalization of a formal Simulation Plan, which would include required air traffic scenario assumptions, the selection process of en route controllers, and the selection of an appropriate Air Route Traffic Control Center (ARTCC) and its representative sectors. In February of this year, the working group reached a consensus on the Simulation Plan content, and ACB-330 personnel are finalizing the working version. The Center facility site selection has been completed and will be announced shortly. Pending budget approval, the development of initial traffic samples from SAR data will begin in June, and the actual simulation to be conducted at William J. Hughes Technical Center will take place in October and November.

Expected benefits from the simulation results include the assurance of a controller's ability to safely manage traffic during an actual GPS outage, and confirmation of the FAA's commitment to RNAV implementation in support of the NAS architecture evolution. Study results will be analyzed to determine what measures, if any, need to be taken to lessen the impact of a GPS outage, and "lessens learned" from this study will be incorporated into the planned GPS Outage Terminal Simulation (GOTS) study scheduled for FY03.

### WAAS Program Update

By Dan Hanlon, AND-730



The past year has been an extremely busy and rewarding time for the Wide Area Augmentation

System (WAAS) Program. As the program nears customer acceptance and commissioning, all of the disparate activities that make up a complex system are coming together.

At the end of March, the program reached a major milestone when the last of the integrity monitors was integrated into the WAAS signal in space. The implementation of these monitors was one of the major recommendations of the WAAS Integrity Performance Panel (WIPP). The WIPP was convened in January 2000 when systems engineers could not prove that WAAS met the rigorous integrity requirements imposed upon the system. Through cooperation between the FAA and the WAAS prime contractor, Raytheon, these monitors were implemented 3 months ahead of schedule. System testing and evaluation is scheduled to begin shortly. WAAS is on track for the FAA's acceptance of the system from Raytheon next year.

On the fielding front, the WAAS Training and Maintenance System (WTMS) was installed at the FAA Academy in Okla-

homa City. This is a true success story and shows what can be acc o m p l i s h e d when different organizations work together. When the need for the WTMS was identified



last year, the WAAS team immediately set about obtaining the required funding and organizing a team to tackle the problem. With help from other headquarters organizations, the FAA Academy, and Raytheon, the system was installed May 9<sup>th</sup>, ahead of schedule and under budget.

Concurrently, work continues on the new approach procedures known as LPV. LPV was initially developed in an effort to capitalize on the inherent accuracy of the WAAS signal. LNAV/VNAV, the approach capability WAAS will initially be commissioned with, relies on the accuracy of GPS to determine it's horizontal approach limits (HAL). LPV, which will be available to users three to six months after commissioning, uses the much higher lateral accuracy that WAAS provides. This will result in significantly lower approach minima. Best of all, the implementation of LPV requires no changes to the WAAS signal or user receivers.

The WAAS team continues to work towards acquisition of a third geostationary (GEO) satellite. One of the key recommendations of the Independent Review Board (IRB) chartered by the FAA Administrator was the acquisition of an additional GEO to provide a minimum of two satellites over the entire service area. WAAS is currently served by two INMARSAT satellites, neither of which is in an optimum location. The primary purpose of a third GEO is to provide each user of WAAS in the entire continental United States at least two WAAS GEO satellites in view at all loca-



tions.

Internationally, the WAAS team remains very active. Recently, members of the WAAS team, academia, and industry conducted a satellite navigation seminar in India. This program was part of a Trade Development Agency (TDA) effort to help the Indian's in their effort to build a space based augmentation system (SBAS) of their own. The

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WAAS team has also had numerous meetings with Brazil, Japan, members of the European Union, and others over the past few months. In late June, the team will meet with members of the Interoperability Working Group (IWG) to continue work on making sure that the system will be interoperable worldwide.

There is more work that lies ahead, but these recent activities and associated accomplishments have helped to keep the FAA on track for WAAS commissioning in 2003. For future updates on the program, please see the next quarterly issue of the SatNav News, or visit our website at http://gps.faa.gov.

### Western-Pacific Region Supports Additional Special GPS-Based Approaches and Departures for IFR Helicopter Operations

By Bob Brekke, GPS TAC/AWP-520

In addition to the recently approved Satellite Technology Implementation L.L.C. (STI) developed GPS-based "Special" RNAV COPTER routes and approaches serving hospitals heliports in Northern California, the Western-Pacific Region is participating in a cooperative effort with STI to implement additional "Special" RNAV COPTER approaches and departures that will serve a network of hospital helipads in Northern California.

In total, there will be six "Special" RNAV COPTER approach and departure procedures to various hospital helipads in the Northern California area. These procedures will greatly increase the safety of flight for use by helicopters into and out of area hospital helipads.

Scheduled for implementation in the summer of 2002, these "Special" RNAV COPTER approach and departure procedures are the result of many months of collaboration and coordination between various entities in the FAA and STI. The Western-Pacific Region (AWP) Air Traffic Division, AWP AWO, along with three different air traffic control facilities - Oakland Center, Stockton Terminal Radar Approach Control (TRACON), and Sacramento TRACON were just a few parties involved in making these "Special" RNAV procedures a reality.



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