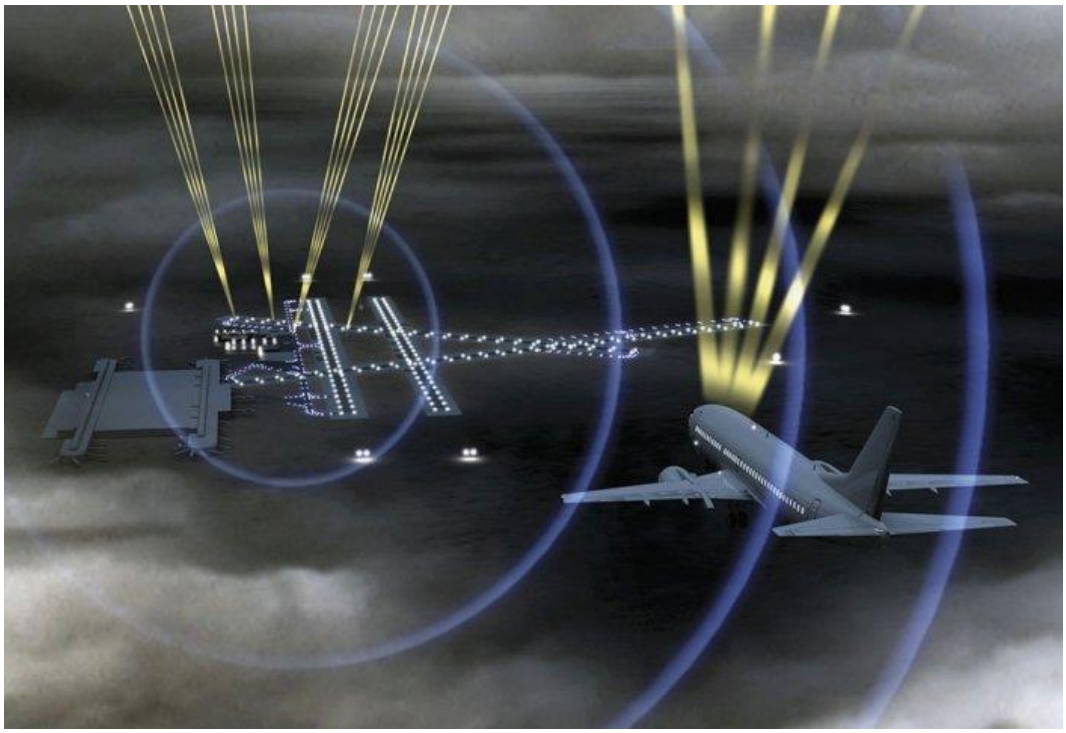
New standards draw closer for GBAS

GAST-D standards are to be approved by late 2018, as a leap ahead in capability compared with existing certified GBAS ground stations. *Jenny Beechener* reports

Progress towards development of a satellite-based landing system that can match the performance of the safest and most precise Instrument Landing Systems (ILS) took a step forward in December 2016, with the finalisation by ICAO of draft Standards and Recommended Practices (SARPS) for an advanced Ground Based Augmentation System (GBAS).

Industry stakeholders are due to approve GBAS Approach Service Type D (GAST-D) standards by the end of 2018, followed by type certification by 2020.

Existing certified GBAS ground stations and airborne receivers are limited to approach guidance down to 200 ft decision height, or Cat I minima. Meanwhile, industry is developing ground-based and airborne receivers to enable precision approach procedures down to the runway threshold, or Cat II/III, thereby bringing the benefits of GBAS operations to airports in all weather.



Depiction of the Honeywell SmartPath GBAS. (Honeywell)

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GBAS Cat I, also known as GBAS Approach Service Type C (GAST-C) is already operational in many parts of the world. SLS-4000 SmartPath from Honeywell was certified by the US Federal Aviation Administration (FAA) for public use at Houston George Bush Intercontinental (2013) and Newark Liberty International (2012), and the Port Authority of New York and New Jersey (PANYNJ) plans to introduce the technology at other New York airports including JFK and La Guardia. As recently as September 2017, Seattle-Tacoma International secured approval to

initiate a GBAS project (it was one of the early test sites more than a decade ago). SmartPath is also certified for revenue operations at airports in Germany (Bremen and Frankfurt), Australia (Sydney and Melbourne), Spain (Malaga), and Switzerland (Zurich).

In Russia, manufacturer NPPF Spectr reports some 90 locations equipped with its core LCCS A-2000 GBAS, operating with 10 different aircraft types. Japan Air Navigation Service (JANS) launched a programme in October 2016 with NEC and the Electronic Navigation Research Institute in October 2016 to install systems at Tokyo Haneda; and PANSA is the latest ANSP to announce plans to implement GBAS at Krakow Airport in Poland.

GBAS augments global navigation signals received from space by providing corrections to aircraft, to improve the accuracy and to provide integrity for the aircraft's own navigational position data. GBAS corrections are sent from a ground-based transmitter and can provide position, navigation, and precision approach services. The technology supports more efficient flight procedures such as steeper glide slopes, multiple runway touchdown points, curved approaches from Required Navigation Performance (RNP) segments, saving fuel and reducing noise impact.

In March 2017, Frankfurt Airport raised the angle of final approach on all three of its runways to 3.2 degrees as an active measure to counteract noise. Results from a demonstration at San Francisco International using a portable SmartPath in August 2016 revealed that 256,000 fewer people were exposed to a 55 dB noise level as a result of combining RNP and GBAS on a new approach path over water. Non-revenue flights conducted outside peak hours were used so as not to interfere with normal traffic flow. The San Francisco Airport Commission, with the FAA, Boeing, United Airlines, and Delta Airlines are assessing whether the technology can help mitigate noise abatement, terrain constraints, and weather challenges for its two parallel runways.

Another benefit of GBAS is its smaller equipment footprint compared with ILS. One GBAS station supports multiple runway ends, and requires only one VHF assignment for up to 48 different approach paths, where ILS needs one UHF and one VHF frequency per system.

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GAST-D

Continuing the work begun in the first phase of the European SESAR modernisation programme, SESAR 2020 aims to verify that a GAST-D ground station can operate and provide the signal integrity to deliver the performance necessary for Cat II/III minima in an airport environment. Indra Navia is leading the GBAS technical package in SESAR, and it is the only manufacturer to provide multiple transmit antennas with its GAST-D prototype to cover large complex airports.

"We believe the big market segment will be Cat III and we are committed to pursuing this," Hugo Moen, GBAS business development manager, remarked to *Jane's* . "We are going directly for a GAST-D system that will cover all aspects of operation from Cat I to Cat II/III."

This means that Indra Navia is not spending unnecessary time on Cat I development, or putting at short-term risk its position as a leading manufacturer of ILS equipment. Indra's experience includes implementation of the first certified Special Category I (SCAT-1) local area precision approach system based on satellite signals implemented across Norway in the 2000s, and still in operation.

GBAS antenna at Frankfurt Airport. (DFS)

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SESAR GAST-D research addresses several areas. The main challenge is ionospheric anomalies, which could impact signal integrity. As satellite signal availability increases with the launch of more satellites, and multifrequency comes into play with new constellations, airborne and ground monitoring systems are using new algorithms to compensate for ionospheric challenges. New constellations in Europe (Galileo) and China (Beidou), and the latest US Global Positioning System (GPS) satellites all provide multifrequency signals.

An Indra ground station in the Canary Islands is part of tests led by Spanish ANSP Enaire into ionospheric threats for low latitude regions. The goal is to have viable ionospheric monitoring algorithms that can maintain signal integrity when the first phase of SESAR 2020 is due to conclude in 2019.

An Indra GAST-D ground station has been supporting tests at Frankfurt Airport since 2013, and a separate SESAR 2020 technical activity is focused on validating the infrastructure to support Cat II/III operations. The test station operates with VHF Data Broadcast (VDB) stations that relay essential information including signal corrections, integrity information, as well as the approach paths, to the aircraft.

Indra GBAS product manager Linda Lavik said the focus of activities at Frankfurt is to validate GBAS GAST-D operation in the environment of a large airport with dense traffic and a complex layout. "Typically one VDB is adequate for a small airport. The goal is to manage with no more than two. We are rationalising the infrastructure to better support complex airports and make it more cost-effective." Meanwhile, project partner DFS (air navigation service provider for Germany) is looking at operational aspects such as the provision of equipment and procedures necessary to operate and maintain a GAST-D ground station.

A third GAST-D Indra prototype is operational at Oslo Gardermoen Airport in Norway, where it is part of a SESAR operational work package. Here, the aim is to improve the efficiency of navigation in the terminal area up until the capture of the approach, with particular focus on ATC procedures and airspace design.

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Cat II minima benefits

Newark Liberty International and Houston George Bush Intercontinental airports in the United States are upgrading their GBAS to include the most recent software and Satellite Based Augmentation System (SBAS) receiver from Honeywell. The SLS-4000 Block II update was approved by the FAA in 2015; it enhances system availability through an updated signal deformation monitoring algorithm. The upgrade also includes real-time ionospheric monitoring using the SBAS receiver, not available with SLS-4000 Block I software.

"Cat I GBAS does not know what the ionospheric conditions are so it operates as if the worst conditions are present," explained Honeywell senior manager Pat Reines. "That still gets us to Cat I minima. When we have the means to say the ionospheric conditions are benign, which they usually are, then we can enable Cat II minimums. There is no need to change the aircraft avionics to achieve this."

SLS-4000 Block II deployment is supported by hub carriers at Newark and Houston including United Airlines and Delta, which expect to be the first to receive operational approval to carry out Cat II operations on a Cat I GBAS. This lowers the decision height from 200 ft and 0.5 n miles visibility down to 100 ft and 0.25 n miles. Honeywell anticipates that future SmartPath deliveries will feature Block II software, and the company says the interim solution offers ANSPs and carriers near-term benefits while waiting for aircraft avionics development to match the capability of GAST-D ground stations.

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SmartPath continues to spread

Honeywell reported its selection by Leonardo in May 2017 to deliver a SmartPath GBAS ground station to Kuala Lumpur International Airport, as part of a broader modernisation programme due for completion in 2018. Factory acceptance is due in October 2017. Meanwhile, the Civil Aviation Administration of China (CAAC) completed the first flight inspection of the replacement SmartPath ground station at Shanghai Pudong International in September 2017, following lightning damage in 2016. The upgrade includes enhanced grounding protection and fibre optic cabling. An eight-month stability test is expected to lead to certification in March 2018. The Airports Authority of India (AAI) is also working on certification of a ground station at Chennai, installed in August 2017 following flooding in 2015.

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