Certification of aircraft for EGNOS use in landing procedures
EGNOS is the European satellite-based augmentation system (SBAS), comparable to WAAS in the USA. Its utilisation in the aviation sector has been studied under the EU-funded GIANT, GIANT 2, HEDGE and Accepta projects.

One important use for SBAS is in vertical guidance of aircraft during final approaches. This procedure is called lateral approach with vertical guidance (LPV), also known as APV SBAS approach. Under this procedure, the aircrew is provided with geometric guidance for the final approach path.

To use this procedure, an aircraft needs to be equipped with a certified SBAS receiver. The steps described here are aimed at obtaining airworthiness certification and operational approval for a receiver, intended for the rotorcraft and general aviation segments only, and for aircrafts already in use.

The operator can choose between two different types of SBAS receiver (see below for detailed description), and is allowed to install the new equipment only in compliance with the aircraft manufacturer’s official instructions, the so-called ‘Service Bulletin’, and EASA provisions.

If a Service Bulletin is not available: the operator can ask EASA for permission to modify aircraft equipment by adding a system, the SBAS receiver. This implies opening a Supplemental Type Certificate (STC), procedure. The approval procedure will differ depending on the modifications needed to install the SBAS receiver (minor or major change, see below), and also on the particular national aviation authority. Once the device has been installed, the operator should receive the Certificate to Release to Service, and after having updated the aircraft documents affected by the installation, he is allowed to use the new SBAS receiver.

The schematic below represents the typical approval procedure to install an SBAS receiver.

**Figure 1 – approval process for aircrafts in service** - Source: Certification Roadmap (HEDGE-WP1 -D1.2), 2010
The standards for equipment approved for navigation are defined in the following European Technical Standard Orders (ETSO):

- ETSO-C145: Airborne Navigation Sensors using the GPS augmented by WAAS.

The equipment installation also needs to be compliant with guidelines outlined in the following documents:
EASA CS: these are EASA Certification Specifications for small and large rotorcraft:
- CS-27: Certification Specification for Small Rotorcrafts (applicable to rotorcrafts with maximum weight of 7000lbs or less and nine passenger seats or less).
- CS-29: Certification Specification for Large Rotorcrafts (applicable to Category A and B units)

EASA AMC: this document is the Acceptable Means of Compliance. AMC 20-28 defines the airworthiness and operational criteria in order to conduct RNAV GNSS approach operation to LPV minima, including provisions for functional requirements, accuracy, integrity, continuity and limitations. Currently, the formal status of this document is that of a Notice of Proposed Amendment, thus the provisions contained are not incorporated in EASA AMC 20 yet, but EASA expects to release this document before the end of 2011.

Some aircraft documents are affected by the installation of the SBAS receiver, and thus need to be updated accordingly:
- The Aircraft Flight Manual (AFM)
- The Basic/Flight Operations Manual (BOM/FOM)
- The Master Minimum Equipment List/Minimum Equipment List (MMEL/MEL)

The SBAS-capable receiver
In compliance with the ETSO and other documents just mentioned, the aircraft owner may decide to install two different types of SBAS receiver:
- A stand-alone system: these receivers are capable of processing GNSS signals using a built-in database to provide the pilot with navigation information.
- An integrated system: these receivers are usually GNSS sensors that send PVT data directly to the Flight Management System (FMS) or through a Multi Mode Receiver (MMR).

Installation of an integrated system is usually more complex, but the process depends mainly on the availability of a Service Bulletin (SB) rather than on the type of receiver.

The installation process
These steps need to be followed in order to install an SBAS receiver:
- Refer to the Service Bulletin instructions, which are usually issued by the aircraft manufacturer. In this case the operator is allowed to proceed with the installation, but has to acquire the Certificate to Release to Service (see next point). The installation must be carried out by an EASA-approved maintenance centre. A list of these is usually available from the National Aviation Authorities of EU Member States. The availability of the Service Bulletin implies a relatively simple procedure for the operator, as the manufacturer will usually offer a certified ‘Equipment Kit’, and the operator needs to request and pay for its installation. After the installation is completed, the operator should inform competent authorities, EASA and National Civil Aviation Authority, that the aircraft is now capable of LPV approaches with SBAS guidance.
- If a Service Bulletin (SB) is not available or does not cover the installation of an SBAS receiver, a Supplemental Type Certification (STC) is required, and the installation process is different depending on the ‘change classification’ of the equipment:
• Minor Change: in this case the operator should contact an organisation holding a Design Organisational Approval (DOA) that submits a technical report for the installation; a DOA acceptance should then be issued and the operator may proceed with the installation. An alternative is to request approval directly from EASA, using Application Form 32, accompanied by a technical report for installation.

• Major Change: in this case the operator needs an STC covering the installation. The STC can be obtained from EASA using Application Form 33 accompanied by a technical report for installation produced by a DOA organisation, and following the instructions described in Part 21, sub-part E.

The classification of a change depends on the intended function. The installation of a single GPS receiver is only considered a minor change where certain restrictions on the use of the equipment apply. In essence, the receiver must be installed as a supplemental means of navigation. Similarly, with the same restrictions, the installation of SBAS capable GPS receivers could be considered a minor change. However, when the intended function is to operate the aircraft on approaches with vertical guidance (APV), the change will be considered as major.

EASA’s current position with regard to classification is as follows:

• Activation of SBAS is usually considered a minor change for en-route function.

• Approaches to LNAV minima are still being discussed, but it looks likely that they will ultimately be considered as a minor change.

• Approaches to LNAV/VNAV or LPV minima: major change.

The criteria are contained in Part 21 and clarified in GM 21A.91 to Part 21. Aspects to consider when installing a SBAS/GNSS receiver for the purpose of conducting approaches to LNAV/VNAV and LPV minima are:

• Low minima (LPV)

• Single system

• Human Factors

• Limited test on ground

• Effect of failures: significant reduction in functional capabilities or safety margins

The Design Organisation’s role is to create the design, installation and test procedures and a certification plan in which the company describes how it will prove that the design complies with the requirements. The design organisation is encouraged to use the guidelines provided in NPA 2009-04.

Because the Acceptable Means of Compliance (AMC) 20-28 – which were proposed by NPA 2009-04 – have not yet been published, the Design Organisation will need to come to an agreement with EASA on the use of the material. In practice this means that both parties agree to use the proposed means of compliance of NPA 2009-04. The agreement is documented in a Certification Review Item (CRI). The means of compliance include guidance on the equipment qualification (preferably ETSO-C145/C146 qualified receivers), presentation of data to the pilot, Flight Manual or Pilot Operating Handbook supplements and more.
At the end of the process, the design organisation receives the approval from EASA and the pilot can use the equipment to operate LPV approaches, provided that he or she has received operational approval from the relevant National Aviation Authority, when required.

The approval process
Once the operator has received EASA approval for a minor or major change, installation may proceed, following the instructions in the SB or STC. Installation is carried out directly by EASA or by an approved Maintenance Centre. It is important to note that the installation is also performed by an EASA-approved Maintenance Centre when an SB is available.

Then, the operator:
- Receives a Certificate to Release to Service (CRS).
- Needs to update the Certificate of Airworthiness, with reference to the new avionics system fitted on the aircraft.

Conclusions
Rotorcraft and aircraft manufacturers play an important role in the approval procedure, as the publication of updated Service Bulletins covering the installation of SBAS receivers allows operators to correctly install a receiver and rapidly obtain the Certificate to Release to Service, without having to produce additional documents (technical report for installation) and without having to request further approval from EASA.

An important element that should be underlined is that, unless otherwise stated, the approval is valid for all aircraft of the same manufacturer and model, as long as these are similarly equipped, i.e. same GNSS receiver, same means of presentation, etc. EASA approves the design, not the installation for an individual aircraft. Thus, the installation and approval process is simplified when a pilot chooses a design company that has already received an approval for a similar design on a similar type/model.

Nevertheless, the total cost of EASA approvals is relatively high, estimated at €10-20 thousand for the operator. Detailed information about EASA fees can be found in the Related Documents section.

Learn more about the benefits of EGNOS for aviation at the upcoming European Regional Airlines Association (ERA) General Assembly, 28-30 September 2011, Rome, Italy:

http://www.eraa.org/events/general-assembly/432-era2011-rome-italy'

Related documents
1. Application Forms 32 and 33 (Download)
2. Certification Specifications 27
3. Certification Specifications 29
4. NPA 2009-04
5. Fees and charges levied by EASA
6. List of Foreign Approved Organizations
7. List of Foreign Approved Organizations (USA)
8. List of Foreign Approved Organizations (Canada)
9. List of Foreign Approved Organizations (Switzerland)
10. List of Certified Receivers (Search for ETSO C145 and ETSO C146)

More information
  ▸ What is SBAS?
  ▸ How to use EGNOS / SBAS in my airport or airplane
  ▸ Aviation case study: Landing with satellite navigation
  ▸ EGNOS portal - Aviation