

**NEW**réf. **WORKGNSS  
EXT**Code OACI 179  
ENAC - SINA**GNSS : Principles, Augmentation and  
Evolutions of EGNOS (1/2)****COURSE DURATION**

10 days

**NUMBER OF PARTICIPANTS**

32

**WHEN AND WHERE**

ENAC Toulouse :

- May 12 to May 23 2014

Course in english in ENAC/Toulouse.

**Course in english****PARTICIPATION  
CONDITIONS**Course fee :  
3622 €Practical information :  
See at the end of this catalog**FURTHER INFORMATION  
AND REGISTRATION**Sandrine CASTIGLIONI  
+33 (0)5 62 17 40 38Mandatory registration form :  
See at the end of this catalog**COURSE DIRECTOR(S)**Christophe MACABIAU [Science and Air  
Navigation Engineering Department]**objectives**

Will Global Navigation Satellite Systems (GNSS) ever become the 'sole means' of navigation service ? Can the current satellite systems be improved and what are the enhancements required to make the system acceptable for civil aviation use ? What is the view of civil aviation authorities on satellite navigation and their involvements on the Add-Value concerning their Navigation service domain ? The objective of this seminar is to provide answers to these questions .

The tutorial will analyse the civil aviation needs and requirements regarding navigation , and how GNSS with its augmentations, can fulfil them. The training provides an in-depth presentation of GNSS, including the planned modernization of GPS and GLO-NASS and the development of Galileo and Beidou. Based on the analysis of the current GNSS performance , on the presentation of the operational use and on requirements of civil aviation, it will clarify why GNSS cannot support by itself most of civil aviation phases of flight without augmentations. The different kinds of augmentations (ABAS, SBAS, GBAS) will then be reviewed in great details. A specific emphasis will be put on the European SBAS initiative, EGNOS. Its planned coverage extension towards the south of Europe and the main part of Africa will be discussed emphasizing its feasibility and expected performance.

**participants**

The course is designed for staff working in any area of CNS/ATM , to whom an overview of current and future development of the NAV/Atm system might be beneficial. It is aimed at people with a perception of the current Navigation domain , and wanting to take part in an in-depth analysis concerning the understanding of the way GNSS and its extension possibilities can support Navigation Service in Civil Aviation.

After completing the course, participants will have a comprehension of the basic GNSS principles, its limitations and its recent evolutions. They will also understand the different types of augmentation system used by civil aviation (SBAS,GBAS .. etc... ).

The course participants will have an understanding of the operational and technical aspects of NAV application from GNSS. Specifically, trainees will master the meaning and principles associated with area navigation (RNAV) and the PBN concept. Additionally , participants will be able to explain the difference between RNAV and RNP Specifications, and to list the different stages of the PBN implementation processes and state which navigation applications support the different phases of flight.

Globally this training target engineers, involved in the planning of national "NAV" infrastructures of the local ANSP . This course is designed for operational, technical and managerial ATM staff interested in the developments of the field Navigation, more especially with a view toward implementation in their own environment of GNSS procedure Design. The course is also oriented for technical audience with a perception of the current Communication, Navigation and Surveillance domains, and intending to take part in an in-depth analysis of the techniques and strategies in CNS/ATM concept .

**topics covered include****1. GNSS : Concept and strategy**

Reminder on Nav aids and basic strategy in Navigation Services

- Basic descriptions and performances of Conventional Nav aids
  - Notion of requirements and strategy view of Eurocontrol for Navigation
- GPS System Description
- Basic principles. Pseudorange measurements.
  - GPS : space , control and user segments . GPS Architecture.
  - Time and coordinates reference system.
  - Position computation.

GPS Architecture and Technique

- Signal structure : modulation and frequencies. GPS Navigation Message.
  - Propagation channel : ionosphere and troposphere propagation properties, interferences , multipath
  - Performances : UERE, DOP , Accuracy , Availability , Integrity , Continuity.
- Differential techniques : DGPS
- Principles of correction of common bias systematic error : code differential and phase differential techniques.
- Others Satellites Constellation for Navigation
- GLONASS , GALILEO , Beidou , Modernized GPS .

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**topics covered include****2. Navigation Service for the CAA**

General consideration on navigation , Operational requirements and strategy.

- Different phase of flight (En-route, TMA, approach and landing) , Notion of general Navigation errors,
- Required Navigation performance overview and operation benefits,
- Introduction to the Policy of Augmentation of Accuracy , Availability , Integrity (ABAS,GBAS,SBAS,RAIM,EGNOS ...),
- Landing phase (non-precision, precision),
- RNAV. Concept,
- PBN concept (Performance Based Navigation).

**3. Safety of Life Services in Satellite Navigation (present and emerging technologies)**

General consideration on EGNOS , WAAS , Operational requirements and strategy.

- Introduction to the notion of safety of life, and its requirement for Navigation,
- Benefits of an SBAS System for aviation Open Service, safety of life, commercial Data service,

- Concept of Basic system of Augmentation in SBAS strategy,
- Presentation of EGNOS principle and performances on the Open Service(OS), on the Safety Of Life(SOL) and on the Cockpit Demo Development System (CDDS),
- Extension of EGNOS on an enlarged area of the earth planet,
- Study case of improvement of the coverage for the Core area of Africa.

**4. Demonstration and Simulations on the simulator or equipment device of ENAC**

Demonstration in "Direction Technique de l'Innovation" of French DSNA , or in French company (Thales , Astrium , CNES , Egnos Safety of Life Provider in ESSP).

Hands-on illustration will be proposed based on operational or simulation tools located at ENAC, the French DSNA/DTI/R&amp;D, or at one of the main GNSS-related companies in Toulouse area.

For information only : 54 hours

**COURSE DIRECTOR(S)**Christophe MACABIAU [Science and Air  
Navigation Engineering Department]