

# Interference to GNSS in Civil Aviation

2023 ITNST Tutorials

**Interference to civil aviation is a major concern for safety and efficiency. It is however important to know about the real impact of interference to civil aviation receivers, and rules for GNSS spectrum compatibility in order to know what and when interferences are a real concern.**

## GOALS

The tutorial covers the impact of interference to GNSS receivers, including the model of the receiver signal processing chain, efficient C/N<sub>0</sub>, and interference thresholds. It discusses the detailed civil aviation GNSS interference environment, various cockpit and on-board devices that may cause interference, and the impact of interference on GPS L1 and GNSS L1/E1-L5/E5a Civil Aviation Receiver signal processing stages. Finally, it concludes by discussing the relevant standards and regulations.

## ATTENDEES CONCERNED

Graduate students, Professionals in the field of satellite navigation and spectrum regulation

## CONTENT

### Tutorial 1

GNSS Augmentation for Aviation – Todd Walter, Stanford University, 28 June 2023 14h-17h30

This course will describe the use of the Global Navigation Satellite System (GNSS) to support air navigation. Particular attention will be paid to challenges that can affect the availability and safety of GNSS based navigation. The currently operating systems that augment the Global Positioning System (GPS) will be described. These are Aircraft Based Augmentation Systems (ABAS), Ground Based Augmentation Systems (GBAS), and Satellite Based Augmentation Systems (SBAS). They support differing flight operations and different levels of operations. Each method is described in detail and how it overcomes the challenges to provide suitable guidance.

The main challenges that must be overcome are satellite faults, ionospheric effects, tropospheric effects, local reflections of the signals at the aircraft, and radio frequency interference. This course will describe each effect in detail and how they are addressed. Aircraft navigation is judged by four criteria: accuracy, integrity, continuity, and availability. How well each system performs on these metrics will be described. The course will also describe how these systems have been and are being integrated into the national airspace. The course will conclude with a discussion on the future direction of these augmentation systems utilizing new signals and new GNSS constellations.

### Tutorial 2

Interference to GNSS in Civil Aviation – Christophe Macabiau, ENAC, 28 June 2023, 14h-17h30

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### Tutorial 3

3-topic tutorial – Todd Humphreys, University of Texas at Austin, 28 June 2023, 14h-17h30

- (A) Non-terrestrial communications networks
- (B) Low-cost IMU + carrier-phase differential GNSS positioning
- (C) Locating sources of GNSS interference using TDOA and FDOA from low-Earth orbit.





<b>Title / Code</b>	Interference to GNSS in Civil Aviation / Tutorial ITNST 2023
<b>Attendees concerned</b>	Students and Professionals
<b>Number of attendees</b>	30
<b>Course Manager</b>	Christophe MACABIAU
<b>Duration</b>	3.5 hour
<b>Dates</b>	28 june 2023
<b>Language</b>	English
<b>Tuition fees</b>	300 €
<b>Adresse</b>	ENAC 7 Avenue Édouard Belin 31400 Toulouse - France

#### Information and registration

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