



GNSS Interference

Signals from the Global Navigation Satellite System (GNSS) are the main inputs used for aircraft positioning and time reference onboard an aircraft. These inputs are used for navigation, surveillance, and communication functions.

GNSS Radio Frequency Interference (RFI) is increasing in some areas of the world, particularly around conflict zones.

This article explains GNSS RFI and its effects on aircraft systems, highlighting the latest recommendations on how to operate Airbus aircraft in an RFI environment. It also highlights how Airbus is actively contributing to the industry effort to address this phenomenon.

This article was initially published in 2019. It was updated in April 2026 to provide more recent information on the subject. This article will be updated to reflect the evolving nature of this subject.

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The history of the GNSS in aviation dates back to the 1970s and 1980s with the development and deployment of the Global Positioning System (GPS). The GPS reached full operational capability in 1995. Since then, civil aviation has widely adopted GNSS as a primary source for Positioning, Navigation, and Timing. The resulting improved accuracy of aircraft positioning has significantly enhanced safety and enabled the use of more direct flight paths, resulting in a notable reduction in fuel consumption.

RADIO FREQUENCY INTERFERENCE (RFI)

A low power signal sent from space

GPS signals are received with low power, comparable to the power received from a 60W light bulb located more than 20 000 km away from the surface of the earth. Due to this low power, GPS signals are highly susceptible to RFI from any source located near an aircraft emitting in the GPS L1 frequency band (1575.42 MHz +/-10 MHz).

Intentional GNSS RFI is divided into two major categories: GNSS Jamming and GNSS Spoofing.

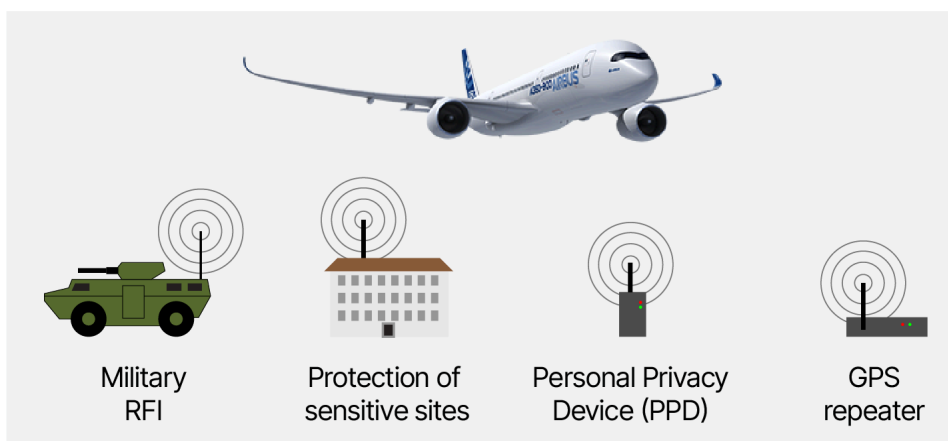
GNSS jamming

Type of radio frequency interference that degrades the GNSS reception capability. **The GNSS data used by the aircraft systems can be degraded or lost.**

GNSS spoofing

Type of radio frequency interference with emissions of GNSS-like signals that may be acquired and tracked in combination with or instead of the authentic signals. This can result in **erroneous GNSS data used by the aircraft systems.**

Main Sources of Jamming and Spoofing



(fig.1) Main sources of GNSS jamming and spoofing

Military activities

The majority of GNSS RFI events recently observed in-service result from military Electronic Warfare activities in conflict zones or related to the testing of such capabilities. The affected areas are often identified via NOTAMs informing flight crews to expect interference when operating in these areas. However, if such military RFI activities are not identified or communicated in advance, aircraft may be exposed to jamming, spoofing, or both without prior notice.

Protection of sensitive sites and VIPs

Another major source of RFI is the implementation of security measures for sensitive sites and Very Important Persons (VIPs) intentionally interfering with GNSS to counter Unmanned Aerial Vehicles (UAVs). Affected areas typically include airports, locations with dignitaries or political figures, and correctional facilities.

Personal Privacy Devices (PPD)

Personal Privacy Devices (PPDs) intentionally jam GNSS receivers in close proximity, aiming to make tracking devices ineffective. These devices have caused significant operational disruptions at airports when activated in the airport's vicinity.

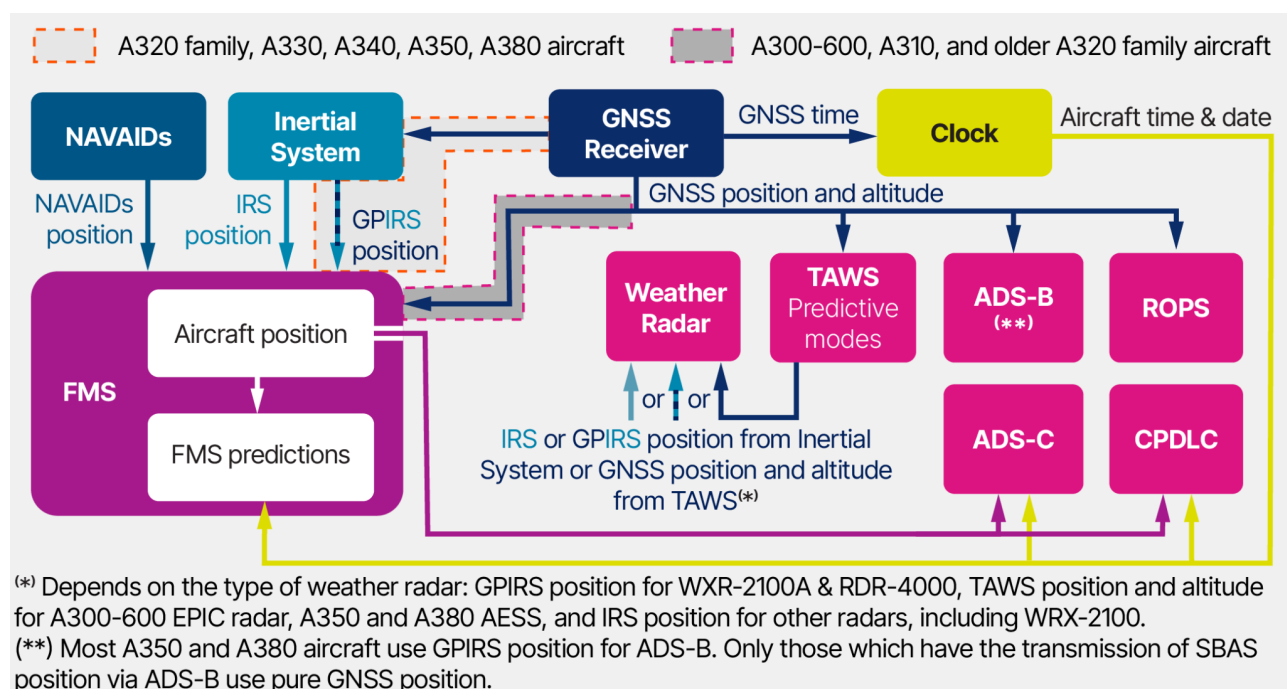
GNSS repeaters

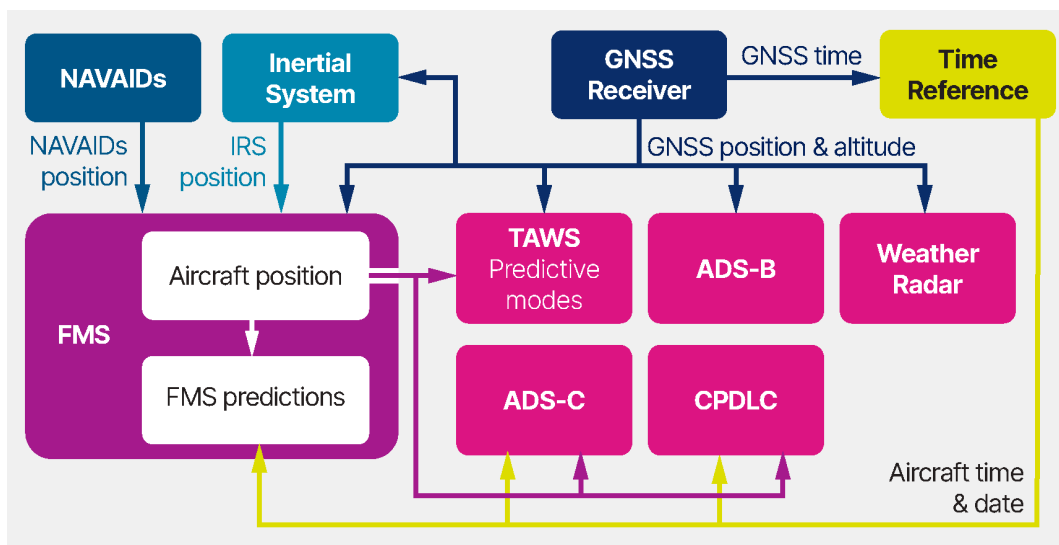
GNSS repeaters receive the authentic GNSS signals and re-broadcast ("repeat") them to enable reception inside buildings, where the GNSS signals would be otherwise masked. If GNSS repeater emissions are not properly managed, they are equivalent to GNSS spoofing, possibly impacting aircraft operating in the vicinity of the repeater.

Several Aircraft Systems Are Affected by GNSS Interference

There are many direct or indirect users of the GNSS data inside an aircraft. Depending on the aircraft type and the system architecture, the effects of GNSS interference may differ.

(fig.2) Simplified view of the main users of GNSS data on Airbus Aircraft (except A220)





INFORMATION

(fig.3) Simplified view of the main users of GNSS data on A220 aircraft

A detailed list of the effects of GNSS RFI on aircraft systems is provided in the following documents:

- **A300, A310, A320 family, A330, A340, A380 aircraft:** FCOM - Procedures - Normal Procedures - Supplementary Procedures - GPS interference
- **A350 aircraft:** FCOM - Procedures - Normal Procedures - Supplementary Procedures - GNSS interference
- **A220 aircraft:** FCOM volume 2 - chapter 03 Normal Procedures - Supplementary procedures - GNSS INTERFERENCE
- **Flight Operations Transmission (FOT) A220-FOT-34-50-002** available on the AirbusWorld portal
- **In-Service Information (ISI) article 34.36.00049** available on the AirbusWorld portal.

EFFECTS OF GNSS RFI ON THE NAVIGATION FUNCTIONS

Effects of GNSS Jamming (Signal Lost)

While GNSS plays a major role in the aircraft positioning system, Airbus aircraft are designed to be robust against the loss of GNSS signals. The use of other data sources (IRS, VOR, and DME) enables the aircraft systems to maintain a position computation capability. **A loss of GNSS inputs does not result in a map shift or erroneous position computation by the Flight Management Systems (FMS).**

In the case of a loss of the GPS signal:

- **A300, A310, A320 family, A330, A340, A350, and A380 aircraft:** The FMS (or ADIRS on A350 aircraft) switches from the mixed GPS/IRS position to an IRS-DME/DME position, or IRS-VOR/DME, or pure IRS, in order of priority.

- **A220 aircraft:** The FMS switches from the onside GPS to the other side's GPS position, or DME/DME, or VOR/DME, or blended IRS, up to Dead Reckoning, in order of priority.



INFORMATION

Refer to the FCOM description of FMS position computation for more detail.

Loss of some navigation capabilities

When GPS data is lost, the aircraft position performance may be degraded resulting in an operational impact on Performance Based Navigation (PBN).



Effects of GNSS Spoofing (Erroneous Signal)

A300, A310, A320 family, A330, A340, and A380 aircraft

In the case of GNSS spoofing, **the FMS (or ADIRU depending on the aircraft configuration) may not detect that the signal is erroneous**, leading to erroneous aircraft position that can be associated to:

- Unexpected aircraft turn in **NAV** mode with autopilot engaged
- Map shift on the Navigation Display
- Abnormal IR drift information on the **POSITION MONITOR** page.

In addition, on ground, A300-600 aircraft with EPIC, A320 family, A330, A340, and A380 aircraft may auto-align their IRS to an erroneous GNSS reference.

A350 aircraft

A350 aircraft position has better robustness against GNSS spoofing due to position hybridization based on both MMR sources and additional position monitoring. In most spoofing events reported to Airbus on A350 aircraft to date, the ADIRU rejected the erroneous GNSS position. However, erroneous aircraft position computation may still occur. At the time of writing the article, one case of erroneous position computation has been confirmed on A350.

On ground, A350 aircraft may also be affected by an automatic IRS alignment to an erroneous GNSS reference.

A220 aircraft

A220 aircraft can also be affected by erroneous position computation in a spoofing area. The FMS uses GPS as the primary position source. In spoofing conditions resulting in large position shifts, the FMS may reject navaid and IRS positions, leading to an FMS in Dead Reckoning mode.

Additionally, on ground, IRS may also align on an erroneous GNSS reference.

EFFECTS OF GNSS RFI ON THE SURVEILLANCE FUNCTIONS

Effects of GNSS Jamming (Signal Lost)

Loss of some surveillance functions

Many surveillance functions rely directly on GNSS information. As a consequence, if the GNSS signal is lost, the function may become unavailable. This includes the following (if functions are installed):

- Predictive Terrain Awareness and Warning System (TAWS)
- ADS-B out position reporting
- ADS-B in Air Traffic Situational Awareness (ATSAW), if installed
- Runway Overrun Prevention System (ROPS)
- Altitude Setting Monitoring (ALTSM)
- TakeOff Surveillance (TOS2) or Takeoff and Landing Awareness Function (TLAF) on A220 aircraft.

Effects of GNSS Spoofing (Erroneous Signal)

Possible undue surveillance alerts and erroneous ADS-B position reporting

An erroneous GNSS position/altitude may trigger spurious alerts from the following surveillance functions: Predictive TAWS, ROPS, ALTSM, and TakeOff Surveillance (TOS). In addition, the ADS-B position reporting may be erroneous.

Possible loss of the reactive TAWS functions (Honeywell EGPWS and AESS only) and of the TCAS and predictive windshear (AESS only)

On A300, A310, A320 family, A330, A340 aircraft equipped with Honeywell EGPWS, or A350, or A380 aircraft, radio altimeter rejection may be caused by an unsuccessful check of its reasonableness, in some specific erroneous GNSS altitude conditions. This results in the loss of the reactive TAWS. Additionally, on A350 and A380 aircraft, this rejection causes the loss of the TCAS and predictive windshear.

Possible impact on the weather radar

Weather radars that use GNSS data (A300-600 EPIC radar, WXR 2100A, RDR-4000, and A350 & A380 AESS) can experience display anomalies due to GNSS spoofing. In automatic mode, the terrain database is used to filter ground echoes from the radar display. Consequently, an erroneous position and/or altitude caused by spoofing can lead the radar to misinterpret weather echoes as ground echoes. This results in their removal, or conversely, the display of ground echoes as weather echoes.

On aircraft equipped with the Weather Hazard Prediction Function, undue hazard prediction icons may be displayed on the ND. Similarly, undue WEATHER AHEAD messages may be displayed on the ND on radar equipped with the function.

In the case of position jumps, the weather radar function may be lost on A350 and A380 aircraft due to an AESS-internal limitation of handling such jumps.



Aircraft type	TAWS		ADS-B out	ADS-B in (ATSAW)	TCAS	ROPS / ROAAS	ALTSM	TOS 2 / TLAF	Weather radar					
	Reactive TAWS	Predictive TAWS							WXR-2100A RDR-4000 AESU, A220 WXR A300 EPIC	Other radars	Predictive Wind-Shear			
↓ GNSS signal is lost (jamming) ↓														
A220	OK	Possible loss	X	N/A	OK	N/A	N/A	X	OK	N/A	OK			
A300, A310				N/A		N/A	N/A	N/A		OK				
A320, A330, A340			X	X		X	X	Possible loss						
A350				N/A			N/A	N/A		N/A				
A380			Possible loss	N/A										
↓ GNSS signal is erroneous (spoofing) ↓														
A220	OK	Possible undue alerts	Possible erroneous position reporting	N/A	OK	N/A	N/A	Possible undue alerts	Possible performance degradation	N/A	OK			
A300, A310	May be lost (EGPWS only)(*)			Possible erroneous traffic position		Possible undue alerts		Possible undue alerts		The displayed weather may not be reliable(**)		OK		
A320, A330, A340														
A350														
A380				May be lost(*)		N/A	May be lost(*)	N/A	N/A		N/A	May be lost(*)		
OK : Function or capability operational X : Function or capability lost (*) May be temporarily lost due to an undue rejection of the radio altimeter by Honeywell EGPWS or AESU. (**) On A350 and A380 aircraft, the WXR can also be lost														

(Table 1) Summary of surveillance effects.

EFFECTS OF GNSS RFI ON THE COMMUNICATION FUNCTIONS

The table below summarizes the effects that have been identified on communication systems. For more details, the flight crew should refer to the FCOM.

(Table 2) Summary of communications effects.

Aircraft type	ADS-C	CPDLC	SATCOM
↓ GNSS signal is lost (jamming) ↓			
A220	Downgraded accuracy (alternate sources)	OK	OK
A300-600 (EPIC only)			N/A
A320, A330, A340			Iridium: OK Inmarsat: X
A380			X
A350			
↓ GNSS signal is erroneous (spoofing) ↓			
A220	Possible erroneous time and position - May be lost	Possible non-reception or erroneous time stamping of messages	OK
A300-600 (EPIC only)			N/A
A320, A330, A340			Iridium: OK Inmarsat: X
A380			X
A350			

OPERATIONAL CONSIDERATIONS

A dedicated FCOM section provides the procedures to be applied before, within and after a GNSS interference area.



INFORMATION

The procedure for GNSS interference is available in the following documents:

- **A300, A310, A320 family, A330, A340, A380 aircraft:** FCOM - Procedures - Normal Procedures - Supplementary Procedures - GPS interference
- **A350 aircraft:** FCOM - Procedures - Normal Procedures - Supplementary Procedures - GNSS interference
- **A220 aircraft:** FCOM volume 2 - chapter 03 Normal Procedures - Supplementary procedures - GNSS INTERFERENCE
- Additional details about operational considerations related to functional and system effects are provided in the "Flight Operations & Training" tab of the **ISI 34.36.00049**, available on the AirbusWorld portal (A220 not covered in this document).

MAINTENANCE CONSIDERATIONS

Airbus published troubleshooting tasks specifically designed to address GNSS RFI events. It is recommended to perform these tasks after exposure to GNSS interference to clear persistent effects and confirm that system anomalies were indeed caused by GNSS RFI, rather than by a different type of failure.



INFORMATION

The troubleshooting tasks can be found in the following documentation:

- **A320 family aircraft: TSM TASK 34-36-00-810-956-A** Loss of the GPS/GNSS Function Because of the Interference
- **A330/A340 aircraft: TSM TASK 34-36-00-810-946-A** Loss of the GPS/GNSS Function Because of the Interference
- **A350 aircraft: AFI TASK A350-A-34-36-XX-6R001-421A-A** Loss of the GPS/GNSS Function Because of the Interference
- **A380 aircraft: TSM TASK 34-36-00-810-858-A** Loss of the GPS/GNSS Function Because of the Interference
- **A220 aircraft: COLLINS SIL 523-0834272** "non-volatile memory (NVM) clearing procedure"



TRAINING CONSIDERATIONS

Updated Flight Crew Training Standards (FCTS)

Airbus published training recommendations for GNSS interference in the FCTS Annex "Manufacturer Data for EBT" (OTT 999.0027/25 Apr 2025) of all aircraft except A220.

Avoid negative training

To avoid the risk of negative training, Airbus does not recommend using GNSS Interference scenarios that may lead to undue TAWS alerts in the simulator.

PRODUCT ENHANCEMENTS

System Enhancements

Airbus is actively participating in industry efforts to address the GNSS interference phenomenon. Ongoing developments include:

Improvement of interference area identification

As a first step, Airbus is developing a capability to automatically report entry and exit of RFI zones using ACMS and FDM data. The reported data will be shared with flight crews for flight preparation and in-flight awareness.

Spoofing detection implementation and performance improvement of IRS

As a second step, enhanced IRS capable of detecting GNSS spoofing will be implemented, offering enhanced performance to maintain a guaranteed level of navigation service.

MMR/GPS receiver, antennas, and TAWS/AESS computer enhancements

In parallel, the development of enhanced receivers, enhanced antennas, and computer standards is ongoing to improve resilience to GNSS interference. This will lead to a reduction in nuisance alerts, minimize the chance of losing surveillance functions, and decrease the likelihood of persistent adverse effects.

Authenticated GNSS signals and spoofing detection within GNSS receivers

As a third step, the industry is progressing on authenticating GNSS signals and messages to prevent undetected spoofing. Suppliers are also working on developing GNSS receivers capable of spoofing detection, which prevents the transmission of erroneous signals to the aircraft systems.

Jammertest campaign



Airbus, in collaboration with other industry actors, participated in the **"Jammertest" campaign in Norway, September 15-19, 2025**, to test new technologies against GNSS interference on an A330neo aircraft. The objectives were to evaluate the performance and maturity of innovative technologies proposed by our suppliers, in a controlled jamming and spoofing environment, and to understand the aircraft systems' behavior reported by Airbus operators.

The data collected during the campaign significantly helped the participants in advancing the definition of new solutions to address the phenomenon.



INFORMATION

An status of the on-going enhancements is provided in the "Flight Operations & Training" tab the **ISI 34.36.00049**, available on the AirbusWorld portal (A220 not covered in this document).

Documentation Enhancements

Airbus regularly updates the FCOM and ISI articles concerning GNSS interference with the latest available information and recommendations. Operators are advised to regularly check these resources for updates. Furthermore, Airbus organizes regular webinars to communicate the latest information.

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GNSS Radio Frequency Interference (RFI) is frequently encountered in some areas of the world, particularly around conflict zones. GNSS RFI includes jamming, which results in the loss of GNSS signals, and spoofing, which provides erroneous signals.

Many aircraft systems rely on GNSS data and may, therefore, be affected by RFI. The resulting impact on aircraft systems varies significantly depending on whether the aircraft is in a GNSS jamming or spoofing area.

Aircraft position computation is generally robust in the case of GNSS jamming due to the reversion to other position sources when the GNSS signals are lost. However, some navigation capabilities may be lost due to the potential degradation of the aircraft position accuracy.

In the case of GNSS spoofing, in some specific conditions and depending on aircraft configuration, the erroneous GNSS data may not be detected. This can result in erroneous aircraft position computation, with unexpected aircraft turns while the autopilot is engaged, and map shifts, as well as abnormal IRS drift.

Many surveillance and communication functions rely directly on GNSS information. Consequently, a loss of GNSS signal generally results in loss of function. In the case of GNSS spoofing, effects may include undue surveillance alerts or degradation of function performance.

The FCOM includes a chapter dedicated to operations in GNSS interference areas, providing a detailed list of cockpit effects and procedures to be applied for all phases of flight.

Airbus published troubleshooting tasks specifically designed to address GNSS RFI events, as well as training recommendations in the Flight Crew Training Standards (FCTS) manual.

Using the benefit of the Jammertest campaign, and in collaboration with the wider industry, Airbus is developing aircraft system enhancements to improve GNSS resilience to RFI. These new features will be progressively implemented as soon as they become available.

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The Airbus Safety magazine

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