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GNSS Interference on Aircraft

BACKGROUND

Modern air traffic relies heavily on the internal accuracy of aircraft systems and the aircraft's ability to monitor its own reliability. In recent years, satellite-based Communication, Navigation, and Surveillance (CNS) services have been taking a growing part in the overall ATM system, and aircraft are becoming more reliant on space-based signals.

The accuracy achieved by these signals enables aircraft to perform instrument procedures without the need to rely on ground-based navigational aids, facilitates the reduction of separation by ATC and helps optimizing airspace capacity. Many aircraft navigation and warning systems rely heavily on accurate position.

REASONS FOR SIGNAL LOSS

Satellite signals are by nature very weak when they arrive at the receiver and thus vulnerable to interference, both natural or artificial, intentional (including jamming and spoofing) or unintentional (malfunctions). There is concern about the proliferation of interference capable equipment including portable electronic devices (PEDs), incorrectly operated GNSS repeaters, miss-operated test equipment, and the foreseeable proliferation of sophisticated spoofing devices in the future.

For example, Personal Privacy Devices (PPDs) designed to make their users ‘untraceable’ by jamming GNSS signals around them, can also interfere with aircraft or airport Ground-Based Augmentation System (GBAS) and ADS-B ground stations at close distance.

Many instances of en-route signal loss have been linked to the military. Whilst investigations cannot always confirm military activity as the cause of the outages with certainty, this remains likely for cases near conflict zones. These zones are normally closed to civilian traffic, which is re-routed, but interference to CNS services can extend far outside of the prohibited airspace, in particular when high power jammers are used, impacting a very large volume of airspace.

EFECTS OF GNSS SIGNAL INTERFERENCE ON AIRCRAFT

The effects of a degradation of the GNSS signal vary greatly. Satellite signal jamming is not always identified by aircraft systems or the crew, but can have a serious effect on the accuracy of navigation systems and, in some cases, results in unusual system behaviour. For example, some aircraft types have lost the enhanced functions of EGPWS and have experienced Terrain Avoidance and Warning System (TAWS) errors which triggered sudden, unwarranted warnings, including during instrument approaches. Other aircraft lost their clocks, and in some cases of long-lasting signal loss, the clocks began to move backwards.

As false warnings occur, genuine ones may not, subjecting aircraft to more safety hazards. This could have a long-lasting effect on the crew's trust in the aircraft's warning systems: a pilot receiving a false warning due to system position inaccuracy may be tempted to disregard a similar – but real - warning later. Moreover, false warnings increase pilot workload and could cause distraction during critical phases of flight.

GNSS signal interference (whether intentional or unintentional) can occur at any time, with or without prior notice. Flight Crews should be aware of the potential risk and plan for alternative procedures as necessary