

GNSS RFI : Short Term and Mid Term considerations

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Short term – Detect GNSS jamming and spoofing, control damages

> At the Navigation system level there are many solutions

- ▶ The first layer is the detection/exclusion
 - At Thales we have designed a civil certified receiver with indicators on the presence of jamming and spoofing signals
 - › Avoiding false alarms
 - › Avoiding missed detection
 - The system must be thoroughly tested and diagnosed to avoid any contamination of the erroneous GNSS into the other systems using GNSS
 - › Communication ,TAWS, radio navigation, time distribution
 - A back up PNT be solution must be used,
 - › Pure ground Radio Navigation when available
 - › INS Coasting
 - › INS blended with Radio Navigation



> The recovery of the GNSS might be difficult

- ▶ After a long exposure to jamming and/or spoofing signals the receiver might not be able to recover a safe navigation
 - Receivers are not currently designed to sustain long saturation of the RF input
 - Receivers may have received false navigation messages including misleading Almanachs/ephemerides



Medium to Long term – Use anti jamming and anti spoofing techniques

> Resistance inside the receiver

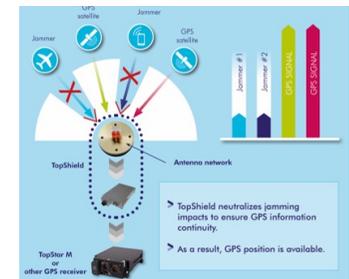
- ▶ There are signal processing techniques that can eliminate the effect of Jamming
 - They are well known in the military domain and must be translated to civil certified usage
 - The impact of such techniques must be weighed against the fundamental signal assumptions in the MOPS
- ▶ Anti spoofing techniques can also be implemented through encryption techniques

> Resistance at the antenna level- CRPA

- ▶ Multi element antenna and antenna electronics can be used to create nulls towards the jamming sources
 - The most powerful tool available today
 - May reduce the nuisance radius around the jammer by a factor of 100
- ▶ A side effect is also to consider most spoofers as jammers and therefore cancel their effect

> But :

- ▶ these techniques have been developed for military applications
 - There are export control limitations to avoid "proliferation" and keep the asymmetry in favour of military platforms
- ▶ These techniques have an impact on the signal injected into the receiver – leading to unwanted errors
 - They might not be available for all phases of flight



Intensive work Required at the Standardization
Already started for the future generation of receivers (SBAS DFMC)

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Thank you

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