



Joint ACAC/ICAO GNSS Workshop

GNSS Vulnerability IATA's Perspective

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IATA at 30,000 ft



- Founded in Havana, Cuba on 1945
- 281 airline members
- Representing 84% of total air traffic
- 63 offices in 60 countries worldwide,
- 1420 employees
- Three major association roles:
 - Representation
 - Standard setting
 - Industry leadership
- Provider of aviation solution

*Mission to **represent**,
lead and serve
the airline industry*



GNSS Use

- GNSS provides **position** and **timing** information supporting several important flight and air traffic management (ATM) operations
 - GNSS is recognized as a main enabler to ICAO PBN operations.
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GNSS receiver

- main source of position information which drives the aircraft navigation system.
 - primary equipment supporting (RNP) operations input to:
 - Navigation Display (ND),
 - GPWS and ADS.
 - some business aircraft use GNSS as a reference source for aircraft flight control and stability systems
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Impact of harmful interference

Impacts on aircraft :

- loss of on-board GNSS functionality;
 - [GPS-L INVALID] and/or [GPS-R INVALID] messages appear;
 - decrease in navigation performance leading to RNP alert;
 - [NAV UNABLE RNP] message appears;
 - in some aircraft, aircraft navigation reverted to IRU or DME/DME after GNSS loss;
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Impact of harmful interference

cont.

- impact on Navigation Display;
 - a large “map shift” was observed;
 - impact on GPWS;
 - [TERR POS] and [EICAS TERRAIN POSITION] messages appear;
 - in certain cases, “Terrain Terrain, Pull-Up Pull-Up” aural alerts occur;
 - loss of auto-land and ADS reporting capabilities.
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Impact of harmful interference

Cont.

- Noting the on-going worldwide deployments of automatic dependent surveillance – broadcast (ADS-B),
 - harmful interference to GNSS will also adversely impact ATM operations.
 - A degradation or complete interruption of ADS-B surveillance services will have significant impact to ATM operations once ADS-B is deployed as the sole mean of ATM surveillance.
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MID Action to report GNSS Interference

- The MID CNS SG/7 meeting (Cairo May 2016) agreed on data collection of actual interference causes and requested States as well as IATA to collect data using the GNSS Interference Report Form.
 - IATA provided incidents reported for the 2015- 3Q .2017
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GNSS interference reporting form to be used by pilots

Originator of this Report:	
Organisation:	
Department:	
Street / No.:	
Zip-Code / Town:	
Name / Surname:	
Phone No.:	
E-Mail:	
Date and time of report	
Description of Interference	
Affected GNSS Element	<input type="checkbox"/> GPS <input type="checkbox"/> GLONASS <input type="checkbox"/> other constellation <input type="checkbox"/> EGNOS <input type="checkbox"/> WAAS <input type="checkbox"/> other SBAS <input type="checkbox"/> GBAS (VHF data-link for GBAS)
Aircraft Type and Registration:	
Flight Number:	
Airway/route flown:	
Coordinates of the first point of occurrence / Time (UTC):	UTC: Lat: Long:
Coordinates of the last point of occurrence / Time (UTC):	UTC: Lat: Long:
Flight level or Altitude at which it was detected:	
Affected ground station (if applicable)	Name/Indicator; [e.g. GBAS]
Degradation of GNSS performance:	<input type="checkbox"/> Large position errors (details): <input type="checkbox"/> Loss of integrity (RAIM warning/alert): <input type="checkbox"/> Complete outage <input type="checkbox"/> Loss of satellites in view/details: <input type="checkbox"/> Lateral indicated performance level changed from: ___ to ___ <input type="checkbox"/> Vertical indicated performance level changed from: ___ to ___ <input type="checkbox"/> Indicated Dilution Of Precision changed from ___ to ___ <input type="checkbox"/> information on PRN of affected satellites (if applicable) <input type="checkbox"/> Low Signal-to-Noise (Density) ratio <input type="checkbox"/> other

Reported Interference in MENA Region

Date	Flight	ACFT	Duration	Remark
05/07/15	APP/Landing	A330		During approach to HECA ,many intermittent alarms: NAV FM/GPS disagree on ECAM
20/08/15	climb 1000-10000 ft	B773	30 Sec	Passing 1000ft on ALSEMIM departure ,GPS update lost.INERTIAL displayed .ANP increased to approx.2.5 EICAS"NAV JNABLE" .GPS update returned afetr 30 Sec.Occured once more on climb at 10000ft .GPS update returned afetr few seconds
28/08/15	Climb GND-7000ft	B737	6 min	Shortly after departure from RWY34R from DOH we lost both GPS L/R. After passing 7000ft we got back one GPS. Both GPS was intermittent ON and OFF until passing 50nm out from DOH. Afterwards It was normal.
29/08/15	Climb	B 737	7min	Outbound from DOH, we lost both GPS L and GPS R passing 2000ft climbing. Returned at approx 60nm from DOH at FL210. Max ANP seen 0.17
28/11/15	Landing 05C	B777		from 1000ft to gnd
06/12/15	Landing 05C	A330		
17/12/15	Take off 23C	A340		Nav fm/gps pos disagree, gps 2 fault unt'l FL70
19/12/15	FL330	B777	6min	on AWY T923 ANP increased to 2,7
21/12/15	FL330	B777		
22/12/15	Cruise level	B777	30-min	
22/12/15	Cruise level	B777	20min	
28/12/15	Cruise level	B777	15min	Loss of GPS (pos ref) with ANP increasing
29/12/15	Approach	B77L		On ILS 34L, EICAS Runway POSND showed inertial position temporary – then GPS showed again EICAS cleared
04/01/16	Take off 23C	A330	20min	GPS1 loss on RWY axis, GPS2 lost and recovered w/o action
23/01/16	Climb 1500-15000 ft	B773		GPS position lost on departure from 1.500ft – 15.000ft between 'turning right' DCT to ALSEM
13/02/16	Cruise level	B777	5min	both gps loss, NAV unable RNP, GPS, RWY POS.
25/02/16	Cruise level	B777		TERR POS, NAV UNABLE RNP, loss of both GPS. GPS2 never recovered from event...
08/03/16	Take off 23C	A330	2min	loss of GPS1
31/03/16	Landing 05C	A330		By 2000ft loss of GPS1, with NAV FMS POS, GPS pos disagree

Reported Interference in MENA Region

Date	Flight	ACFT	Duration	Remark
06/06/16	Landing 05C	A330		tempo loss of GPS1 btn 6,5 IZFC dme/6,2 and 3,9/3,4
10/06/16	30NM EAST OF DASIS UL333	B777	5 min	About 30nm prior to DASIS westbound in Tehran FIR we lost GPS reception from both sensors, we checked with the aircraft around us and the four of them confirmed similar situation, The signal returned some 40nm after DASIS.
07/07/16	Landing 05C	A330		GPS pos disagree
17/08/16	Landing	A330		Both GPS lost on final btn 1000' and 500'.
05/09/16	Cruise level	A330	10min	Loss of GPS1 then GPS2
22/10/16	Cruise level	B777	2 min	Approximately 200nm from position Alram (Ankara/ Tehran FIR boundary) GPS indication on Nav display briefly Blanked and was replaced by INERTIAL. Shortly after crossing boundary, a repeat event occurred, this time lasting for approximately two minutes
28/11/16	Cruise level 350 ft	B772	4 min	In cruise FL 350, 30 NM North-West position ENEDA (Tehran FIR) on Airway UT-36 total loss of GPS signal for approximately 4 minutes (04:14UTC) Self recovered South- East ENEDA.
22/08/17	Cruise level	B777	19 min	EICAS msg ADS B-OUT L annunciated. Almost immediately after R transponder was selected, ADS B-OUT R annunciated on EICAS. It was observed concurrently that INERTIAL was displayed as navigation source on ND in place of GPS. During ensuing 15 minutes, various EICAS messages annunciated including RAAS, RUNWAY POS, NAV UNABLE RNP, GPS, TERRAIN POS, etc. At approximately 0929z, GPS was restored. All systems operated normally prior to and following this event.
27/08/17	Cruise level	B772	40 min	Loss of GPS signal in ROSTOV FIR, for approximately:40
23/10/17	Cruise level FL380	A320	5 min	within ANK FIR, and approximately 40 miles east of waypoint BAYIR, ECAM caution ADS B Traffic and ADS B RPTG 2 were triggered followed shortly by NAV GPS1 / NAV GPS 2 fault.
24/10/17	Cruise level	A330	extended time	During both sectors DOH BEY and BEY DOH. From area around 37.23N 038.50E and for the rest of LTAA FIR complete loss of GPS signal was experienced. On the first sector the problem was present until landing at BEY. On the return sector the issue was recovered when entering OIIX FIR at position ALRAM. 4 other aircraft notified the ATC of same problem
25/10/2017	Cruise level FL370	A320	5 min	NAV GPS1 Fault ECAM warning was triggered while overflying Ankara FIR close to EZS VOR.



Impact of Interference in MENA Region

- reports of GNSS interference resulted in sever impact to operations
 - Long duration of signal loss 40 min .
 - RNAV approach procedures suspended in one of the airport
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IATA Position on SBAS

- Airlines who are equipping with SBAS are doing so based upon their **individual operational** requirements and business case.
 - IATA member airlines who are not planning to utilize SBAS are concerned that they may be **adversely impacted** by its implementation.
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IATA Position on SBAS

➤ Three essential requirements for SBAS implementation :

- no mandatory requirements by regulatory authorities to fit SBAS equipment to aircraft;
 - **no unjustified restrictions** to operations due to a lack of SBAS equipment; and
 - no costs related to SBAS being imposed directly or indirectly to airspace users who do not use such technology.
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Conclusion

- IATA express a strong concern on the operational impact of interference to GNSS (31 incidents in MID Region)
 - Support ICAO for its on going efforts in developing and implementing GNSS mitigation plan/measures
 - Consider Users position when planning for SBAS implementation.
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