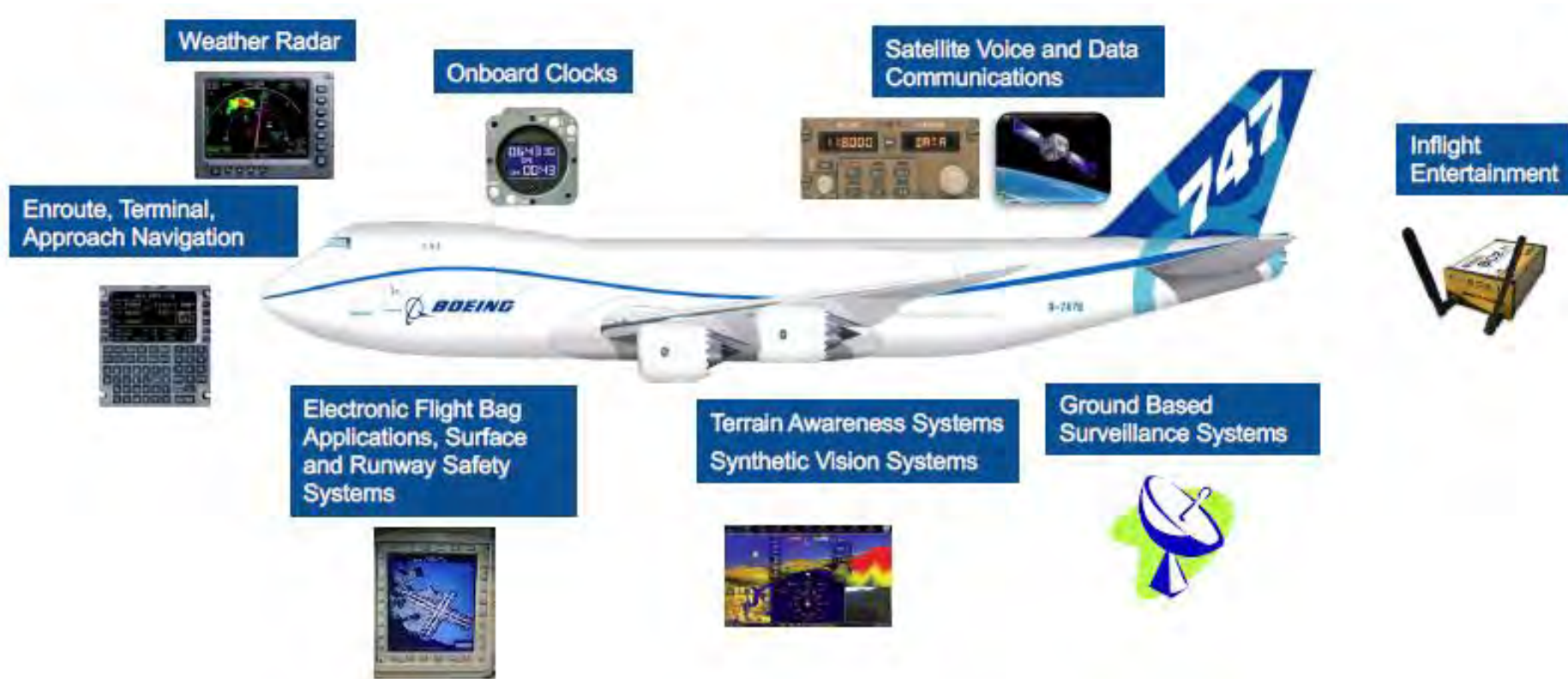


Concept of Operations for GNSS Event Reporting

GNSS Interference

- The vulnerability of GNSS to interference is known and affecting many transportation modes
 - Jamming
 - ✓ Very low power level required
 - ✓ Jammers are cheap and available
 - Spoofing
 - ✓ More difficult, but certainly a threat
 - Environmental occurrences
 - ✓ Generally very rare, but possible

Examples of A/C GNSS Interfaces and Dependencies



Most CNS/Safety Systems have GNSS interfaces and would be impacted during a GNSS event!

Key objectives

1. How to identify and declare GNSS events
2. What information should be collected
3. How to disseminate information and to whom it should be communicated

GNSS Outage Responses

- A tracking system is essential to the effective resolution of a GNSS event
- Verified GNSS events should be reported to the NOTAM system, airport Automatic Terminal Information Service (ATIS) broadcasts, Pre-Flight Information Bulletins (PIBs), and other existing methods

GNSS Event Stakeholder Reports

- Ensure all relevant stakeholders can provide input and receive output
- Identify a GNSS event using a report that captures the most relevant information and can be entered into the centralised tracking system in a timely way
- Most critical information is the ***date and time of the event, the location of the event, and the nature of the operational impacts***

Report Examples

ATC GNSS EVENT REPORT		
Date	12/3/21	
UTC Time	13:55:04	
Facility Location	TMA / ACC / Aerodrome	
Impacted Sector	North Feeder	
Impacted Area	Total / Partial	
Additional Details (Free Text...max 240 char)		
ADS-B targets not available in Northeast Corner of Sector.		
Pilots reporting unable GPS Arrivals.		
145 Characters remaining		
ENTER	RESET FORM	CANCEL

**ATC GNSS
Event Report**

AIRCRAFT GNSS EVENT REPORT	
Date	12/3/21
UTC Time	13:55:04
Aircraft Type	A359
Flight ID	SII377
A/C Registration	9VSHI
ICAO ID	76CDOB
Location	00:21:41 N 104:49:55 E
Nearest WPT or NAVAID	VENPA
Altitude	FL250
Details Page	

**Aircraft
GNSS Event
Report**

GNSS EVENT REPORT DETAIL	
Aircraft Systems Impacted	
NAV	Y / N / U
ADS-B OUT	Y / N / U
ADS-B IN	Y / N / U
FANS / ATN	Y / N / U
TAWS / EGPWS	Y / N / U
SATCOM	Y / N / U
WX Radar	Y / N / U
RAAS	Y / N / U
SVGS	Y / N / U
EFB	Y / N / U
Other Info (Free Text...max 120 char):	
120 Characters remaining	
ENTER	

**GNSS Event
Report Detail**

First Report

- First report of a GNSS anomaly may be due to an alert from the navigation system
- A loss of GNSS may first be observed by a ADS-B transponder warning
- ATC should try to confirm the event and identify potentially impacted aircraft. ATC should query pilots to determine if more than one aircraft is affected, the nature of the impacts to the individual flights, and ATC services that might be needed

Second Report

- Second report will automatically trigger a “Warning” alert if two events occur within a threshold time span, which would likely be between 15 minutes and 6 hours
- ATC will notify pilots that a GNSS event is suspected and query the status of navigation and other GNSS functions on-board their aircraft
- Ground personnel should also coordinate with flight crews to ensure clear communications about the details of the situation

Third Report

- Third event within the time event threshold, the GNSS event tracker will notify stakeholder subscribers that an active GNSS event appears to be in progress
- ATC will make a broadcast announcement on VHF radio that a GNSS event is in progress, NOTAMs will be issued, and ATIS will be updated to reflect the GNSS events and impacts
- Management of ATC workload is critical
- Air carrier air crews and ground-personnel should remain in close contact to relay all information about the event

Recommendations (Part 1)

- Develop and implement a centralised GNSS event reporting capability for use by all GNSS event stakeholders within a State
- With input from stakeholders, develop and implement procedures to identify, communicate, and coordinate responses to a GNSS event
- Develop a set of specific information that is most critical to be included in a GNSS event report to support identification, mitigation, and forensic analysis

Recommendations (Part 2)

- Define the roles and responsibilities for each aviation stakeholder and then do the same with all non-aviation stakeholders
- Engage entities outside of aviation, such as the Land and Maritime Authorities, to understand potential impacts to other industries for a GNSS event and their need to engage in GNSS resiliency planning
- Use planning meetings, table-top exercises, and/or simulations to develop a set of GNSS event scenarios that can be used to illustrate the implementation of GNSS BCPs

Thank You!