Federal Aviation Administration

Early Implementation Experiences

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Outline

1 – Errors Seen In Early Implementations

- 1.1 Software related
- 1.2 GPS related
- 1.3 Installation related

2 – Compliance Monitoring

- Initial data

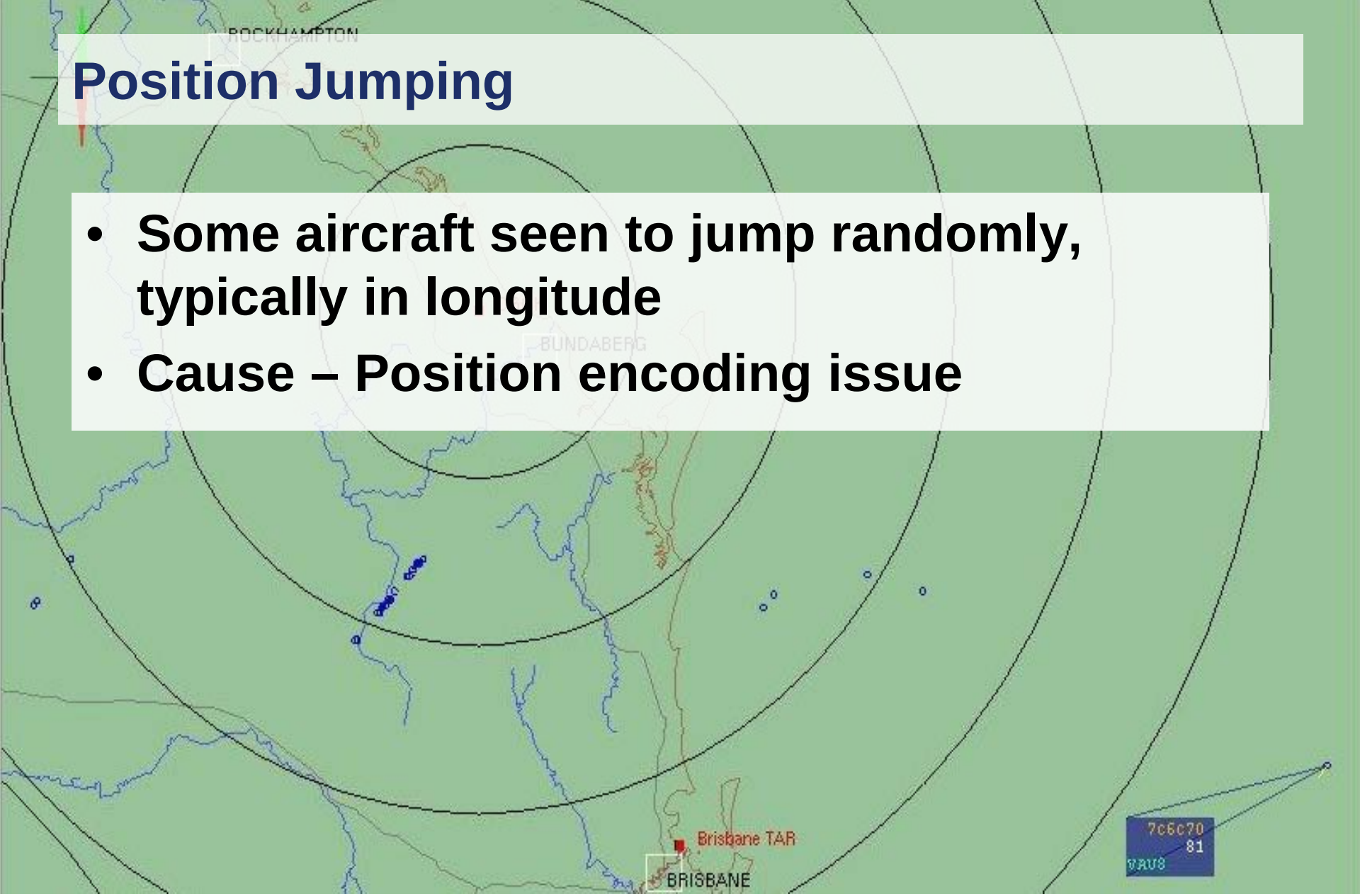
3 – Conclusion

1.1 Software Related Errors

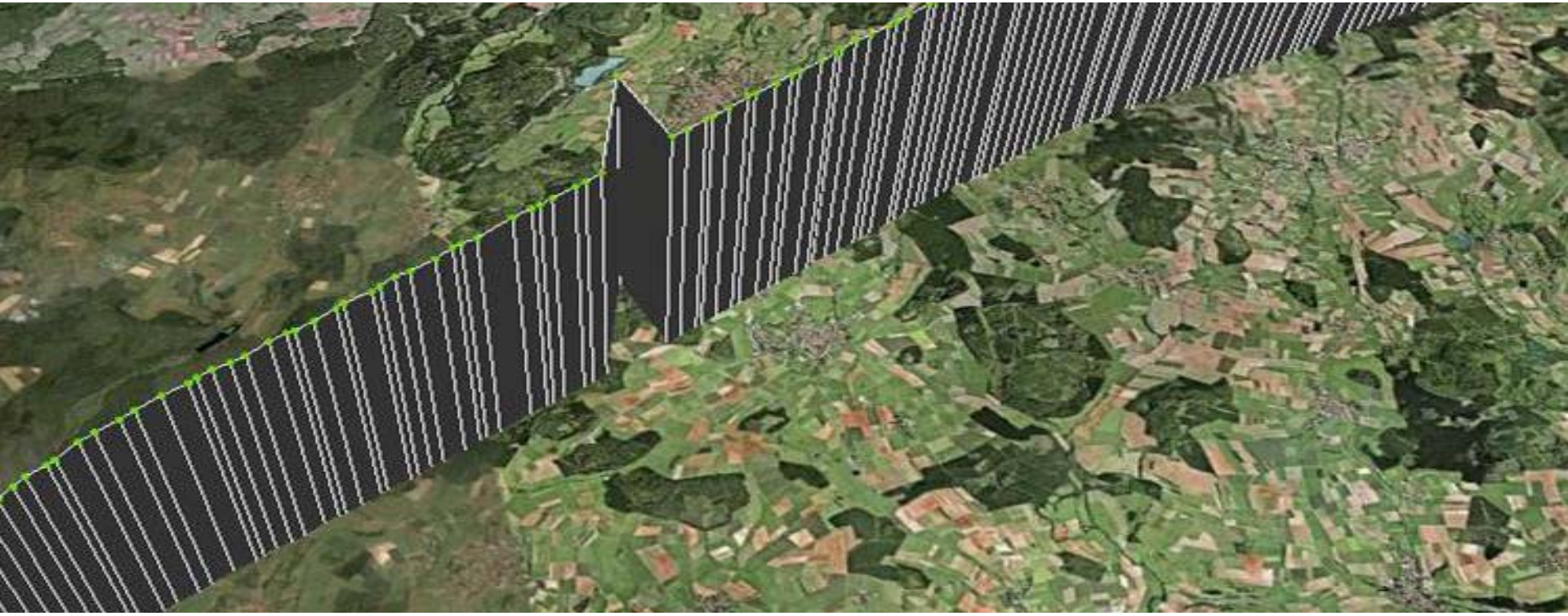
- **Position Jumping**
  - Position encoding related jumps
  - Old encoding format predating DO-260
  - Source selection issues
  - Data corruption
- **Integrity Errors**
  - Value incorrectly based on accuracy
  - Integrity not encoded properly
- **Software related Flight ID problems**

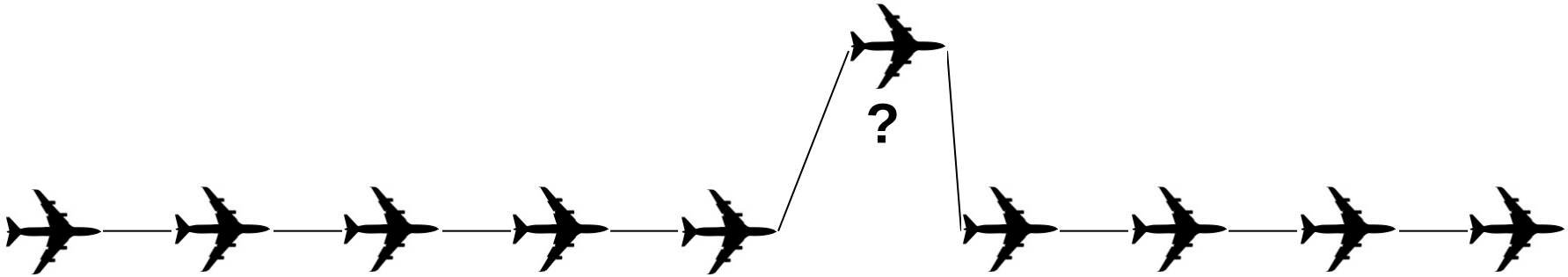
Position Jumping

- **Some aircraft seen to jump randomly, typically in longitude**
- **Cause – Position encoding issue**

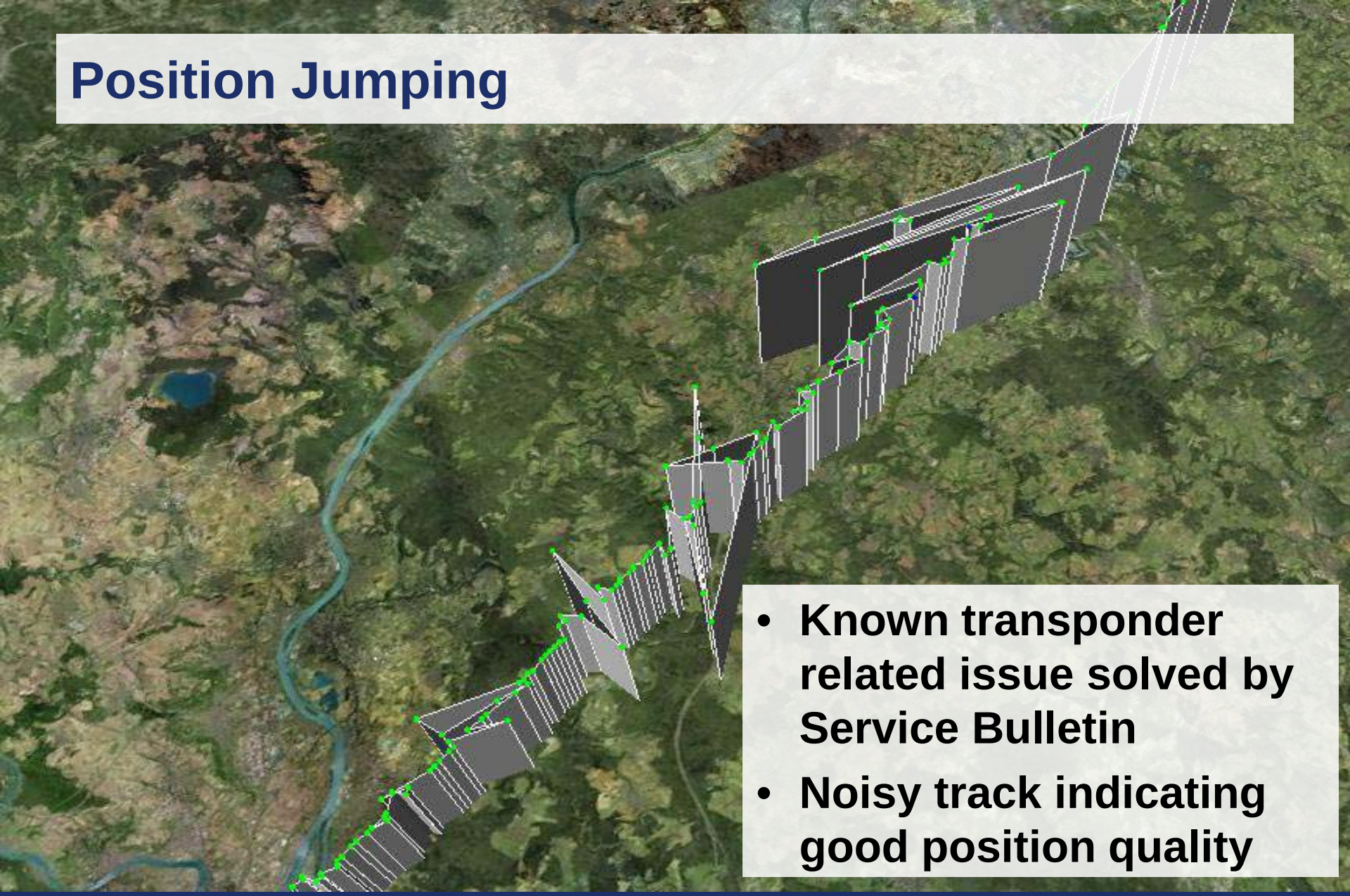


Position Jumping



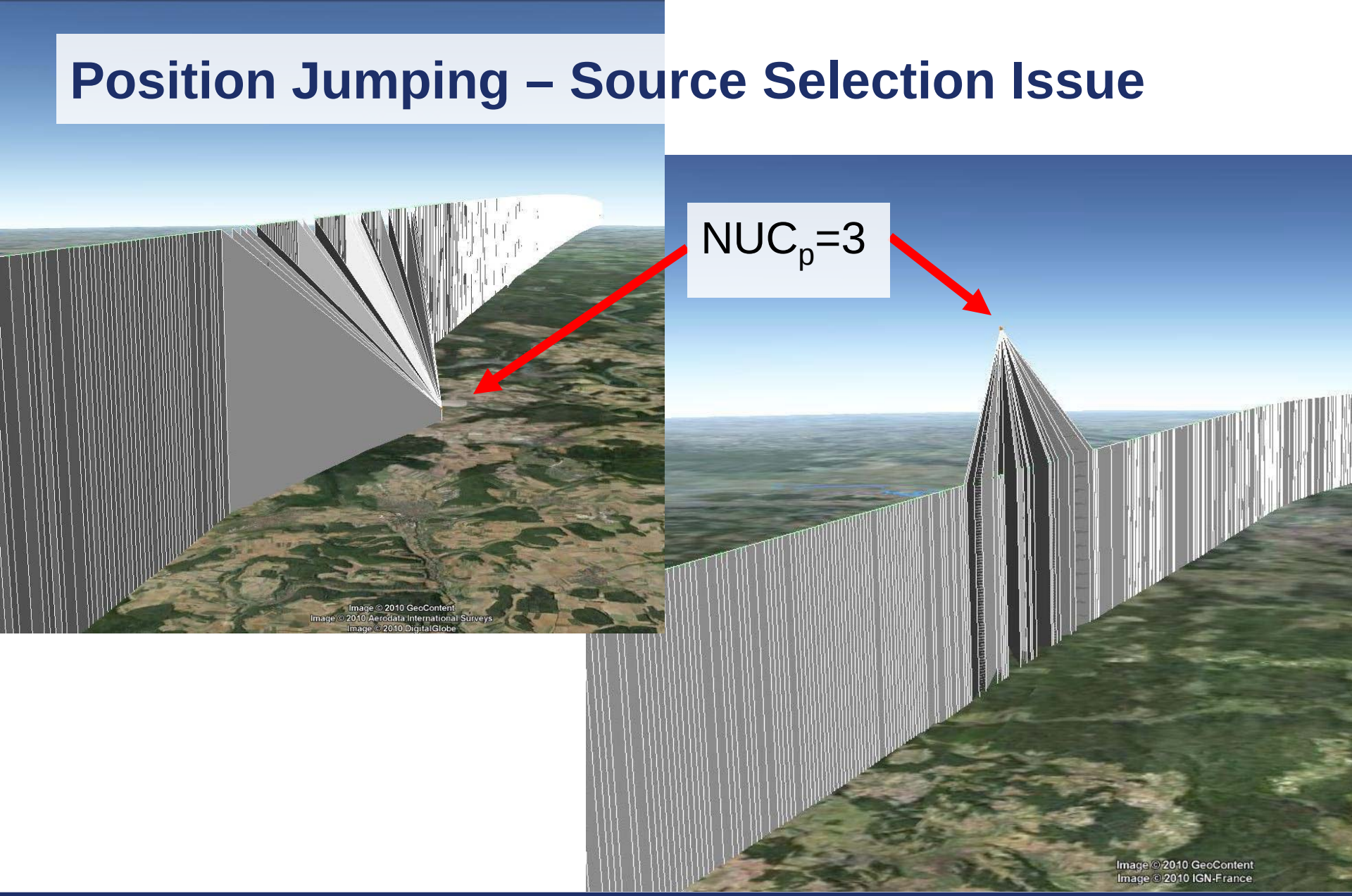


Position Jumping



- Known transponder related issue solved by Service Bulletin
- Noisy track indicating good position quality

Position Jumping – Source Selection Issue



Integrity Errors

- **Error – Transponder broadcasts an Integrity value one category too low**
- **Cause – Integrity encoded based on accuracy rather than integrity**

Integrity Errors

- **NUC normally zero but occasionally jumps to 3**
- **Possibly FMS data source**

Software Related Flight ID Errors

- **Error – Flight ID incorrect or contains invalid characters**
  - Trailing U added to correct Flight ID
  - Flight ID corrupt
- **Cause – Improper software encoding/decoding of source data**

1.2 GPS Related Errors

- **Inconsistent implementation of standard interfaces**
  - Invalid Integrity or other parameters
- **Incomplete data set**
- **Data available but not certified**
  - No standard established for data on bus

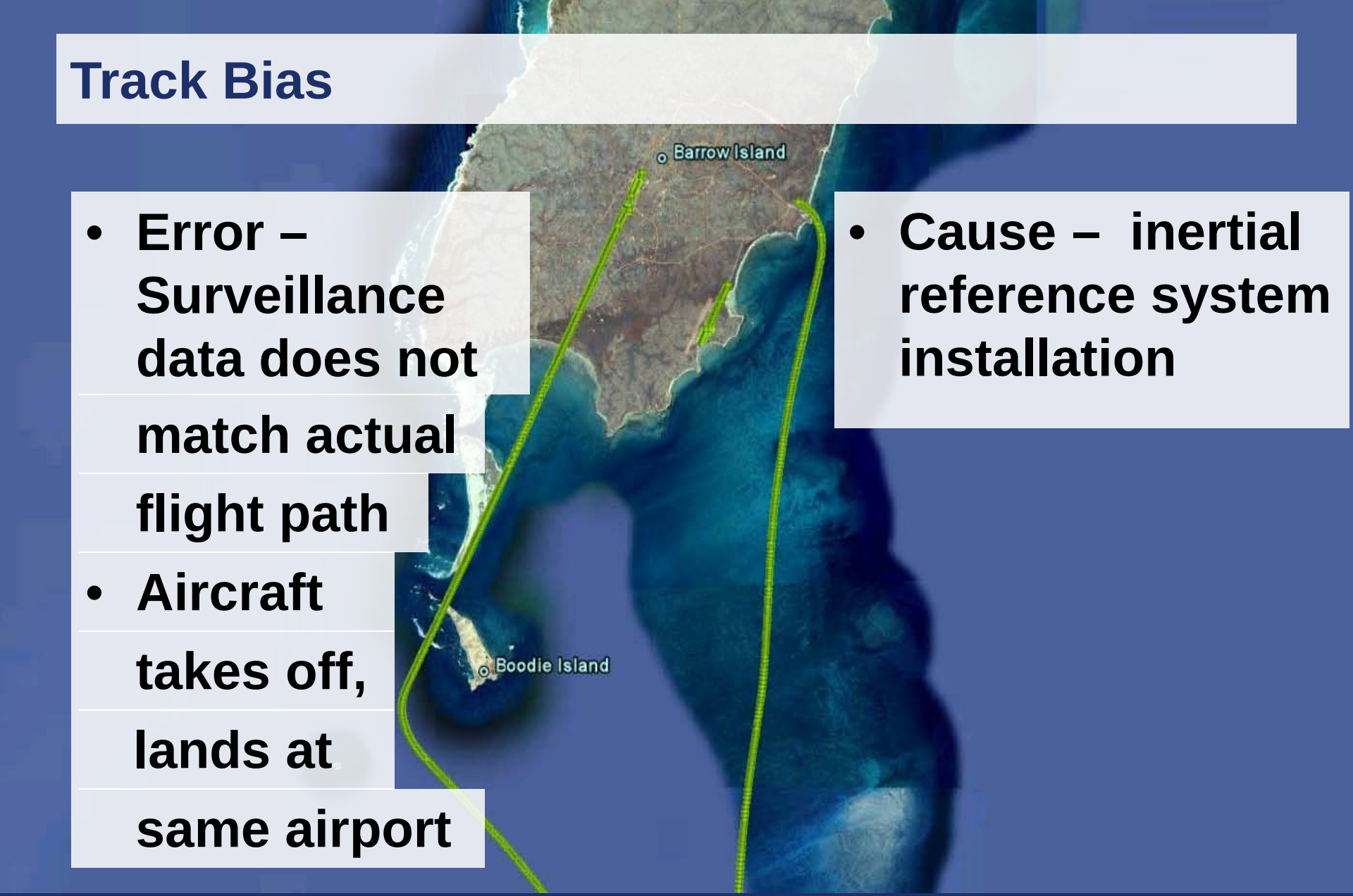
1.3 Installation Related Errors

- **Position Jumping backwards**
- **Track bias**
- **Setting SIL=0**
- **AIR/Ground determination**
- **Incorrect 24 bit address, Flight ID**
- **Australian Statistics**

Aircraft Position Seen To “Jump” Backwards

- **Error – Aircraft position seen to jump backwards**
- **Cause – Dynamic latency between position update because of routing through air data computer**

Track Bias



- Error – Surveillance data does not match actual flight path
- Aircraft takes off, lands at same airport

- Cause – inertial reference system installation

Installation Related Errors

- **SIL=0**
  - Incorrectly programming or “strapping” avionics
- **Incorrectly determining air/ground**
  - Poor Aircraft level analysis
  - Incorrect programming of speed thresholds
  - Single sensor measurements
- **Installers not following programming procedure allowing the avionics unit to set a default N registration value**
- **Incorrectly setting 24 bit ICAO address**
- **Not wiring a Flight ID source**

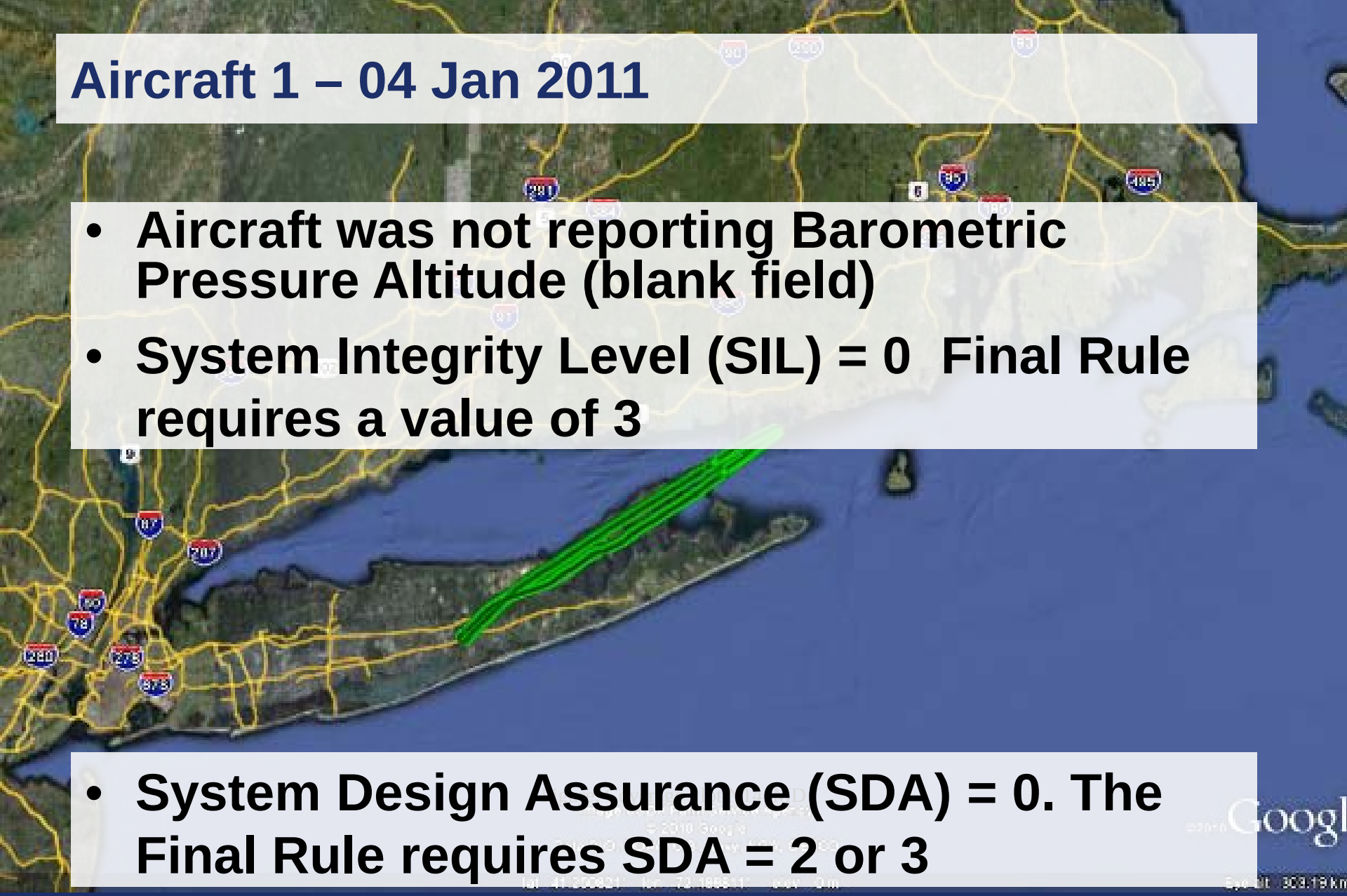
Australian Statistics

- **Sydney Australia, 1-2 October, 779 aircraft observed:**
  - 4.1% errors noted with either Flt ID or 24 bit address
  - 3 incorrect 24 bit addresses
  - 21 had all spaces for flight ID
  - 8 had wrong flight ID

U.S. Compliance Monitoring Results

- **Aircraft 1 – 04 Jan, 2011**
  - No Baro Pressure
  - SIL=0
  - SDA=0
- **Aircraft 2 – 25 Jan, 2011**
  - NACv=0
  - Aircraft Length/Width subfield blank (even on ground)
  - Aircraft Emitter Category subfield blank

Aircraft 1 – 04 Jan 2011



- Aircraft was not reporting Barometric Pressure Altitude (blank field)
- System Integrity Level (SIL) = 0 Final Rule requires a value of 3
- System Design Assurance (SDA) = 0. The Final Rule requires SDA = 2 or 3

Conclusion

- **ADS-B is a complicated system. Only attention to detail and thorough testing will prevent errors *before* an aircraft enters the NAS**
- **Errors being seen in “compliant” systems**
- **ADS-B systems must not compromise safety within the NAS**
- **The FAA monitoring program is beginning to analyze data**

For More Information:

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