ADS-B Flight Testing Activities

FAA
William J Hughes Technical Center

Flight Test Purpose

- Measure the performance of prototype equipment for each candidate link in real time flight operations
- Validate theoretical link budget calculations, simulation models and bench measurements
- Make measurements to answer individual link issues

ADS-B Flight Testing

- Flight Tests have been conducted for the 3 candidate links
  - 1090 MHz Extended Squitter
  - UAT
  - VDL Mode 4

ADS-B Flight Testing

- Flight Test Participation included FAA, EuroControl, industry and other organizations
  - FAA, EuroControl and others provided aircraft and measurement instrumentation systems
  - Industry provided aircraft, equipment and prototype transceivers
  - Valuable data has been collected on each link and utilized in validation for application development

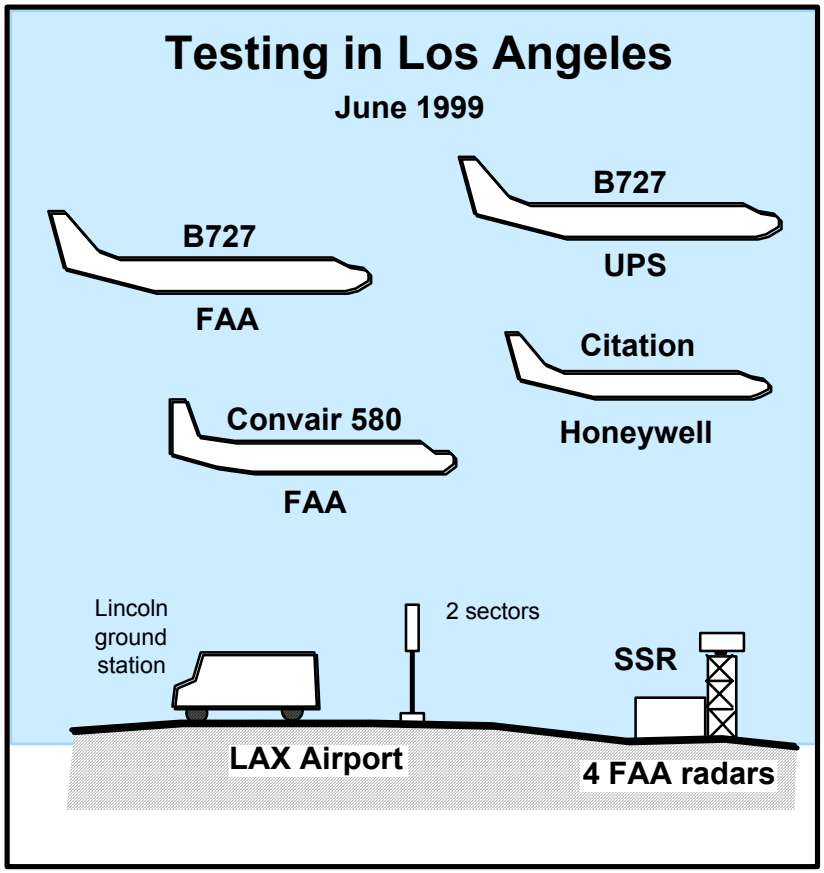
1090 MHz Flight Tests

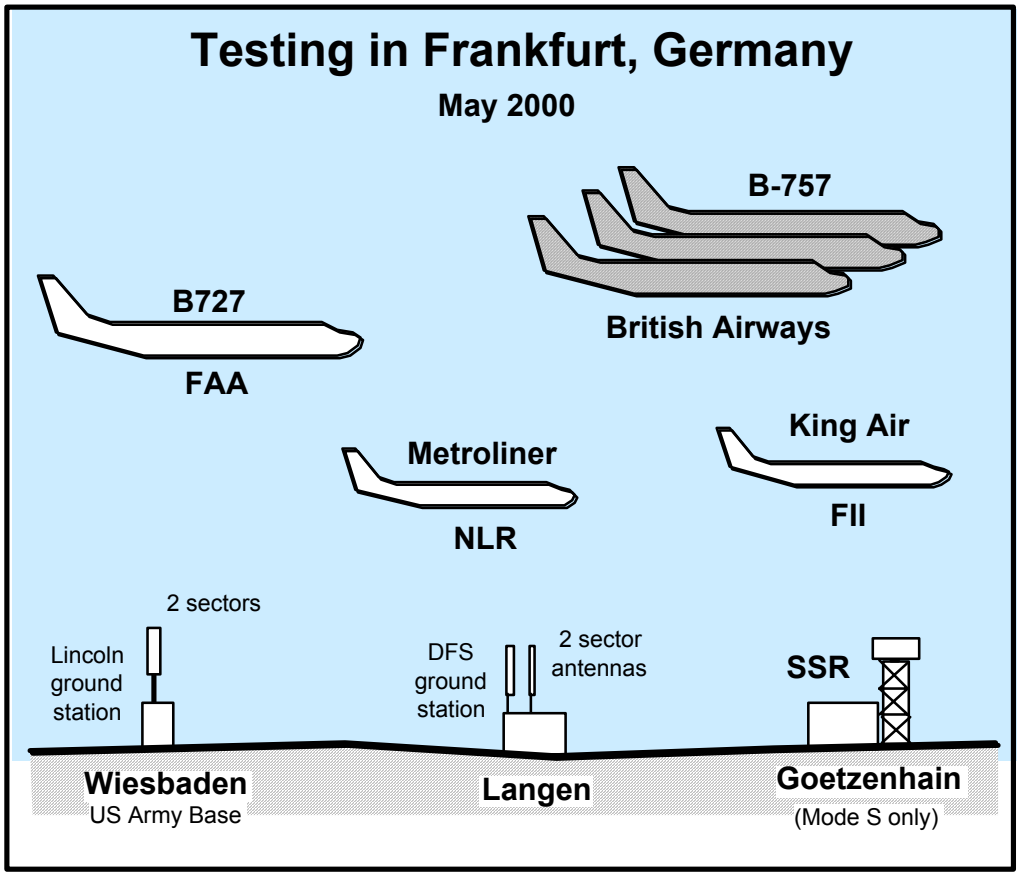
- Flight Tests with 1090 MHz Extended Squitter
  - Los Angeles 1999 Flight Trials
  - Frankfurt 2000 Flight Trials
  - Participated in Safe Flight 21 Program Operational Evaluations in Ohio Valley

1090 MHz Flight Testing Activities

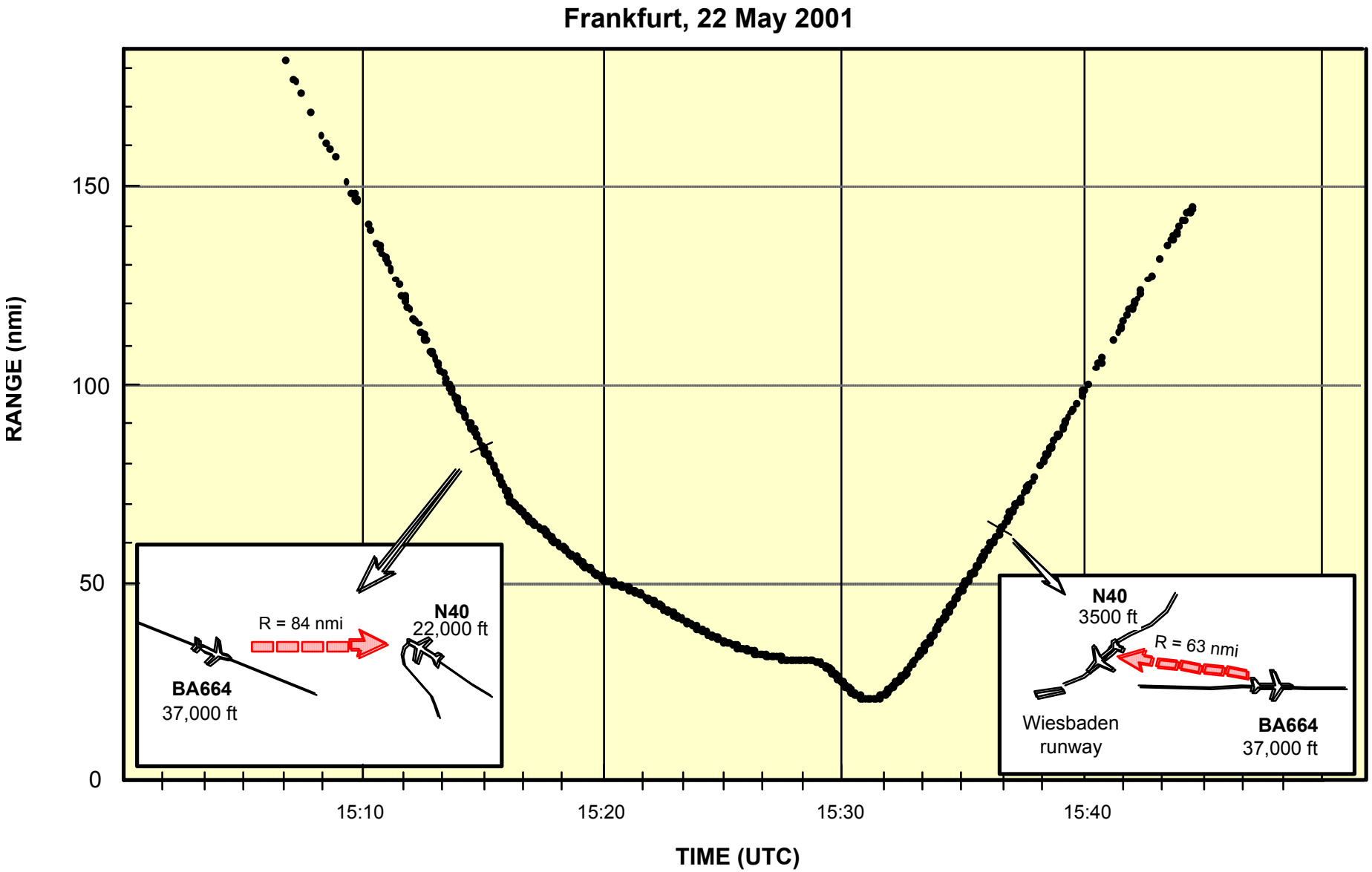
- 1090 MHz Extended Squitter (ES)
  - Co-channel interference associated with existing ground radars, and TCAS is an important determinant in ADS-B system performance
  - Selected high density locations (i.e., LA and Frankfurt) to measure interference environment and measure the system performance in these worst case areas
  - Measurements of flight tests utilized to validate simulation models

1090 ES Flight Testing





Extended Squitter, Air-to-Air Performance



UAT Flight Testing

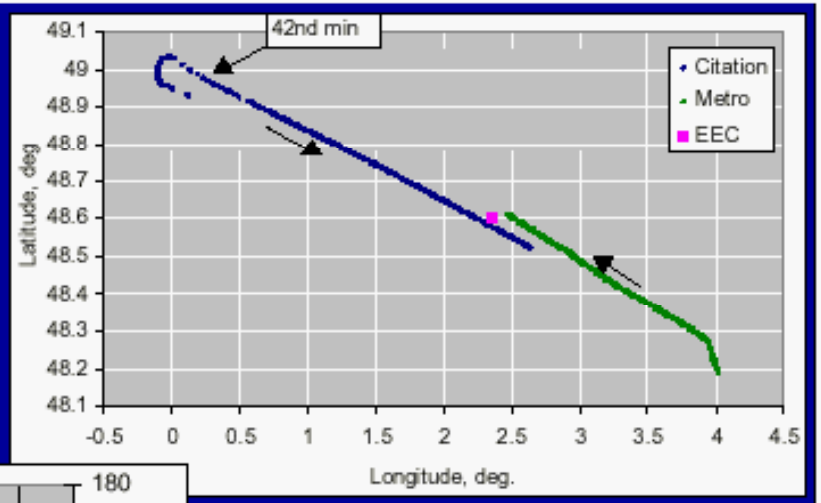
- UAT airborne transceivers and prototype ground stations have been flight tested in various programs, and Capstone equipped aircraft provides radar like services
- Demonstrated and participated in the Ohio Valley Operational Evaluations
- FAA WJ Hughes Technical Center Local Flight Testing
- EuroControl conducted flight trials in 1999 and 2000 as part of their ADS Technology Assessment Task

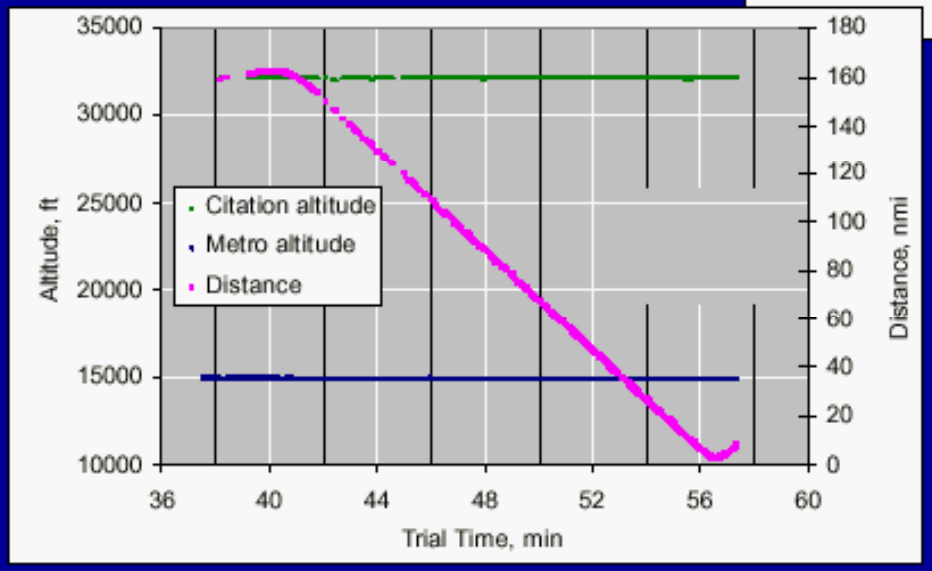
EuroControl 2000 UAT Flight Testing

- Characterization of performance of air-air and air-ground UAT reception
- Utilized Capstone transceiver on 2 NLR aircraft (A1 equipage) and LDPU based ground station operating at 966 MHz
- Both airborne and ground systems configured to record received data

02/10 Trial Session

A/A SV Reception on the Metro: Head to Head





The two a/c fly towards each other at constant altitudes

VDL Mode 4 Flight Testing

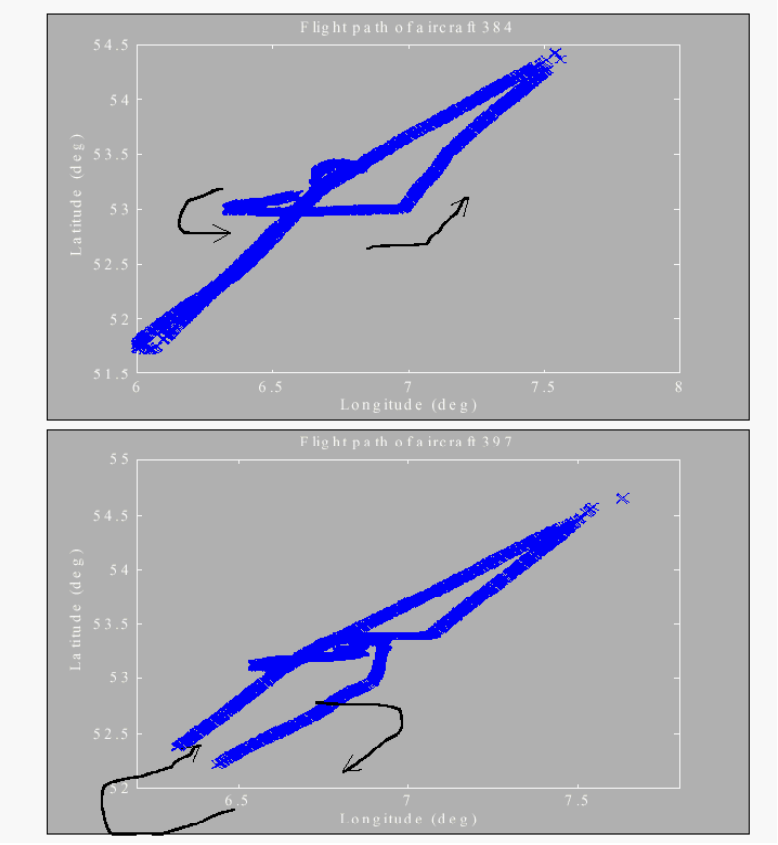
- Numerous Flight Tests have been conducted and prototype systems demonstrated
- Separate testing performed after Ohio Valley Operational Evaluation in 1999 at the FAA WJ Hughes Technical Center
- Eurocontrol with Swedish CAA (LFV) and ADSI in December 2000 at Gronnegan Airport, Netherlands

VDL Mode 4 Flight Tests (Continued)

- Northern European ADS-B Network (NEAN) and other European ADS-B programs have produced useful data results on VDL Mode 4
- FAA WJ Hughes Technical Center flight testing with ADSI radios indicated extended range receptions

Flight Paths for Airborne Users

- Aircraft 384 transmitted from the top antenna and flew:
  - West, then east
  - Northeast
  - Southwest
  - Northeast
- Aircraft 397 transmitted from the bottom antenna and flew:
  - East
  - Southwest
  - Northeast
  - Southwest
  - West



Future Flight Test Activities

- Safe Flight 21 Memphis Evaluations (surface measurements)
- TIS-B Flight Testing at FAA WJ Hughes Technical Center
- Validation flights for each independent link will include test measurement systems