Extended Squitter Tests in Frankfurt

Measurements of Reception Reliability and Interference

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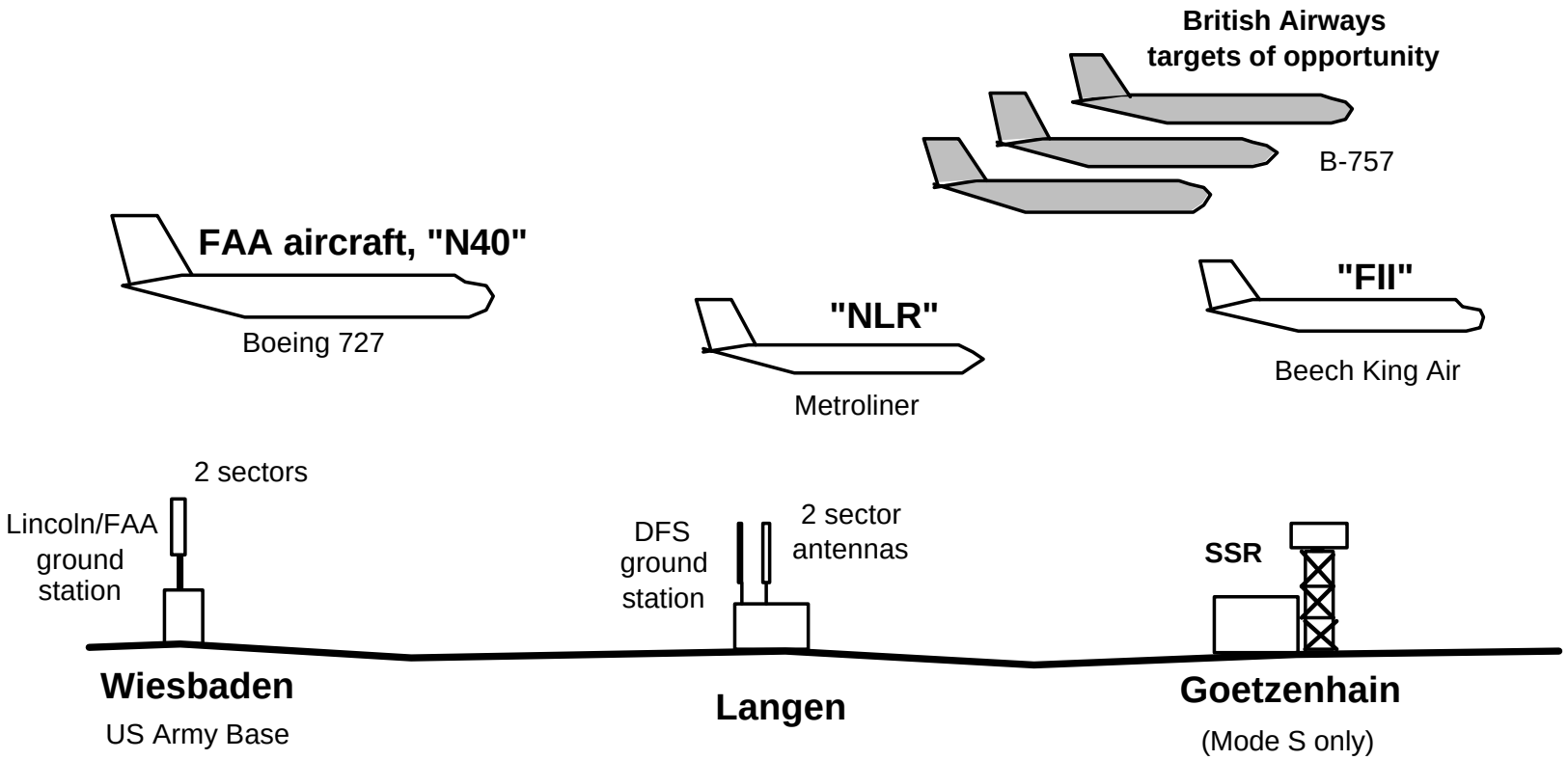
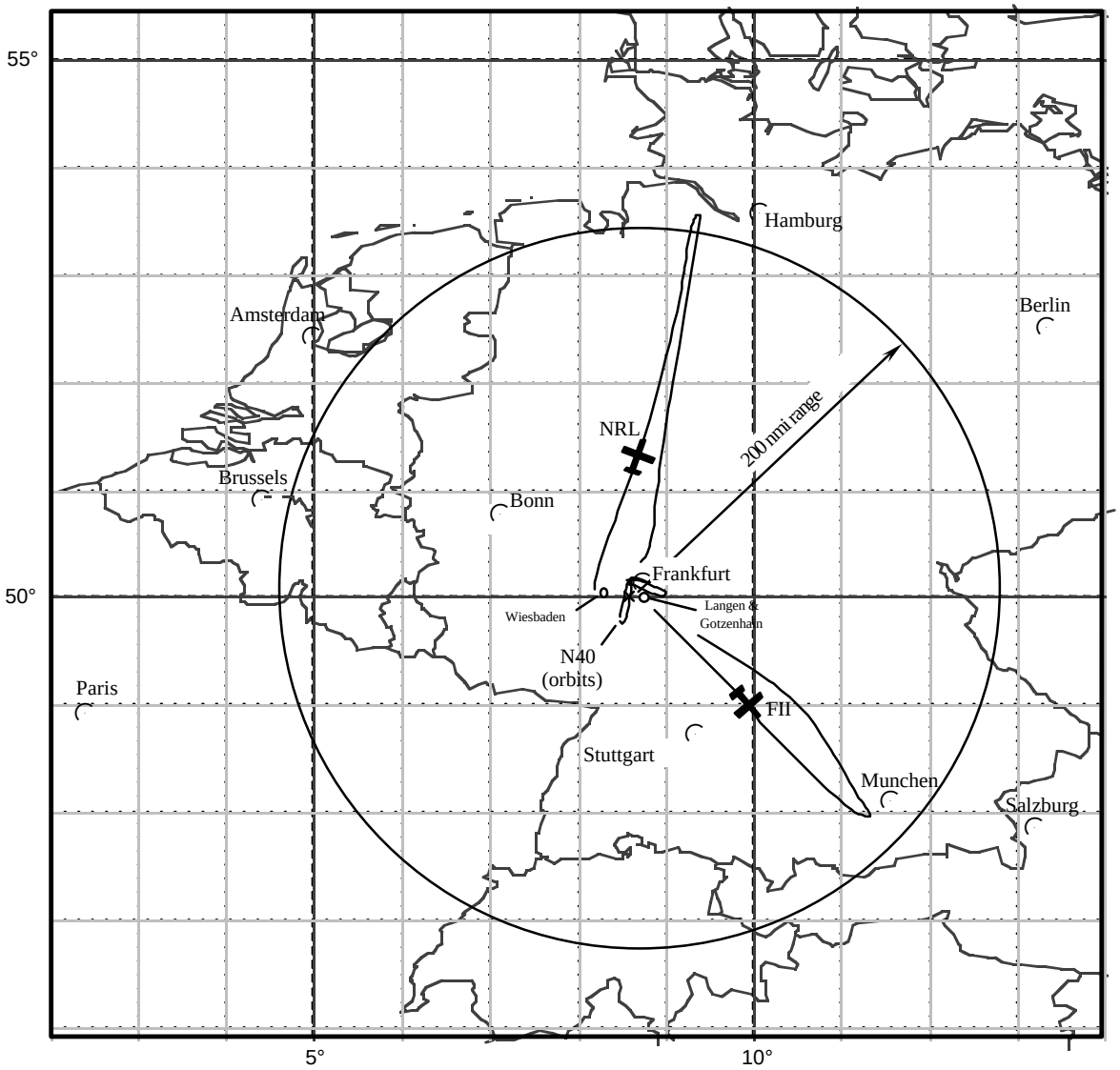
Airborne and Ground Based Facilities



Outline

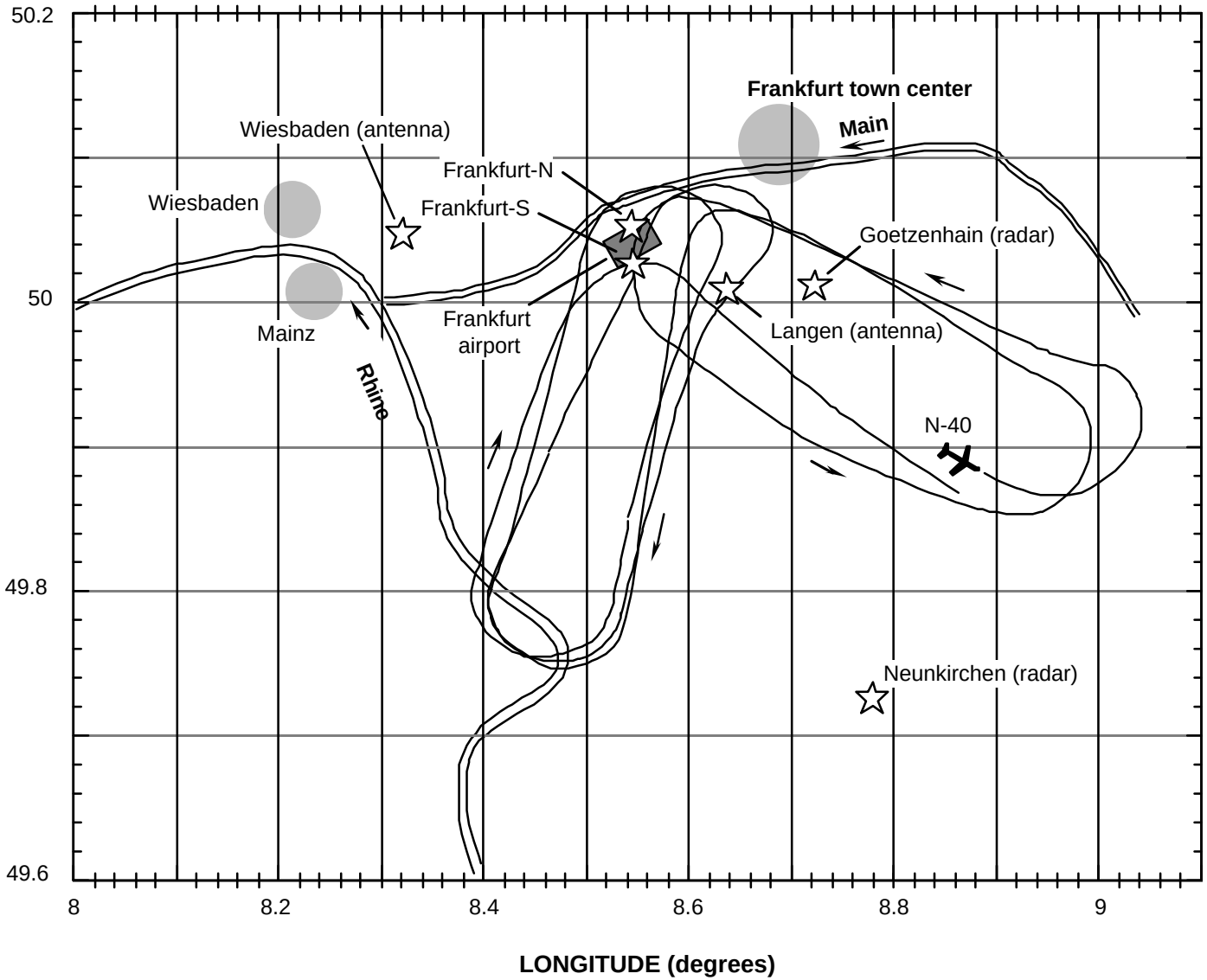
- Project aircraft and ground stations
- Air-to-air performance
- Air-to-ground performance
- Interference measurements
  - > 1090 MHz band
  - > 1030 MHz band
  - > Aircraft density

Flight Paths



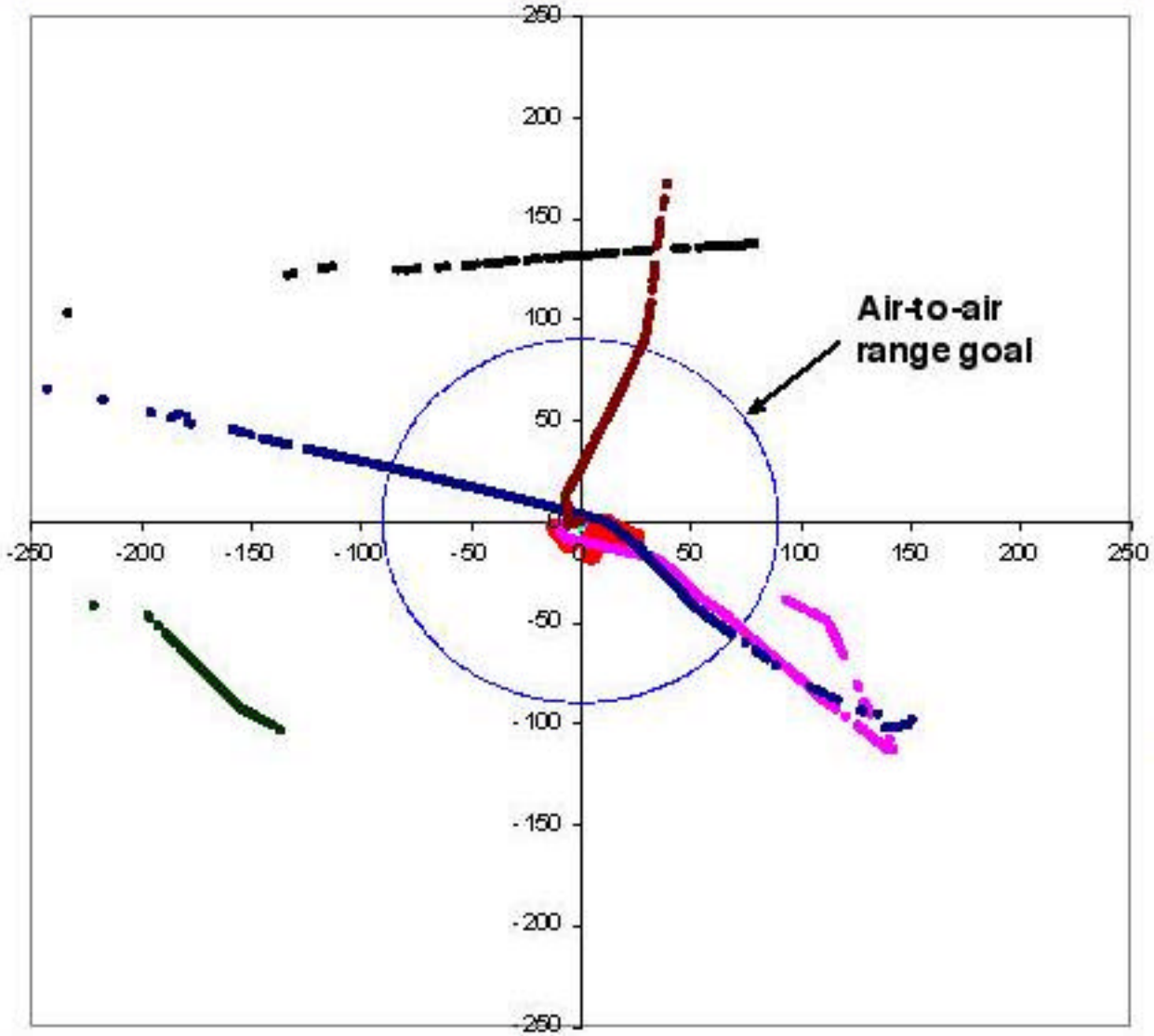
Oval flight Path

Staying in the Frankfurt Area



Extended Squitter Measurements at Frankfurt

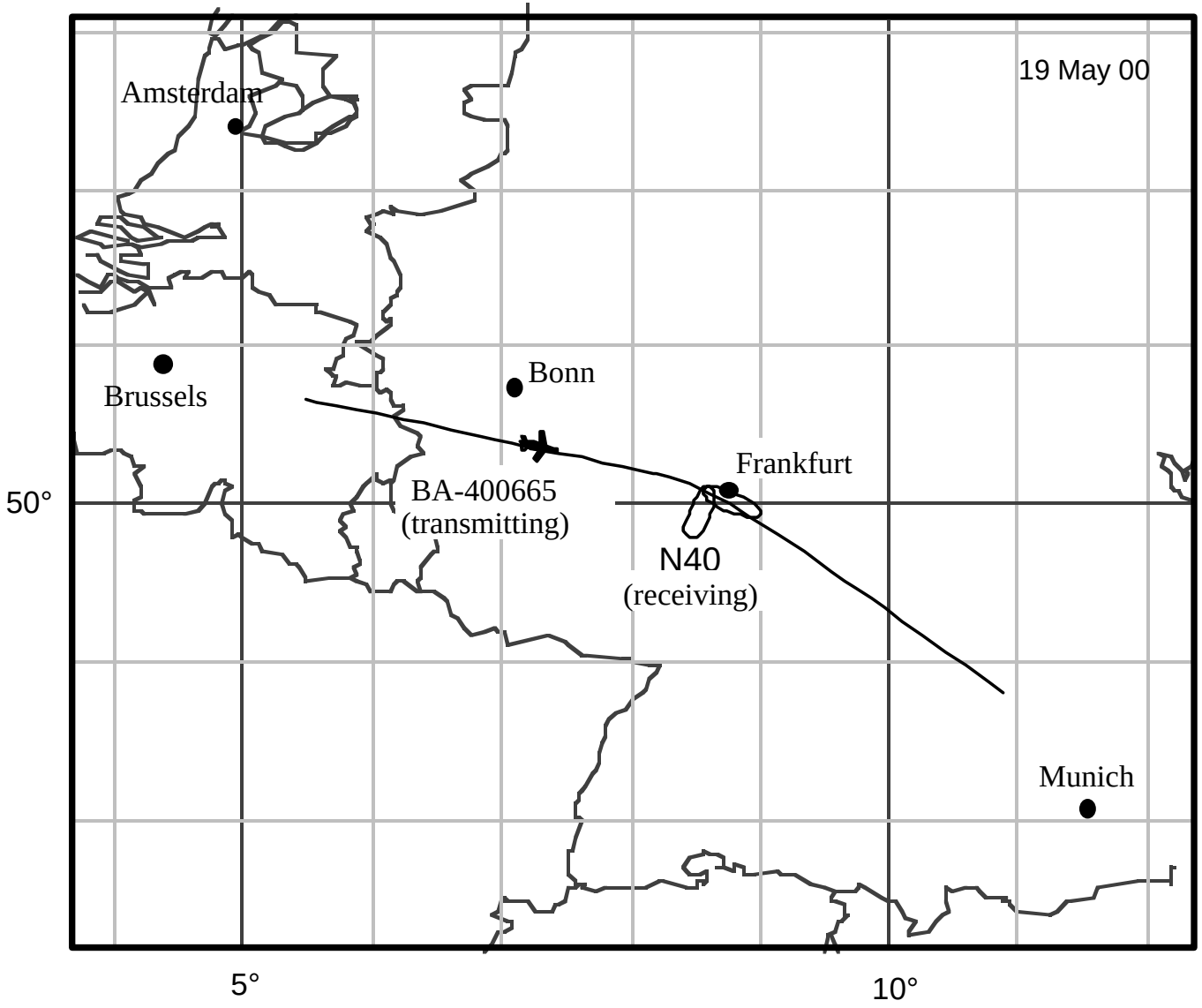
Air-Air Surveillance Performance



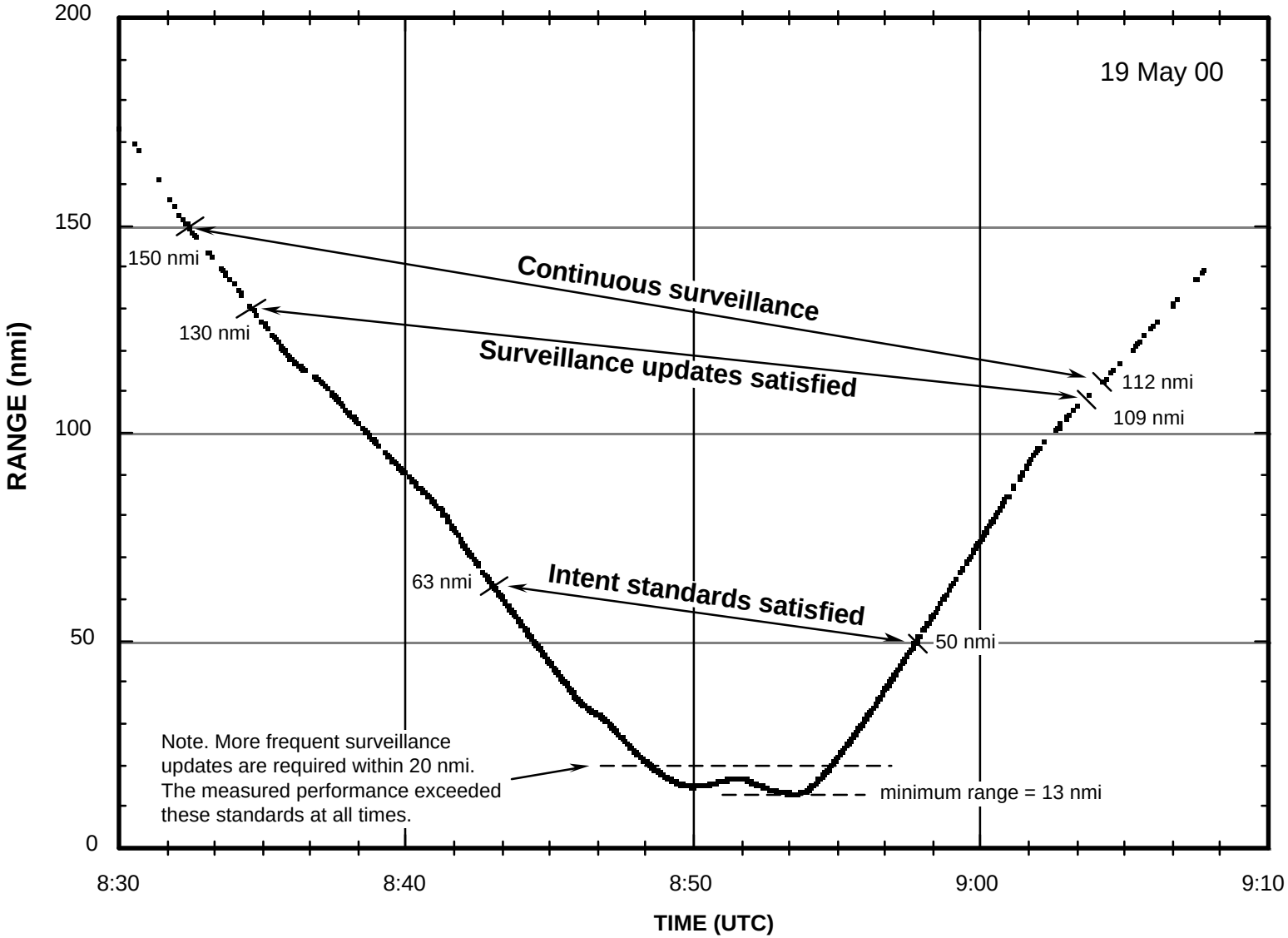
- N40, ownship, holding over Frankfurt
- Ground Station
- Flight Inspection Aircraft
- BA1
- BA2
- BA3
- BA4
- Range Ring

Notes:
- Airborne Reception Aboard N40, 5-24, All Targets
- BA indicates British Airways 757 aircraft in regular service

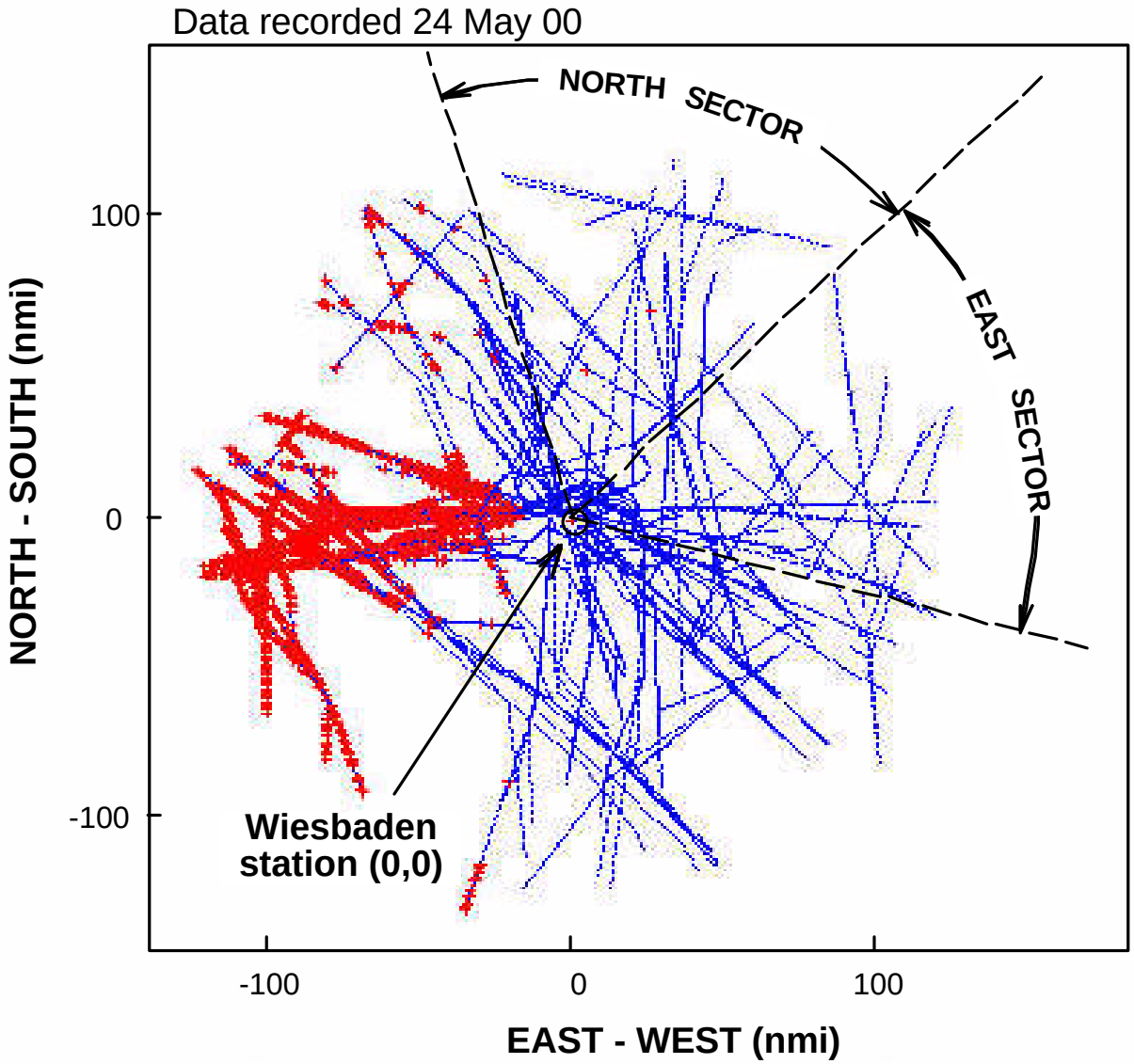
British Airways Aircraft Flying Over Frankfurt



Reception Performance, BA665 to N40

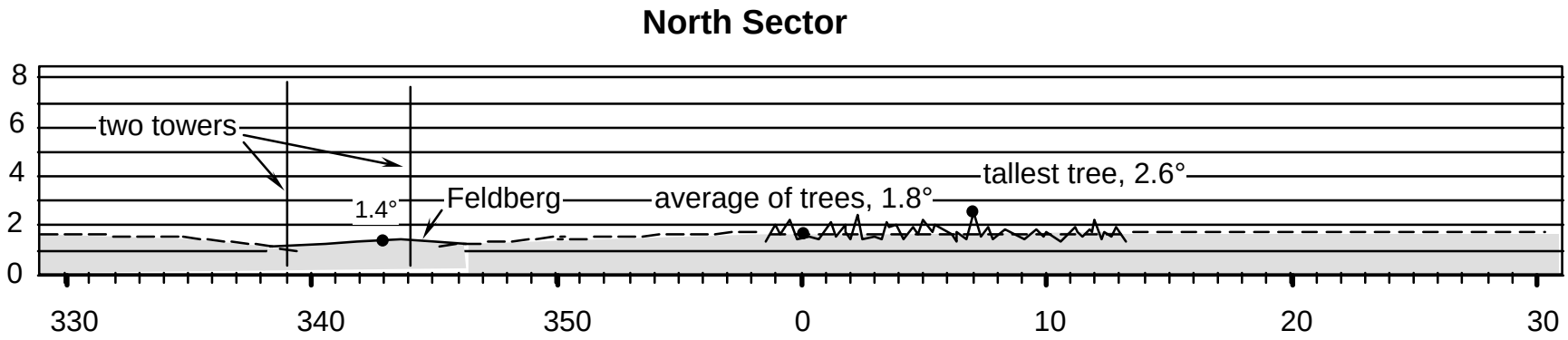


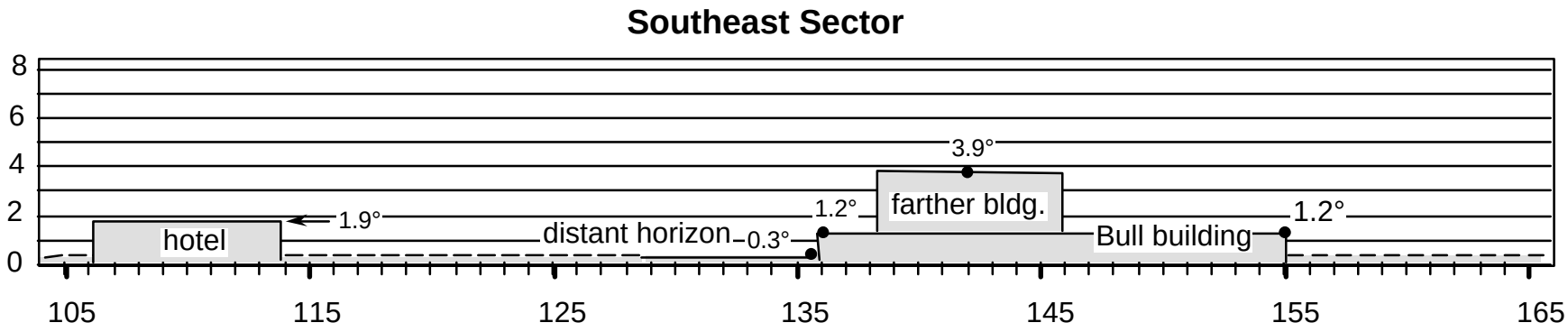
Receptions at Wiesbaden — Spaghetti Plot



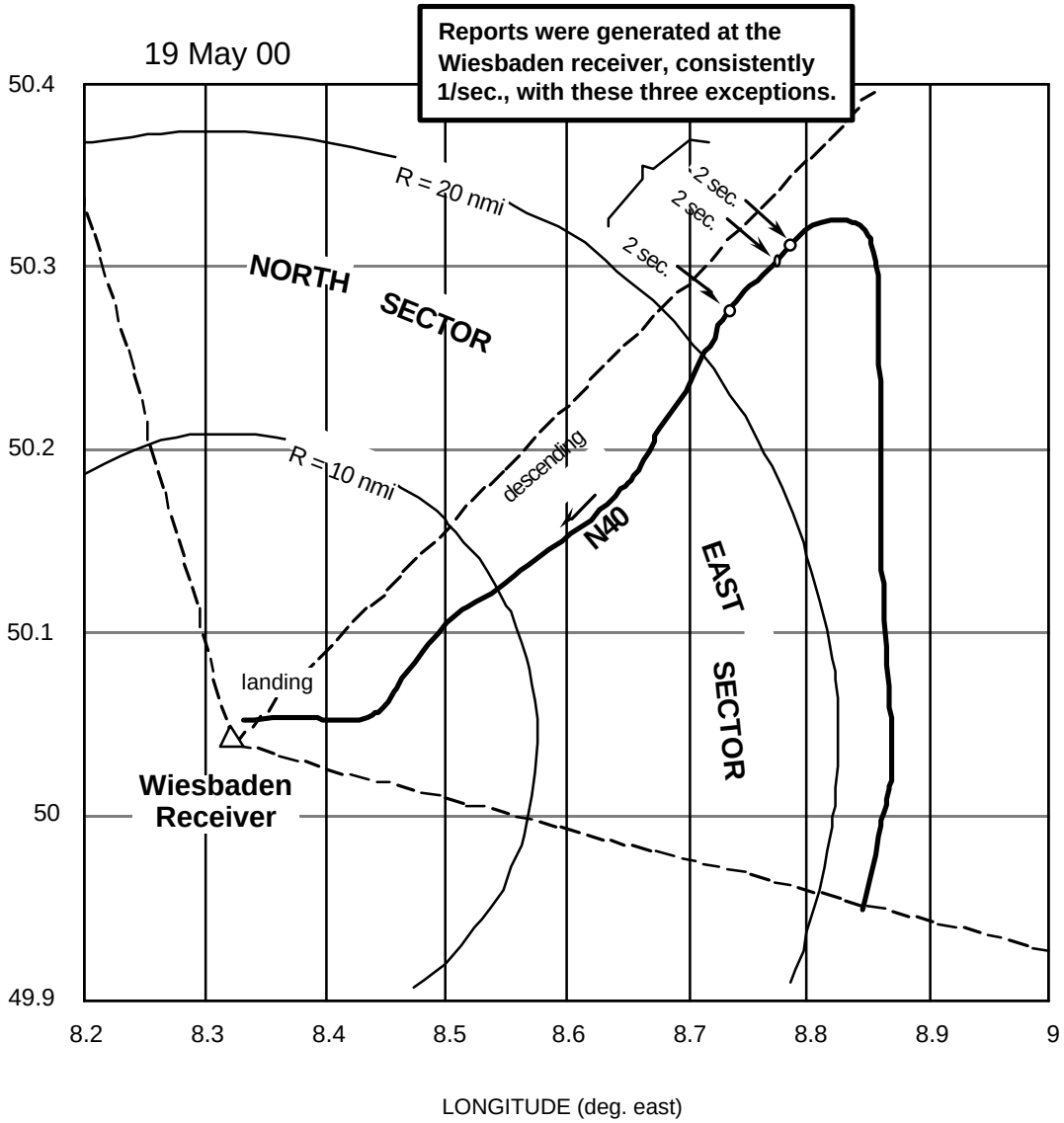
Buildings Affecting the Horizon (Langen)

Horizon Measurements, Langen Station





Air-to-Ground Surveillance,
During Landing Approach



N40 Landing at Wiesbaden

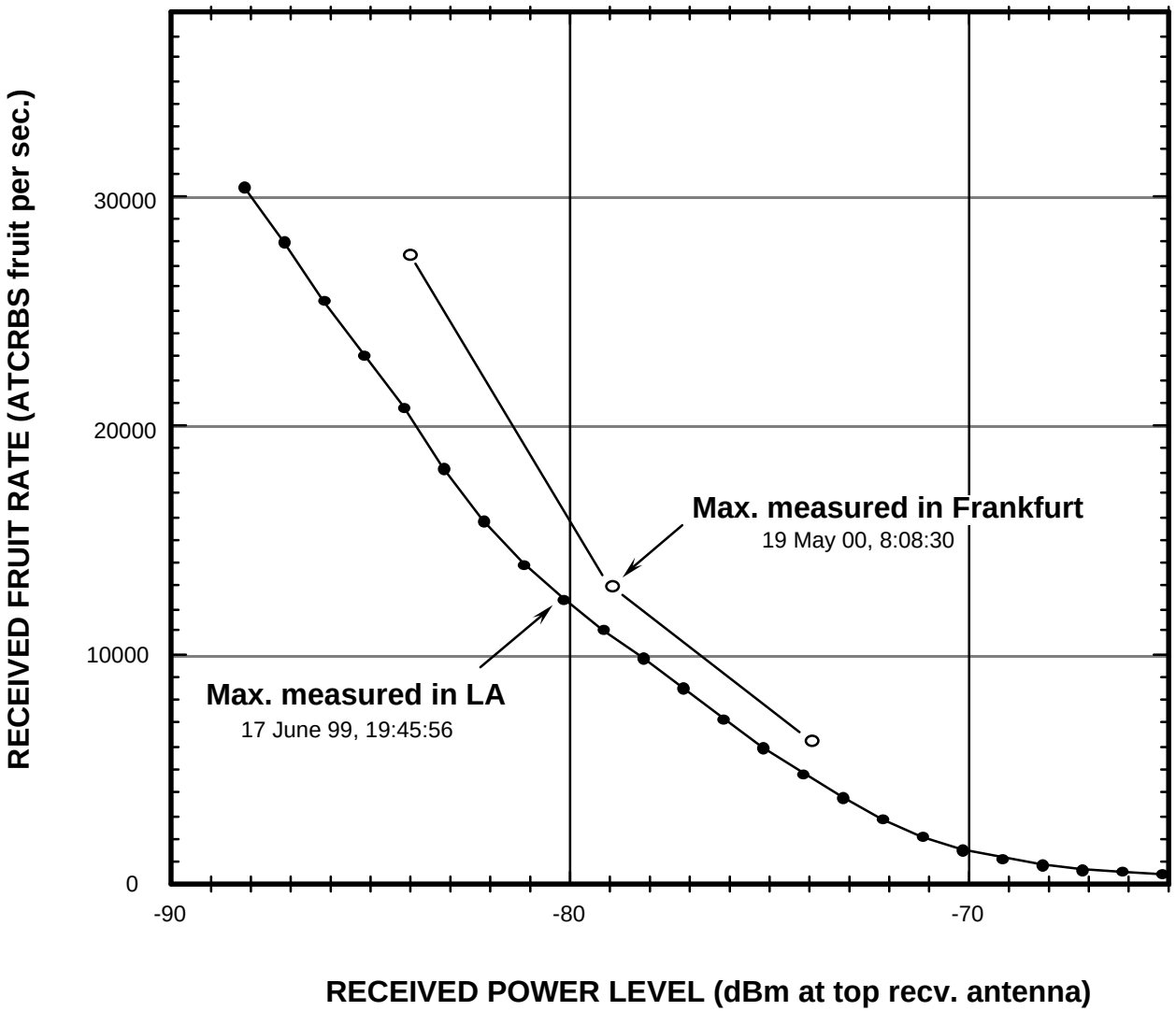
Runway Approach Surveillance

CASE		RESULTS		
Date	Landing Aircraft	Time in Track	Number of Missed Reports*	Report Reliability
19 May	N40	100%	3	99.7%
20 May	N40	100%	0	100%
20 May	NLR	100%	0	100%
22 May	N40	100%	0	100%
22 May	FII	100%	1	99.8%
24 May	N40	100%	0	100%
24 May	FII	100%	1	99.8%
25 May	N40	100%	0	100%

* These results apply to the LDPU receiving system at Wiesbaden. The LDPU normally generates Reports at a rate of one report per second, regardless of the number of receptions during each one second period. If no surveillance messages are received in the one second period, there is no Report.

Interference, 1090 MHz

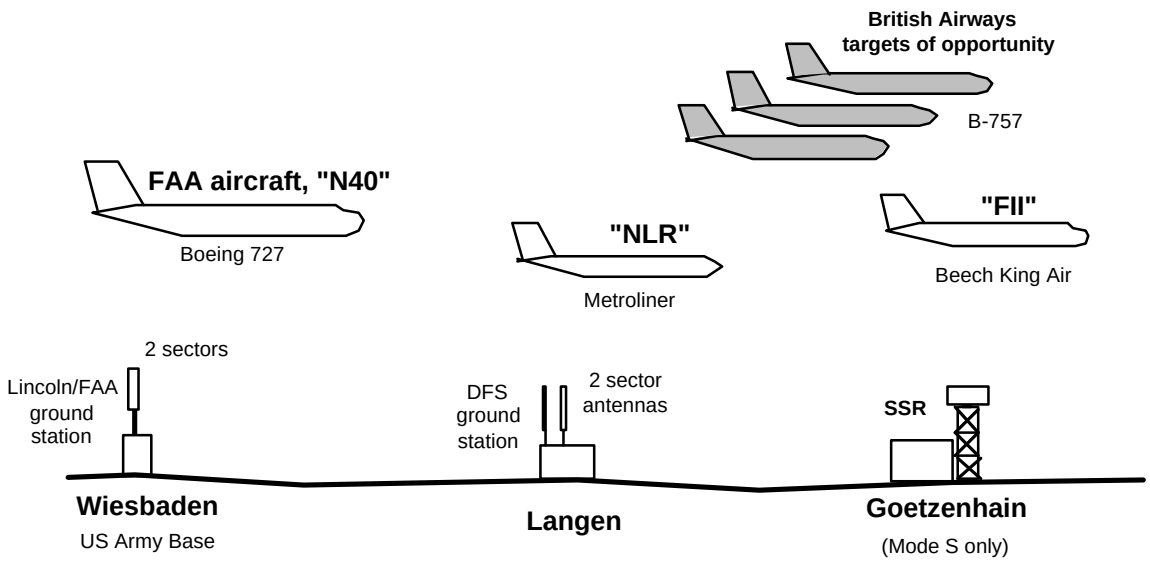
Comparison Between Frankfurt and Los Angeles



Other Environment Measurements

- 1030 MHz band
  - > Interrogation rate vs. altitude
  - > Top antenna vs. bottom antenna
  - > Interrogations from ground vs. those from TCAS
- Number of aircraft
  - > Distribution in range
  - > Distribution in altitude
- Summary of results in backup slides

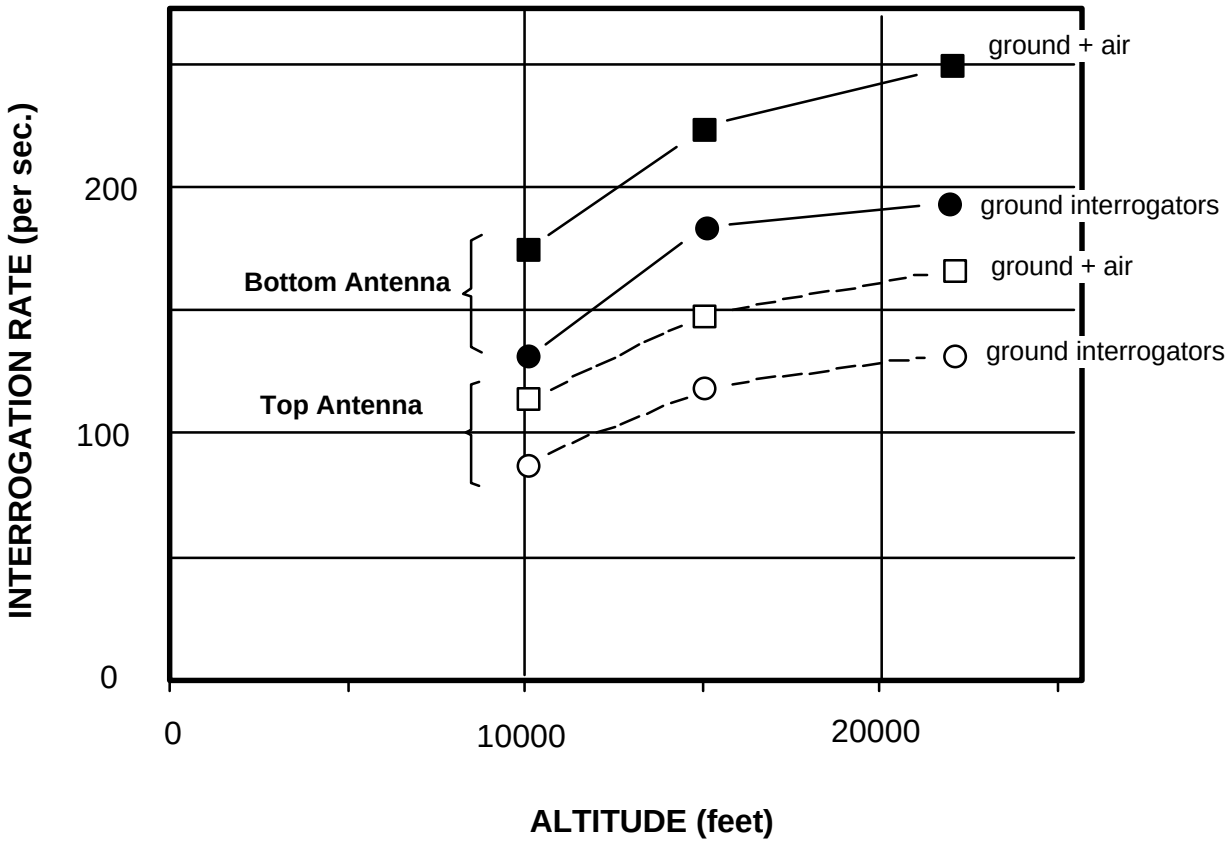
Summary



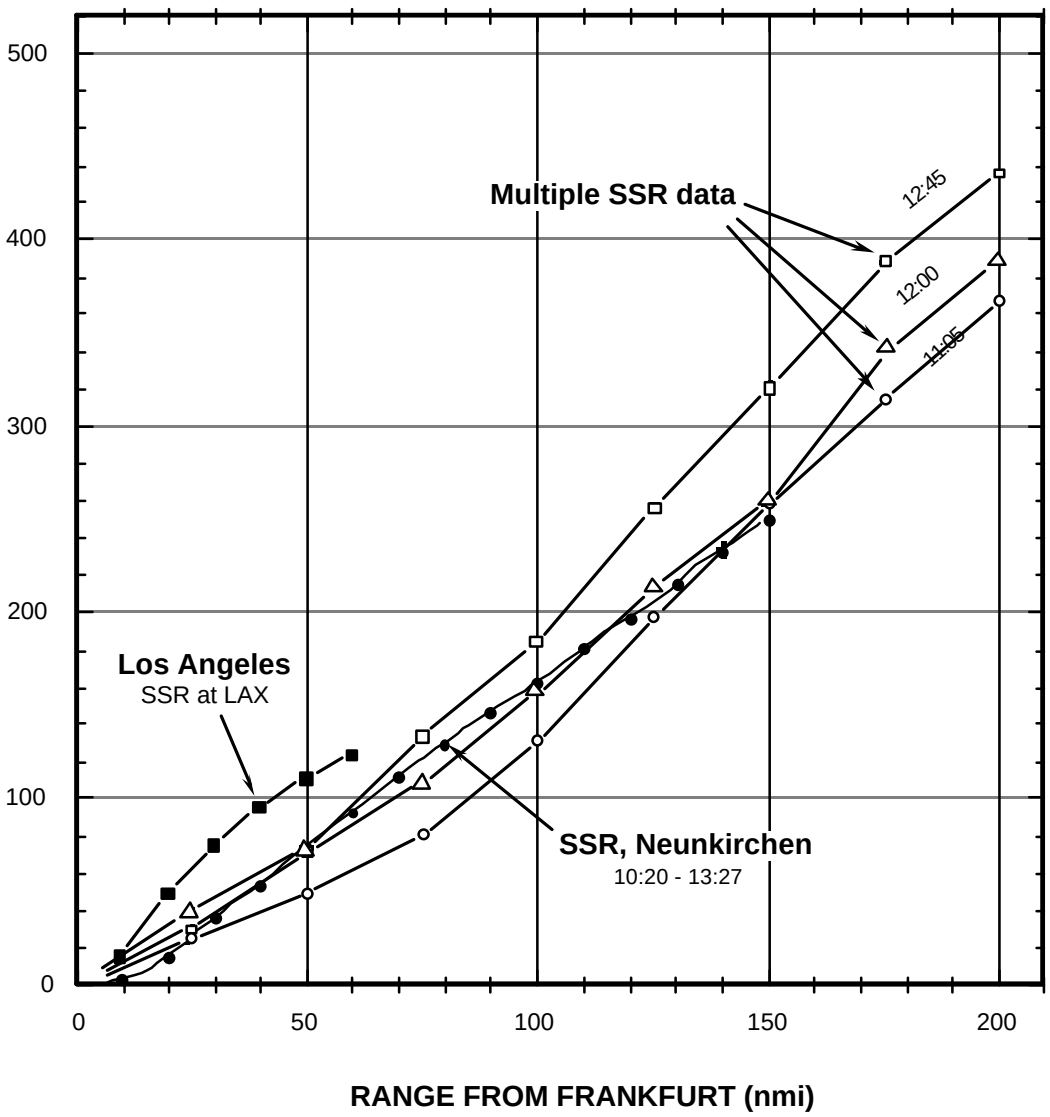
- **Tests in May 2000 were successful.**
  - **> British Airways, added value.**
- **Air-to-air reception typically very good.**
- **Air-to-ground reception excellent (spaghetti plots)**
- **Landing approach surveillance - excellent.**
- **Interference environment:**
  - **> 1090 MHz fruit higher than LA.**
  - **> Aircraft density more uniform than LA.**
- **Final report issued.**

Backup Figures

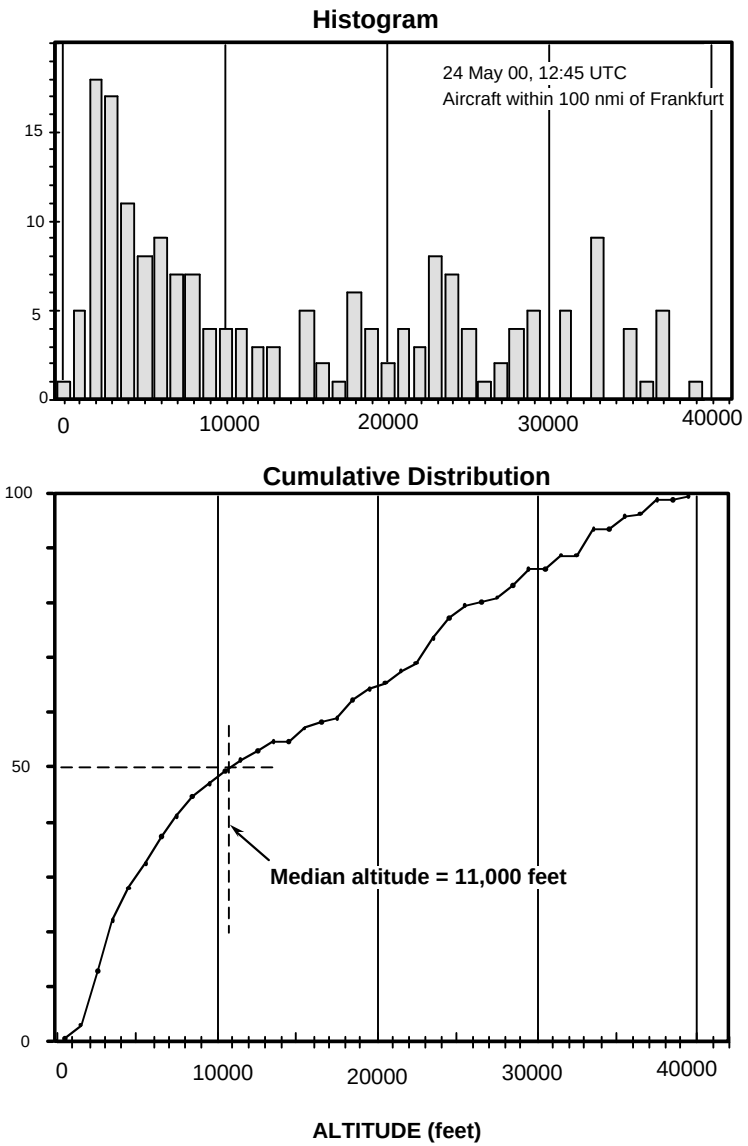
Interrogation Rate as a Function of Altitude

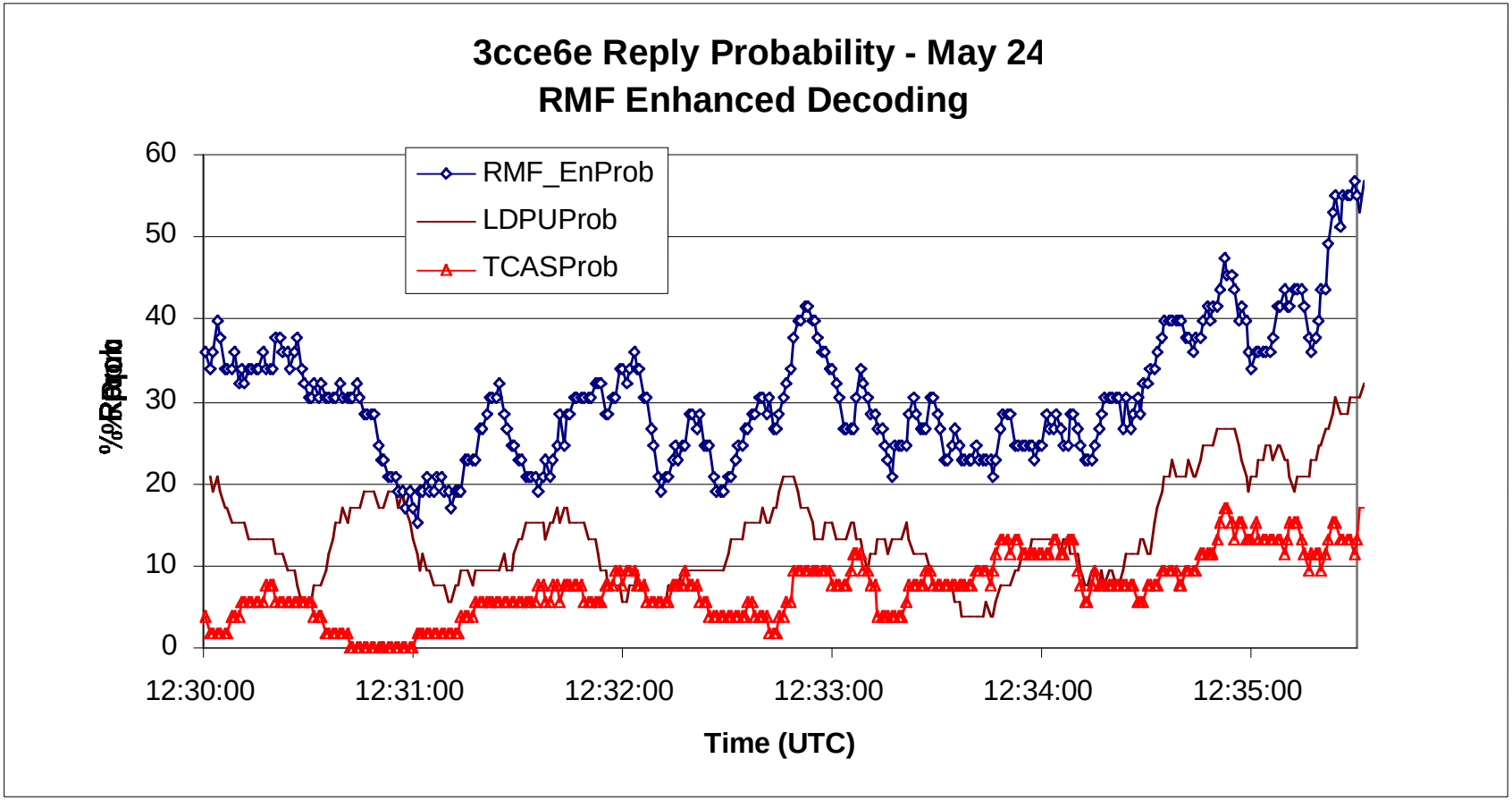


Aircraft Count and Distribution in Range



Aircraft Altitude Distribution



Reception Comparison

Comparison between LDPU and Lincoln's Enhanced Techniques