Second Surveillance Radar Coverage

ES21: Modelling and Simulation Project

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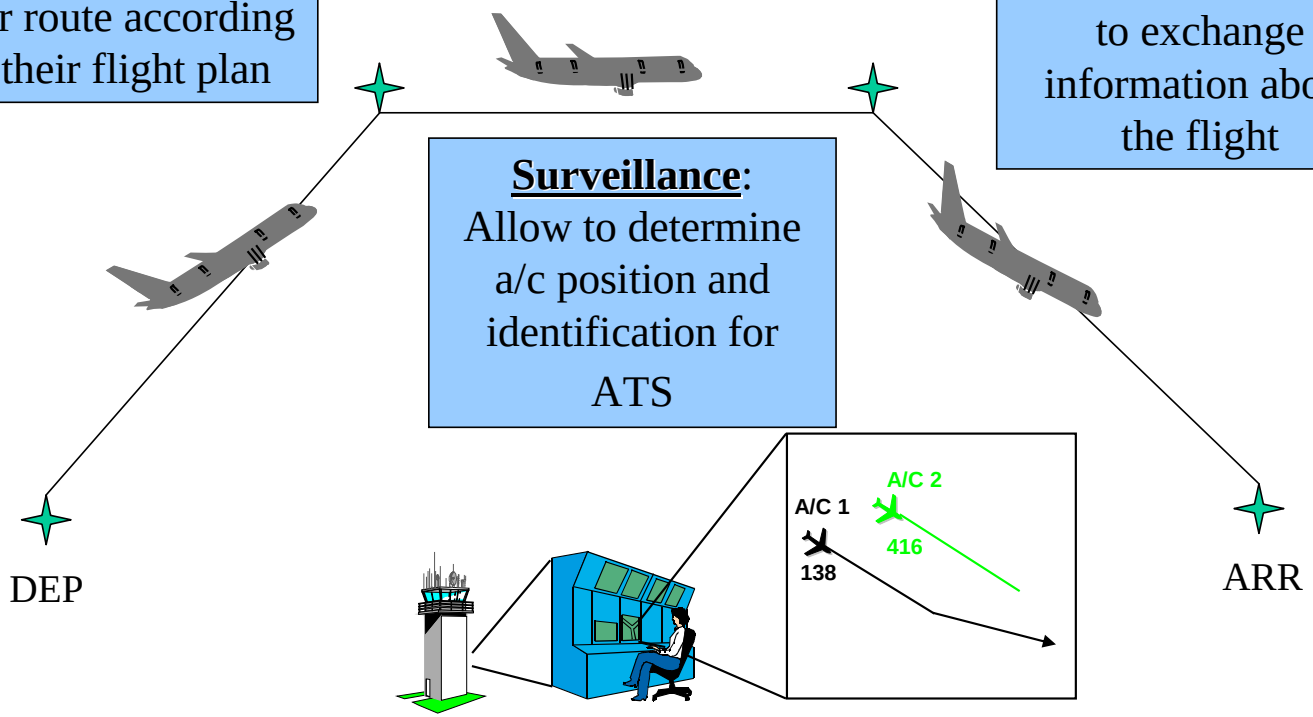
Outline

Surveillance purposes within CNS

Navigation:
Allow a/c to follow their route according to their flight plan

Communication:
Allow a/c and ATC to exchange information about the flight

Surveillance:
Allow to determine a/c position and identification for ATS



ATM Ground Based Surveillance categories

Non-Cooperative Independent Surveillance:

2D aircraft position determined by ground station without reliance on aircraft avionics

- Primary Surveillance Radar (PSR)

Cooperative Independent Surveillance:

3D aircraft position determined by ground station , and acquisition of other aircraft avionic data (Mode A/C/S, DAPs or ADD)

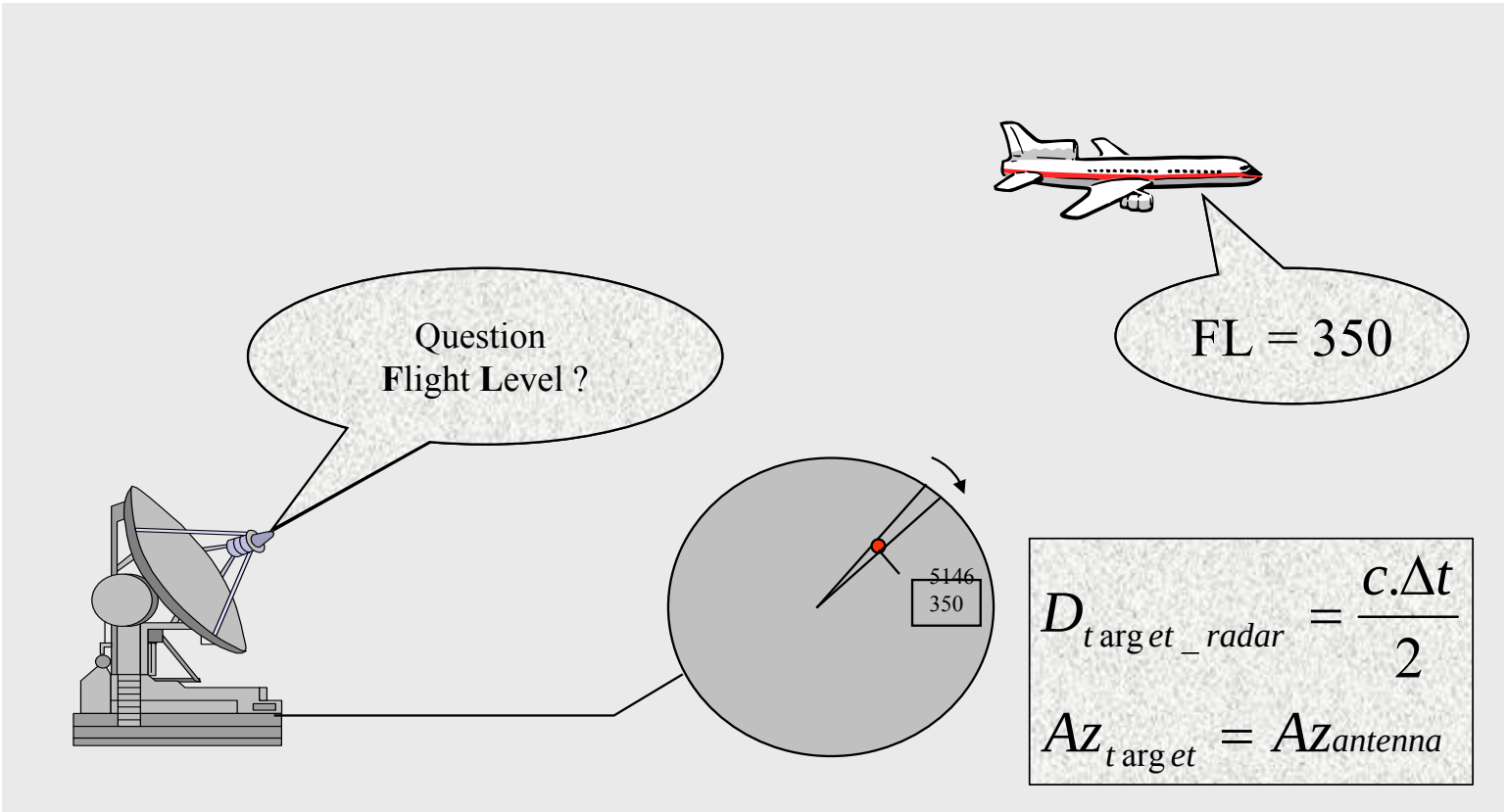
- (Monopulse) Secondary Surveillance Radar (SSR), SSR Mode S,
- Airport Multilateration (MLAT) and Wide Area Multilateration (WAM)

Cooperative Dependent Surveillance:

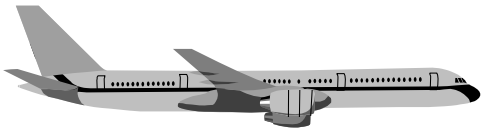
Aircraft position determined by on board equipment (GPS /INS/DME) and broadcast for “air-ground” and “air-air” surveillance

- ADS-B, (ADS-C)

Cooperative Target with Secondary Radar

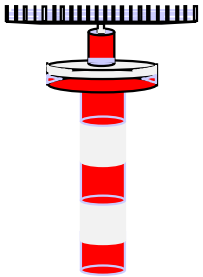


Secondary radar principle

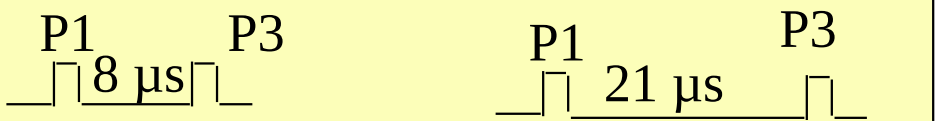


interrogation 1030 MHz /P1P3

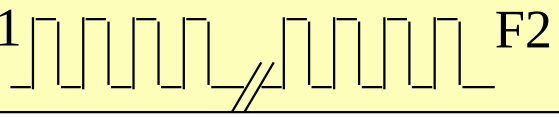
1090 MHz reply
F1+ 12 bits + F2



Ground station Interrogations:



Transponder replies:

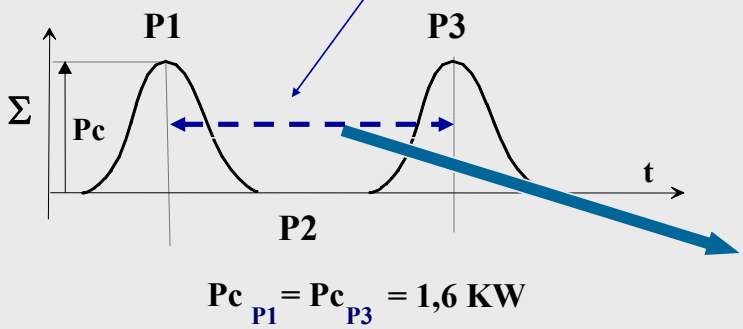


20,3 µs

Interrogation

Radar Interrogation's Frequency : 1030 Mhz
Transponder's Response's Frequency: 1090 Mhz

The duration between P1 and P3 represents and characterize the Mode.

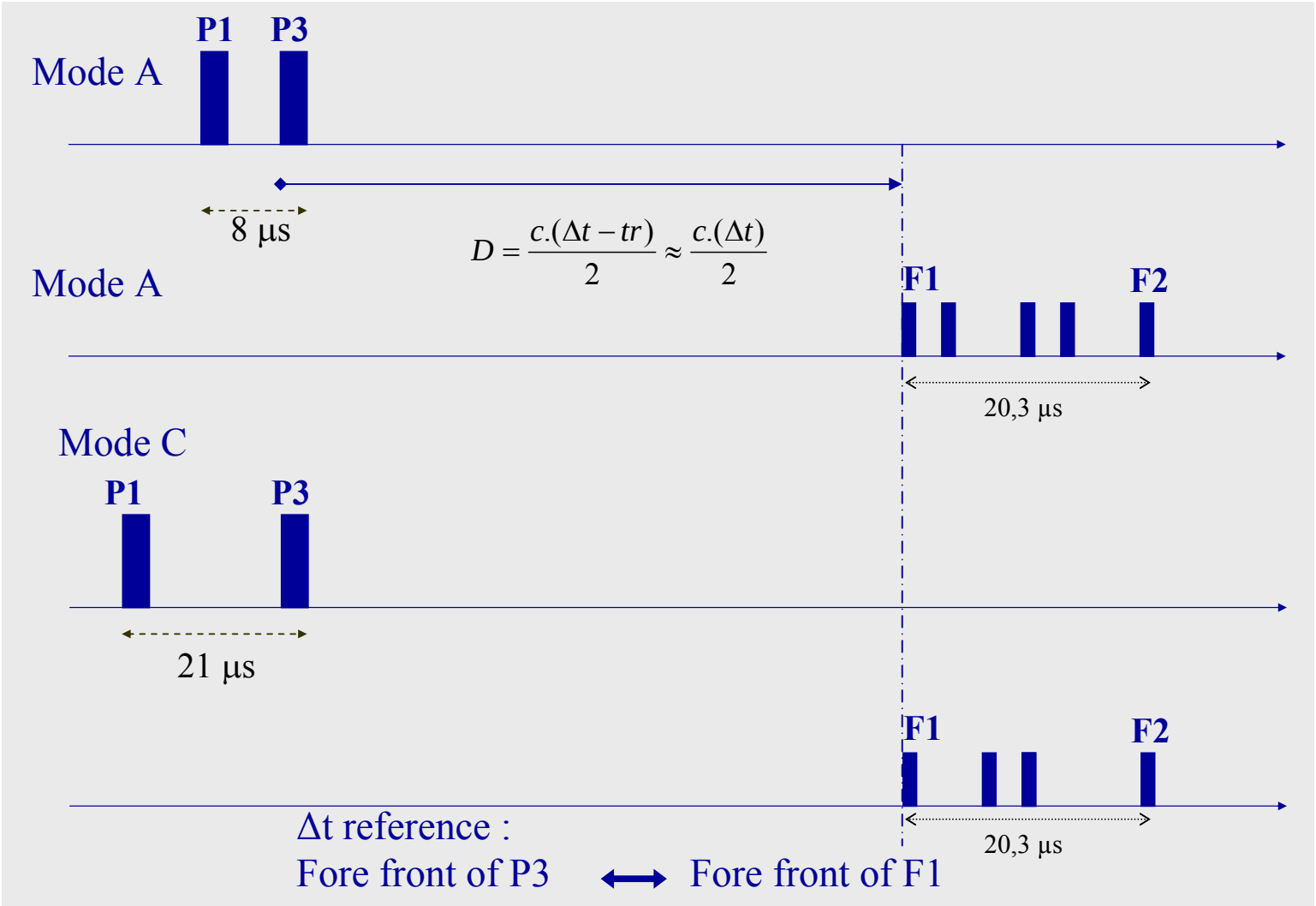


$Pc_{P1} = Pc_{P3} = 1{,}6$ KW

Military	Civilian
1 : 3µs Military ID	A : 8µs **ID**
2 : 5µs Military ID	B : 17µs Unused
3 : 8µs Similar to Mode A	C : 21µs **Flight Level**
4 : ?	D : 25µs Abandonned

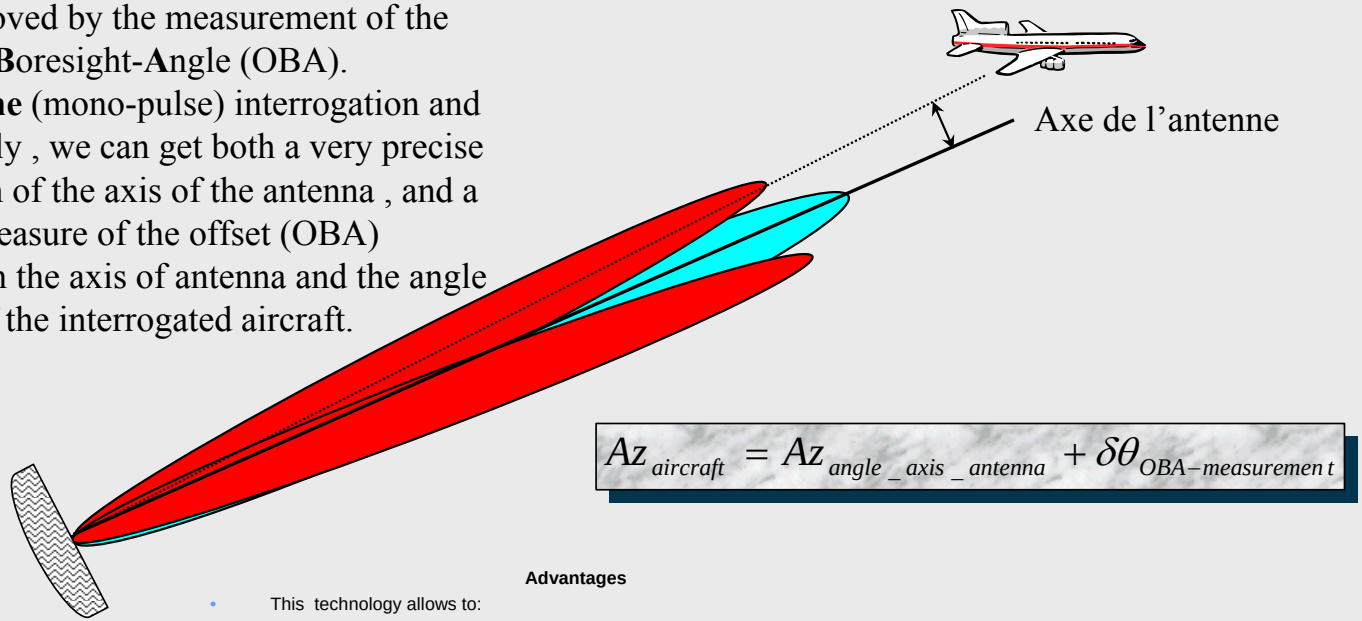
The interrogation sequence will be A?/C?/A?/C?

Distance Measurement (SSR)



Monopulse Technique

The mono-impulsion technology for calculating the sight of the axis of aircraft is improved by the measurement of the **O**ffset-**B**oresight-**A**ngle (OBA).
With **one** (mono-pulse) interrogation and one reply , we can get both a very precise position of the axis of the antenna , and a good measure of the offset (OBA) between the axis of antenna and the angle sight of the interrogated aircraft.



$$Az_{aircraft} = Az_{angle\_axis\_antenna} + \delta\theta_{OBA-measurement}$$

Advantages

- This technology allows to:
  - Get a best accuracy in the measurement of the azimuth
  - La possibility of resolving up to 90% for Garbling with two aircraft and 50% for Garbling with tree aircrafts
  - obligatory technique in the context Mode S Sensor

SSR Antenna

SSR Antenna

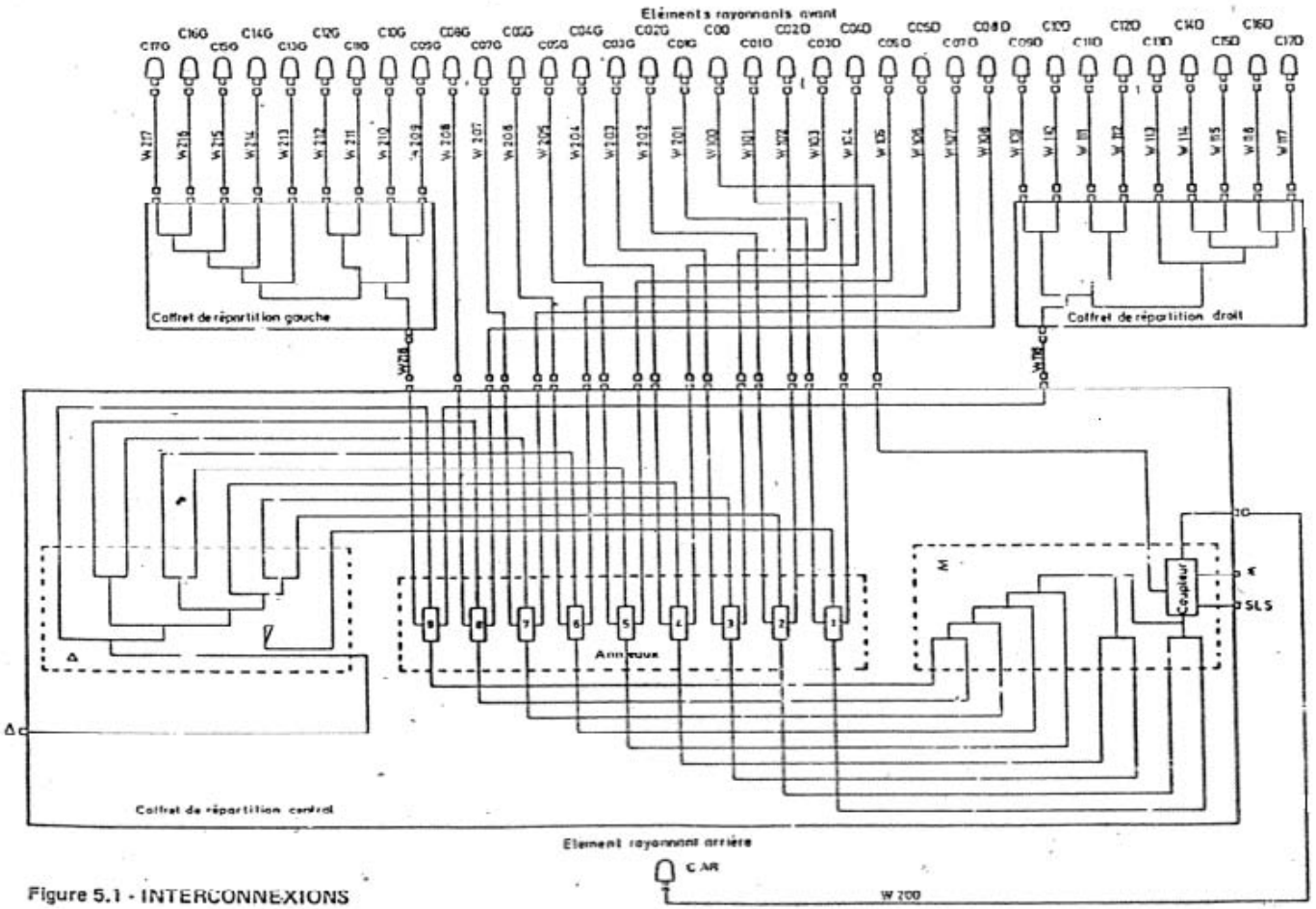
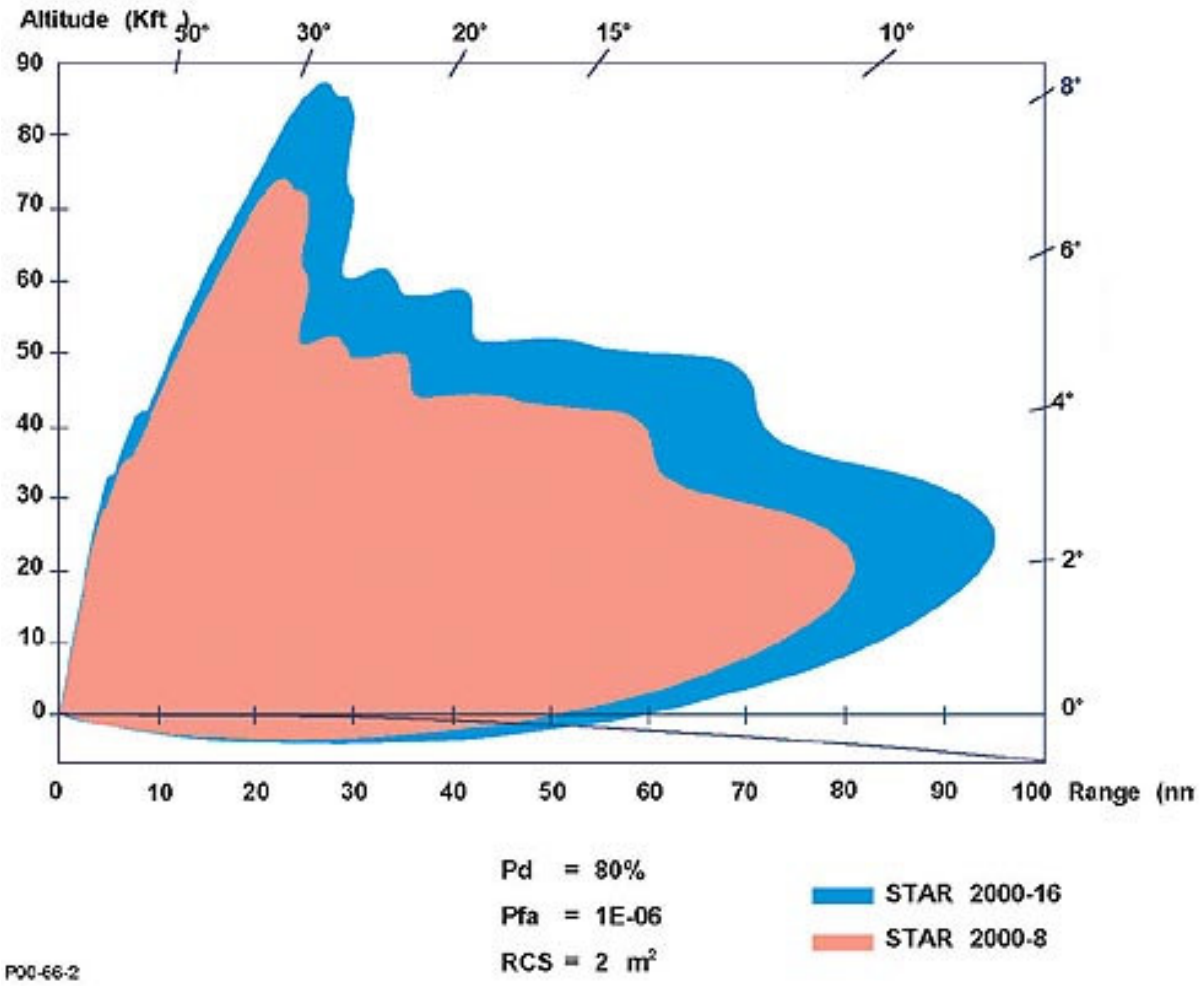


Figure 5.1 - INTERCONNEXIONS

SSR Coverage



Outline

Mission description

- A group with 2 or 3 students, and each group hand in one final reports
- each student give one presentation at least
- finish the task on time
- read references and work out the software structure
- realize your idea into program (JAVA)
- debug and improve the program
- check the program
- give presentation and report