

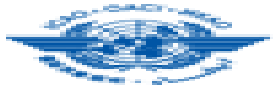
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**Workshop on the Interconnection of Aeronautical
Surveillance Systems
(Dakar, Senegal, 14 to 16 April 2014)**

**Planning criteria for the
coordination of SSR Mode S
Interrogator Identifier codes**

**Presented by FX SALAMBANGA
Regional Officer, CNS WACAF**



I – Definitions **OUTLINE**

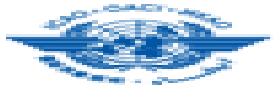
II – Acquisitions Principles

III – Clustering of interrogators

IV – Multiple II codes /1 single Mode S ground station

V – Sectorized use of II codes

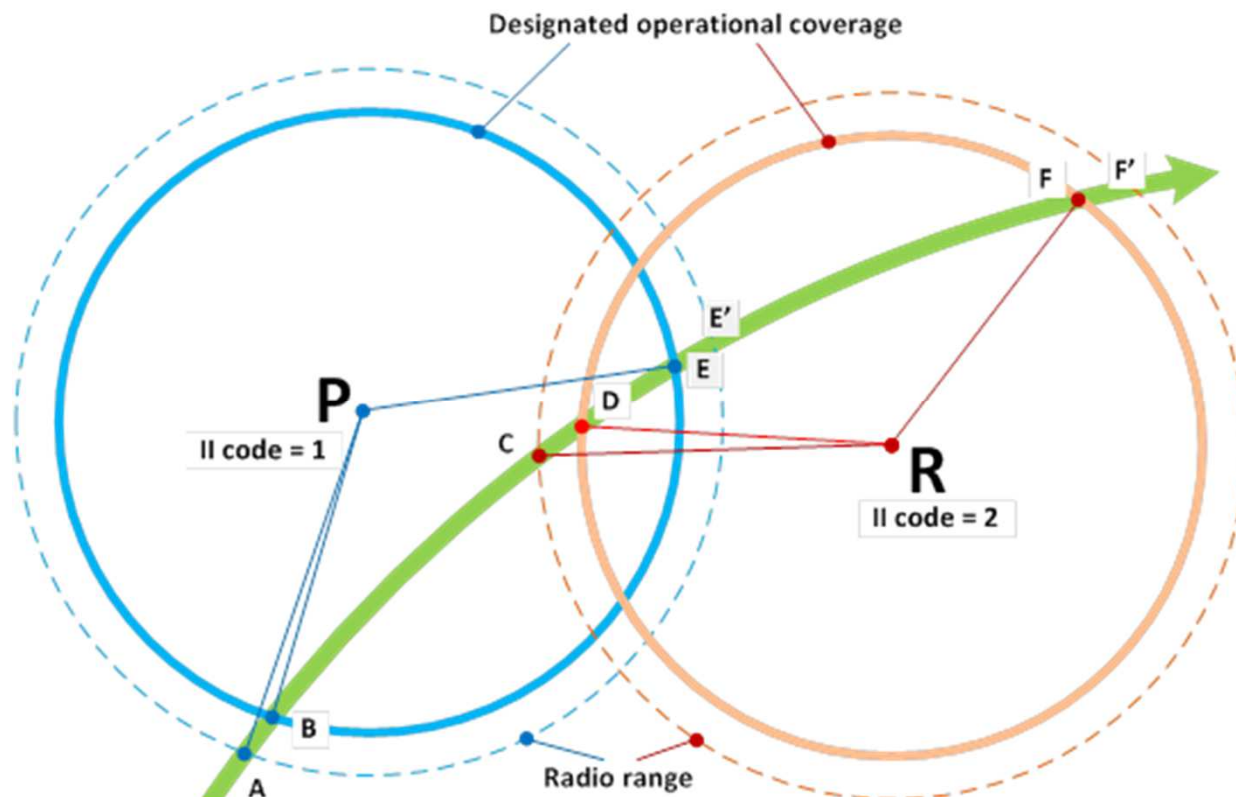
VI – Conclusions



Definitions

Range: Maximum distance to the radio horizon (---- & - - - -)

DOC (Designated operational Coverage): Coverage within which the station is designed to operate (— & —)

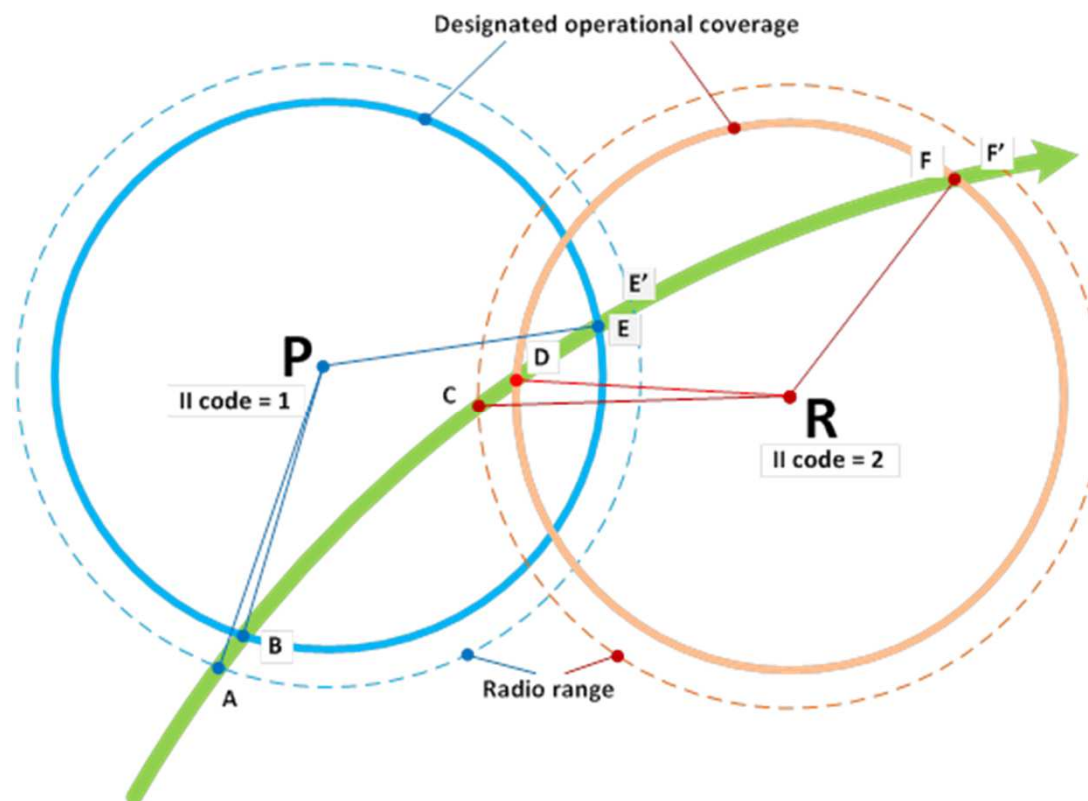




Definitions

Range: Maximum Radio Horizon distance from the station

DOC:

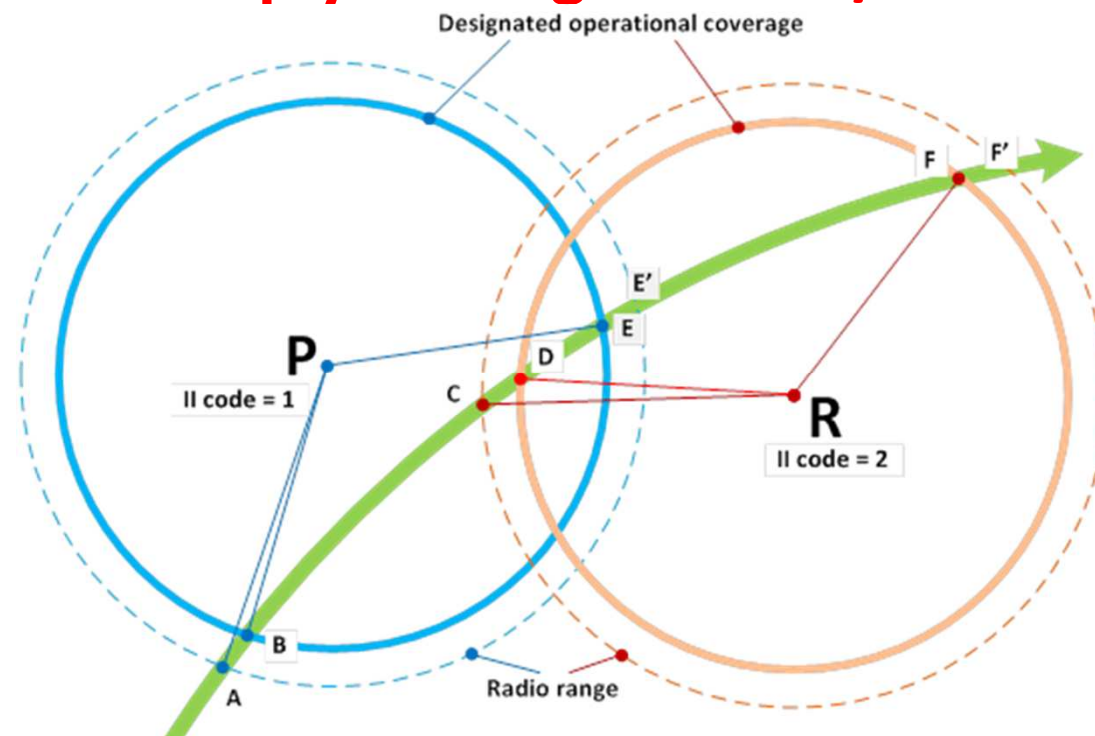




A/C outside DOC of Interrogator P but within Range of P

Point A

- **Receives all-call interrogations from P**
- **Generates an all-call reply with P II code and A/C 24-bit address**
- **P will not accept this reply as long as the A/C is outside its DOC**

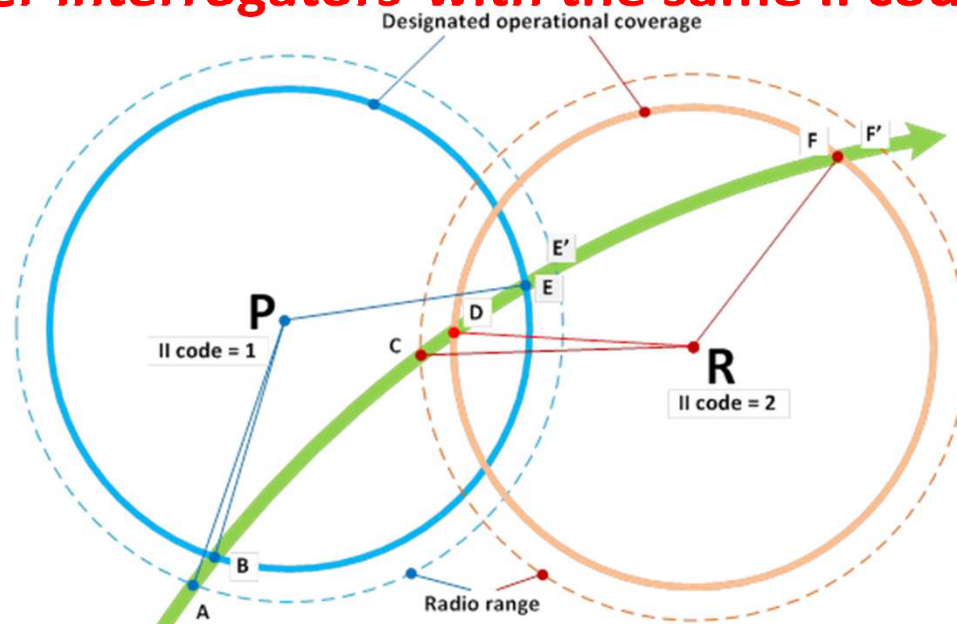




A/C enters Interrogator P DOC

Point B

- A/C all-call reply with P II code and A/C 24-bit address is accepted by P
- A selective interrogation commanding lockout to II=1 sent to A/C
- A/C added to list of “acquired A/C” maintained by P
- A/C transponder will not respond to further all-call from P and from other interrogators with the same II code= 1).

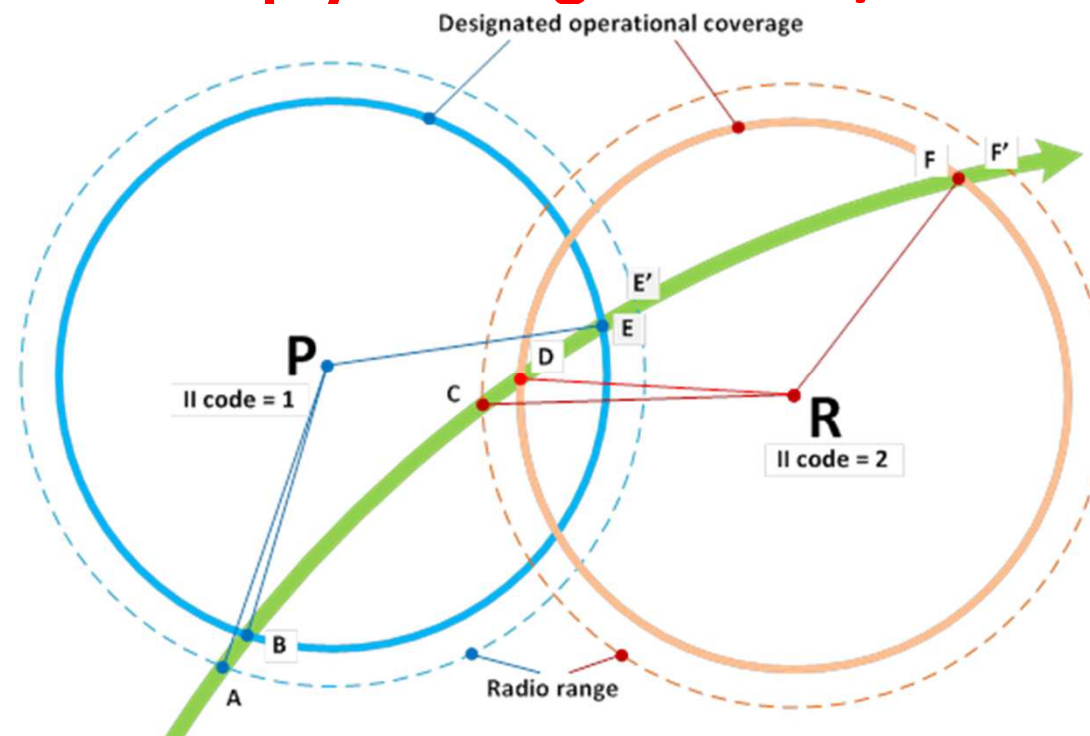




A/C outside DOC of Interrogator R but within Range of R

Point C

- **Receives all-call interrogations from R**
- **Generates an all-call reply with R II code and A/C 24-bit address if the P & R II codes are different**
- **R will not accept this reply as long as the A/C is outside its DOC**





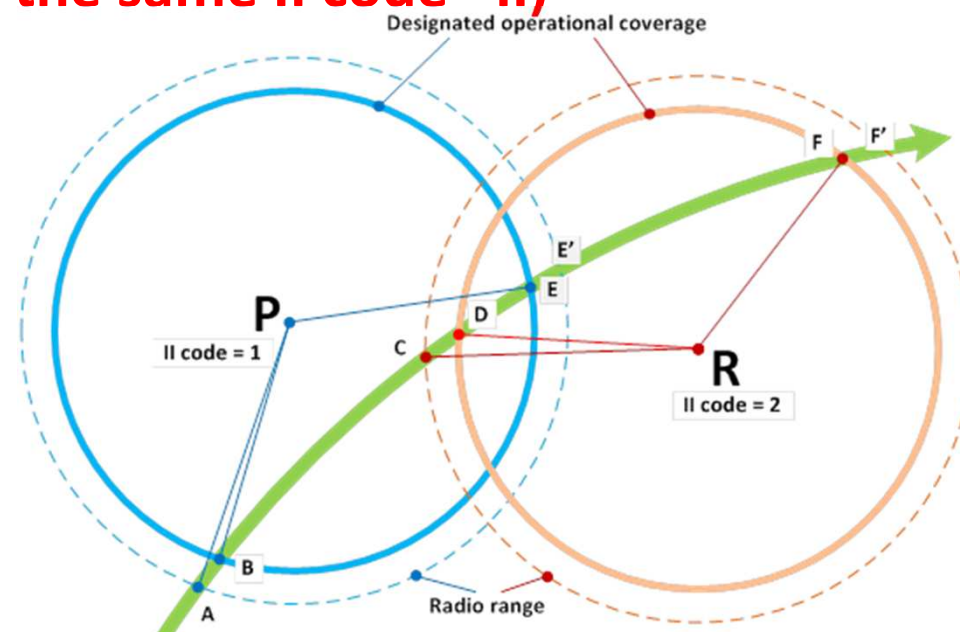
A/C enters Interrogator R DOC

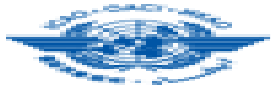
Point D

- A/C all-call reply with P II code and A/C 24-bit address is accepted by R
- A selective interrogation commanding lockout to II=2 sent to A/C
- A/C added to list of “acquired A/C” maintained by R
- A/C transponder will not respond to further all-call from R and from other interrogators with the same II code= II)

- A/C now acquired by P & R

will respond to their selective Interrogations

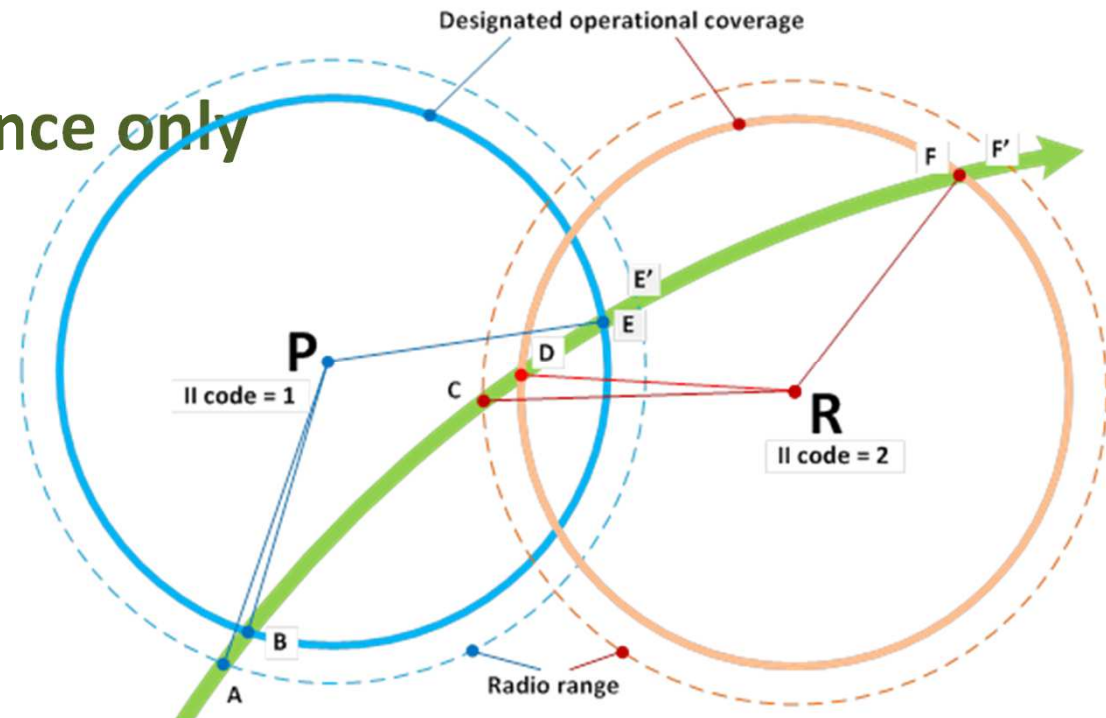


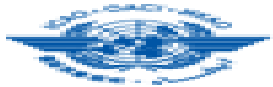


A/C outside DOC of Interrogator P but within Range of P

Point E

- P will no longer selectively interrogate the A/C
- A/C will lose its lock-out status with respect to interrogator P (II=1) after a period of **18 seconds**
- **All-call replies to P will not be accepted because the A/C is outside P DOC**
- A/C under R surveillance only

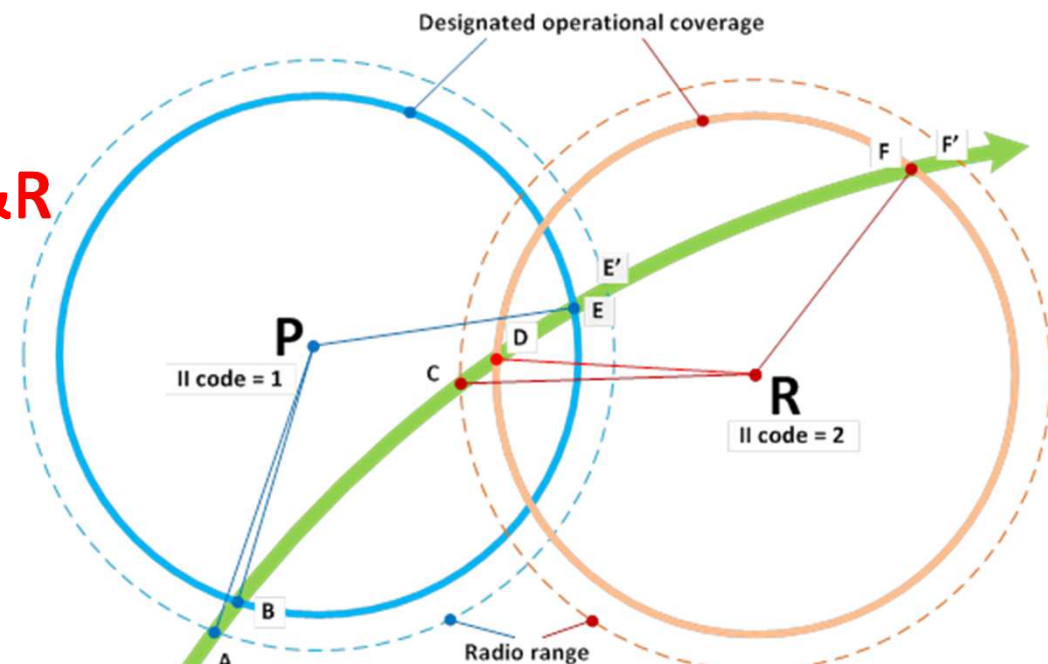




A/C outside DOC of Interrogator R

Point F

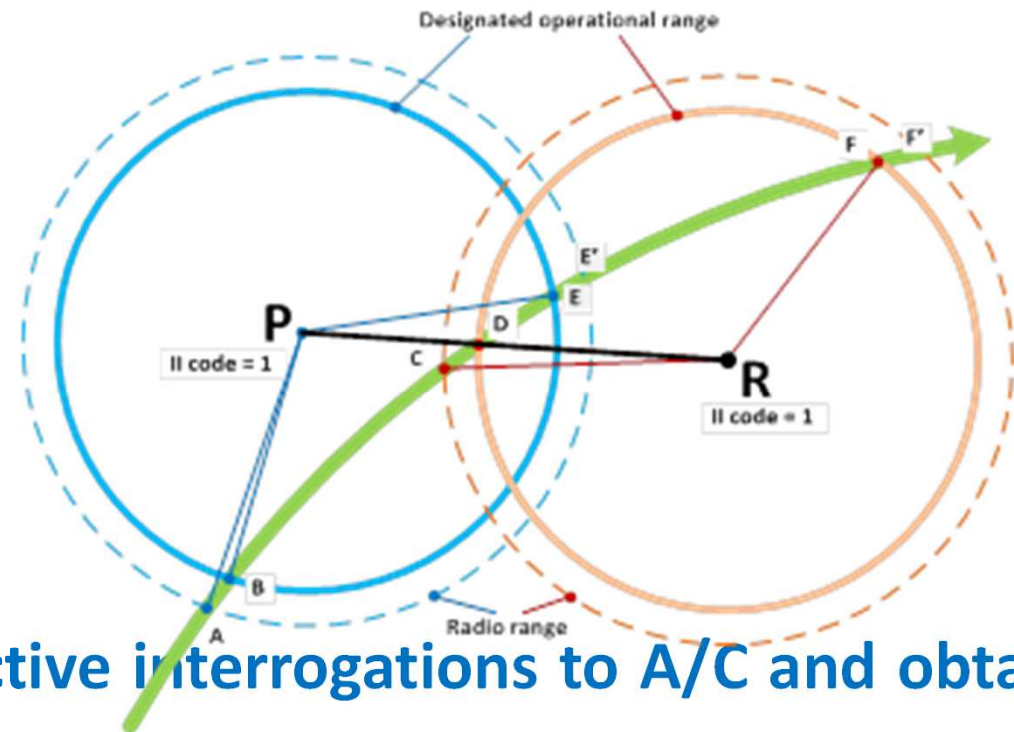
- R will no longer selectively interrogate the A/C
- A/C will lose its lock-out status with respect to interrogator R (II=2) after a period of **18 seconds**
- All-call replies to R will not be accepted because the A/C is outside R DOC
- A/C no longer under surveillance of none of P&R





Clustering of Interrogators -Ground stations networking

- **Sharing of the same II (II=1) by SSR Mode S Stations P & R**
- **Sharing of tables of acquired A/C (24-bit Addr. & approximate acquired A/C location)**

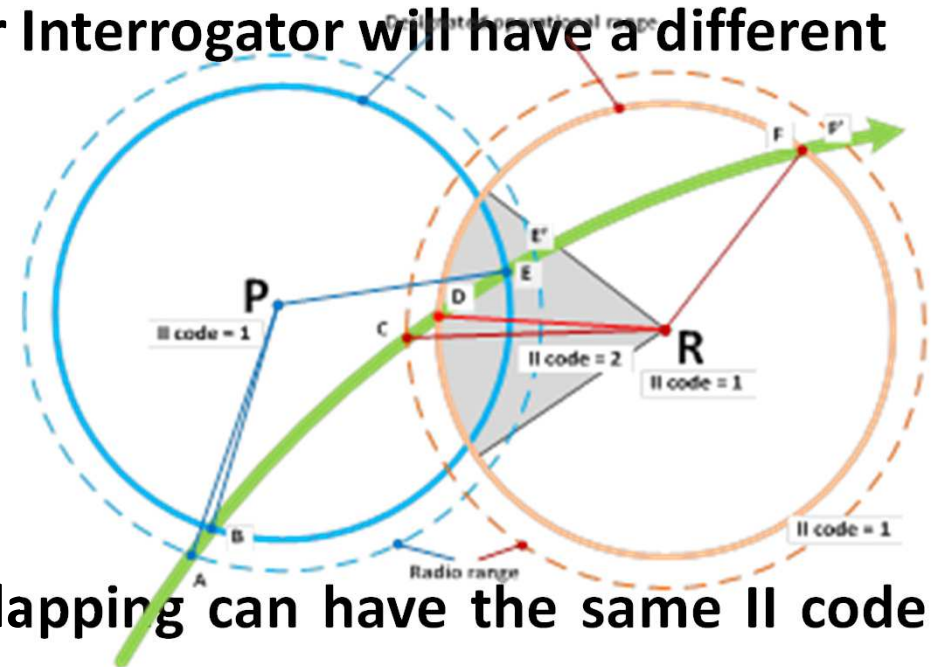


- **Both P & R 4 send selective interrogations to A/C and obtain valid responses**
- **Allow use of the same II by two (or more) stations with overlapping coverage areas (Clustering)**



Multiple II codes by a single Mode S ground station: Sectorization (1)

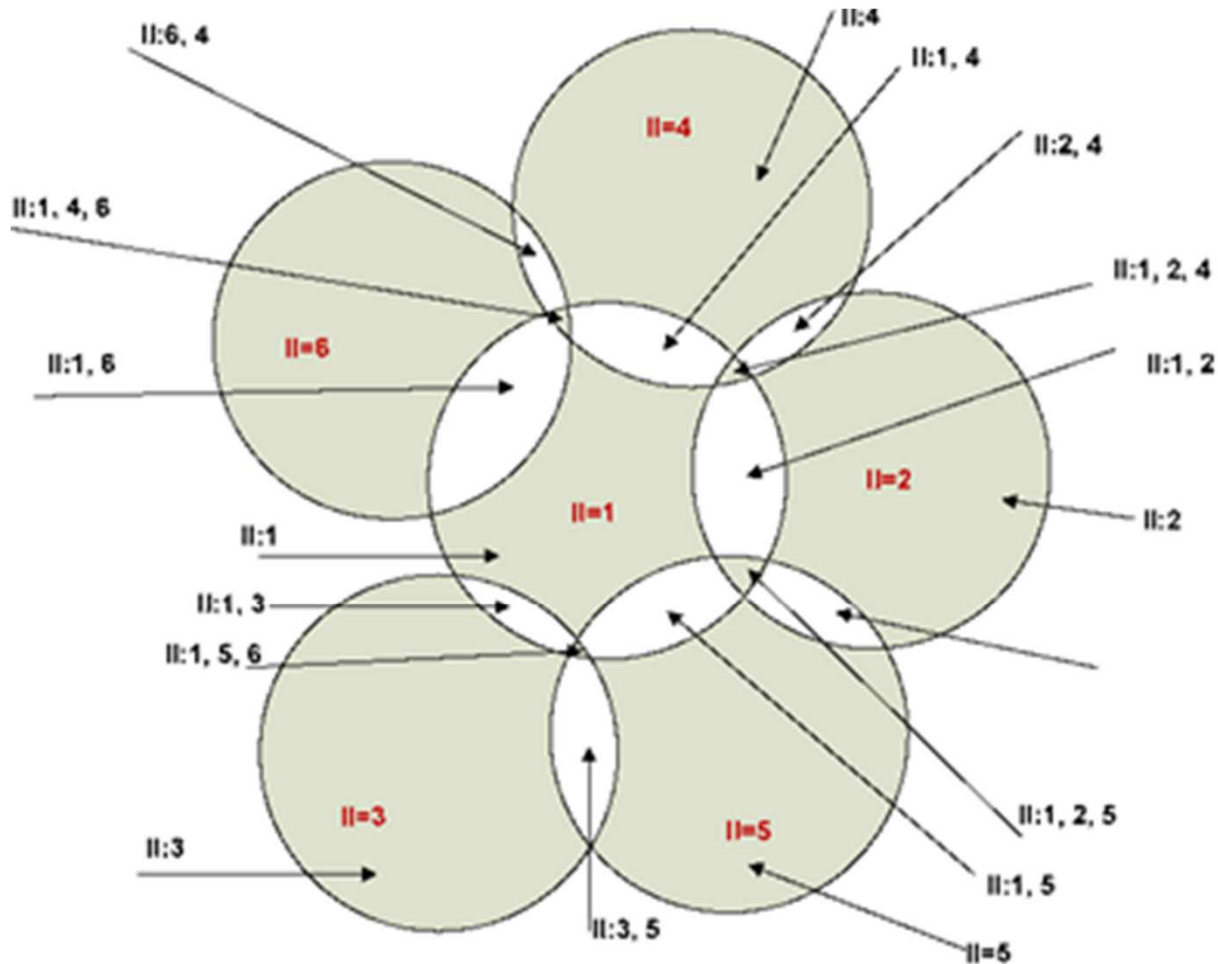
- **Assignment of different II codes to different sectors of an Interrogator**
- **Sector overlapping with another Interrogator will have a different II code while (II=2)**



- **Parts coverage that is not overlapping can have the same II code (II=1)**
- **However, it is recommended to use the minimum possible number of Interrogation Identifiers by one single Mode S ground station**



Practical examples of II code assignments



II=Interrogator Identifier

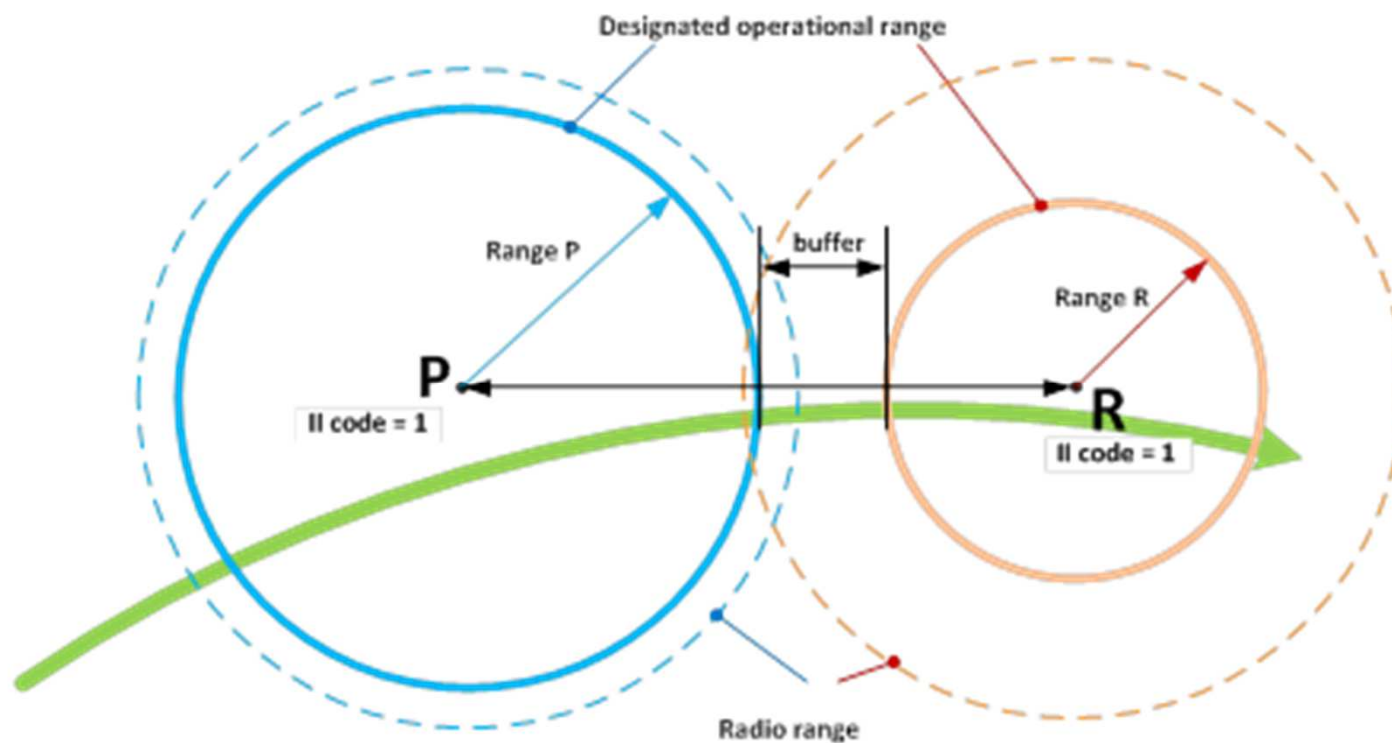
II=1; Interrogator Identifier code assigned to MODE S ground station

II:1, 2, 5: Interrogator Identifier codes used in coverage area, including overlapping areas

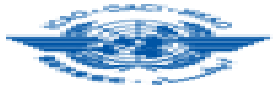


Planning parameters for SSR Mode S ground stations.

- Minimum Separation Distance (MSD) between stations with the same II code: $\text{MSD} = \text{Range P} + 10\text{NM} + \text{Range R}$

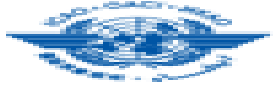


- P & R with different II codes, no separation criteria need to be applied.



Summary

- **SSR Modes S Range**
- **SSR Mode S Designated Operational Coverage (DOC)**
- **A/C 24 bits Address**
- **Interrogator Identifier code (II) four digits (1-15) code**
- **A/C acquisition principles Based on :**
 - **Range and DOC**
 - **All-call (lock out) & Selective (Roll)-call**
- **SSR Modes S II code assignment principles & techniques**



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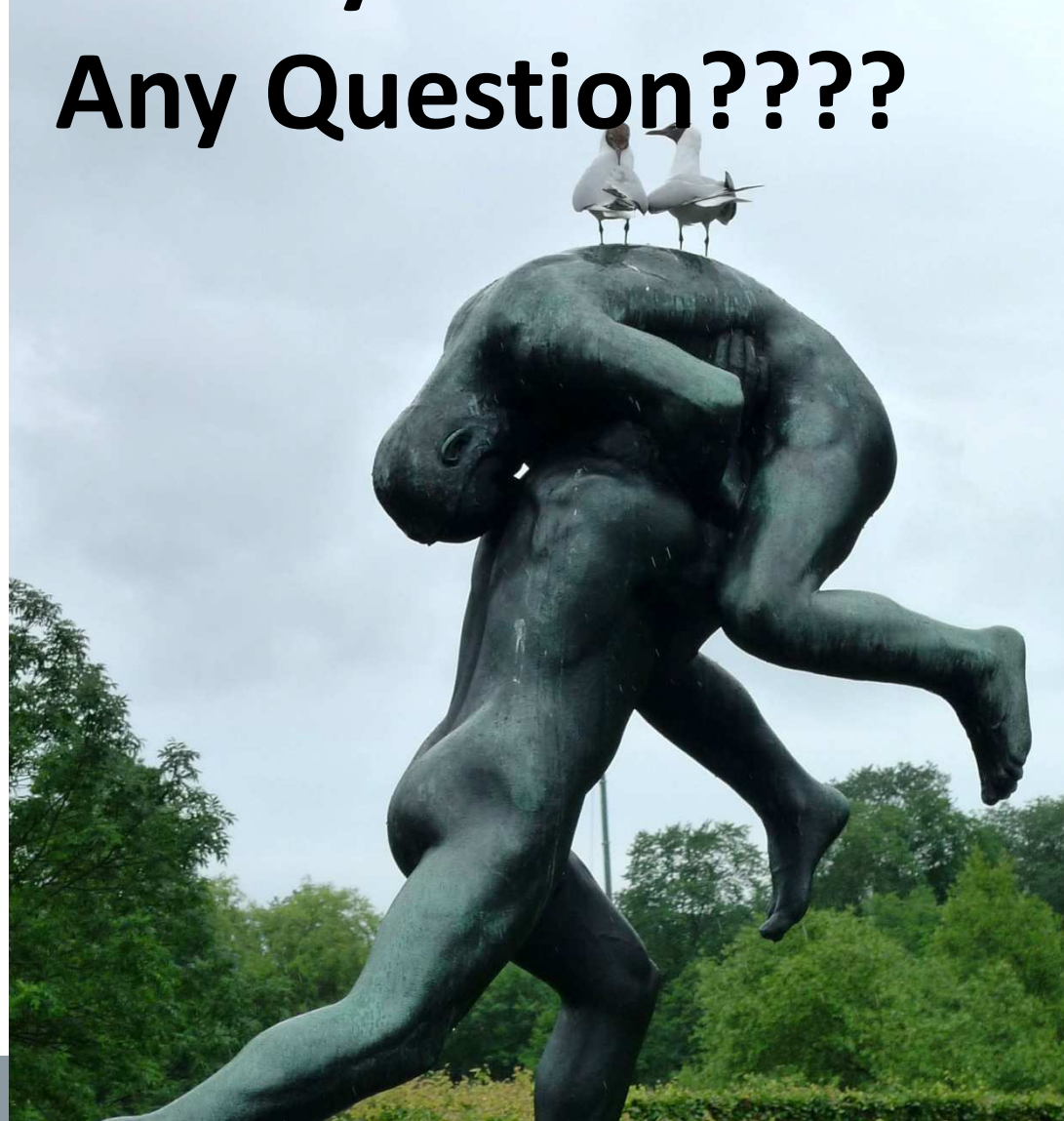
Conclusion

- **The Seamless ATM provision requires Surveillance capability to support PBN, CCO, CDO implementation to ensure agreed level of separation minima;**
- **Aeronautical Surveillance Systems interconnection can be a solution for seamless surveillance capability**
- **Need of Regional coordination;**
- **Need of Interregional coordination (AFI/EUR);**
- **Need of updated data on SSR Mode S ground stations**
- **ICAO Regional Offices and HQs are working to assist States harmonize their implementation projects**



Thank you for your Kind attention !

Any Question????



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