

Mode S & ACAS Programme

Operational Introduction of SSR Mode S

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Mode S Airborne Equipment Requirements for GA Aircraft

For flights in Mode S designated airspace where SSR transponder carriage is already mandated:

Transitional Arrangements

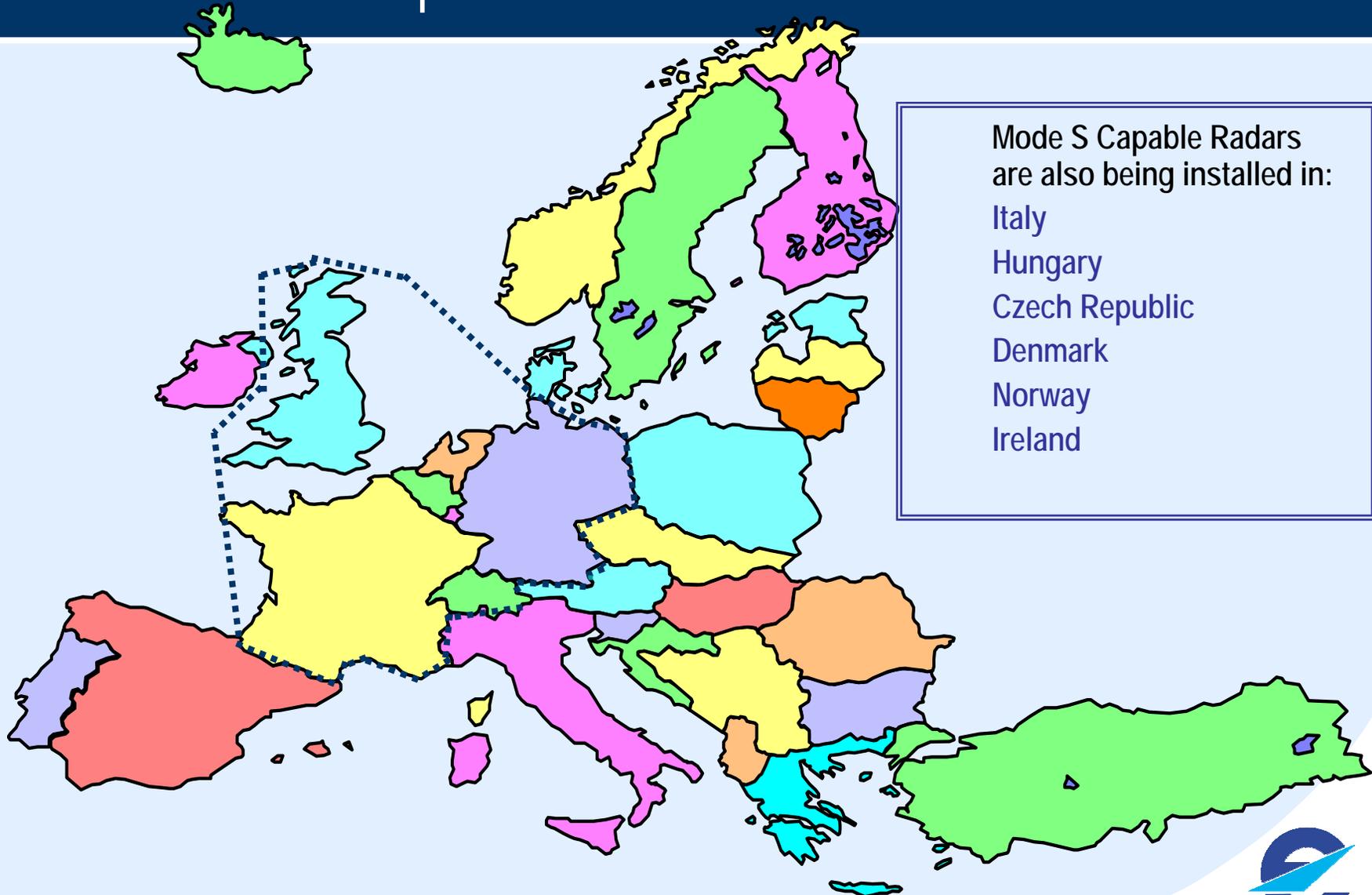
- **IFR as GAT**
 - 1st CoA issued on or after 31 March 2004 – aircraft should already be ELS compliant.
 - Retrofits until 31 March 2007 (recent modification).
- **VFR**
 - 1st CoA issued on or after 31 March 2005 – aircraft should already be ELS compliant.
 - Retrofits until 31 March 2008.
- **Presentation is orientated towards the GA VFR community, but Mode S IFR requirements can be covered, if needed.**

Mode S ELS Functionality

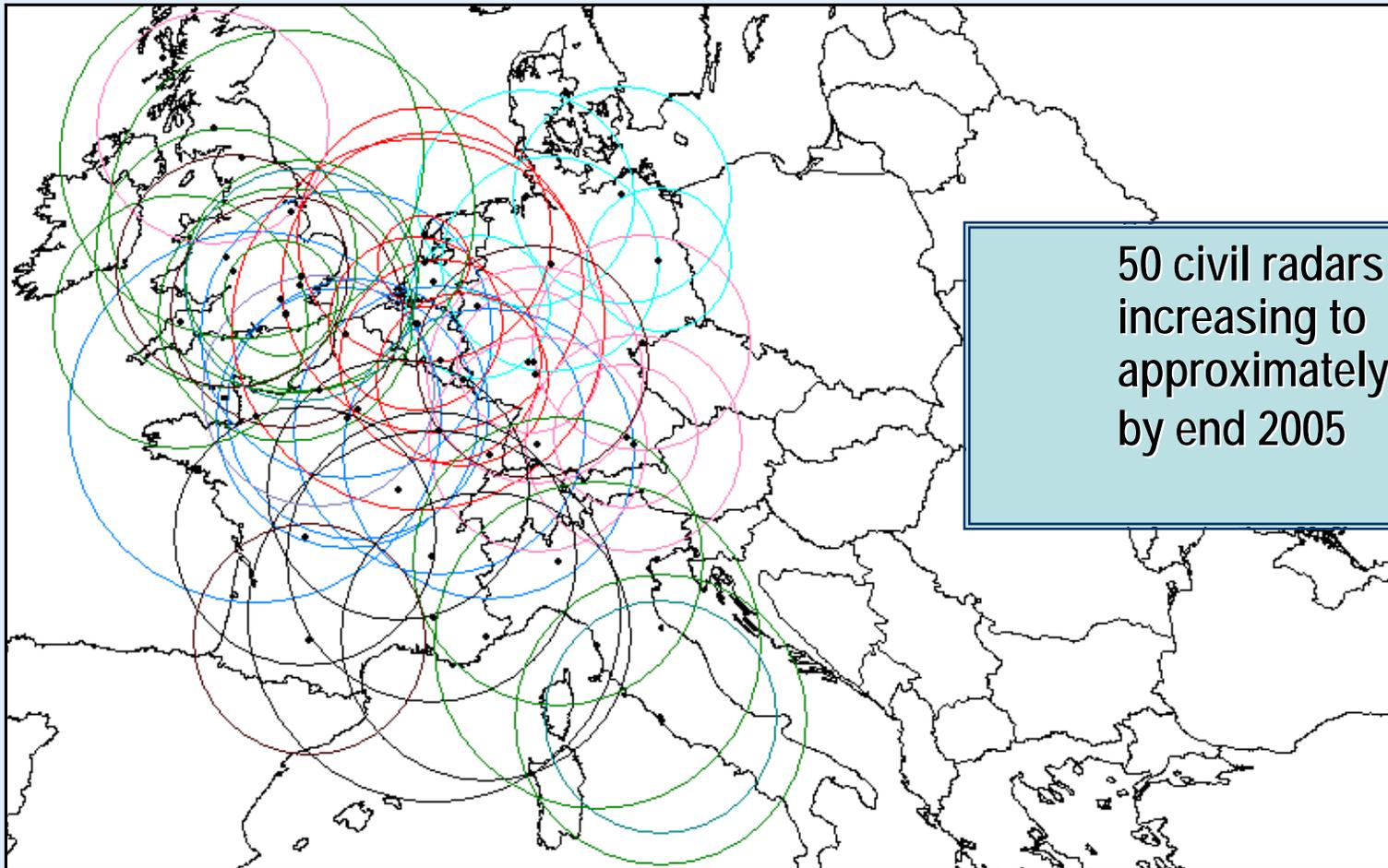
JAA TGL N° 13, Revision 1, provides full details for
Certification of Mode S transponder systems for ELS
But Some Remarks

- **Aircraft Identification (often referred to as Flight ID)**
 - As entered by pilot in item 7 of flight plan, or if no flight plan filed – aircraft registration marking.
- **ICAO 24-bit Aircraft Address**
 - Issued by national registration authority. Not a substitute for Flight ID.
- **Flight Status (airborne / on the ground)**
 - Important for ACAS, and at high activity airports.
- **Antenna Diversity**
 - Required by ICAO, when mass exceeds 5,700 kg, or, maximum TAS exceeds 250 kt.

Designated Mode S Airspace for VFR Expected from 31 March 2008



Mode S Radar Cover

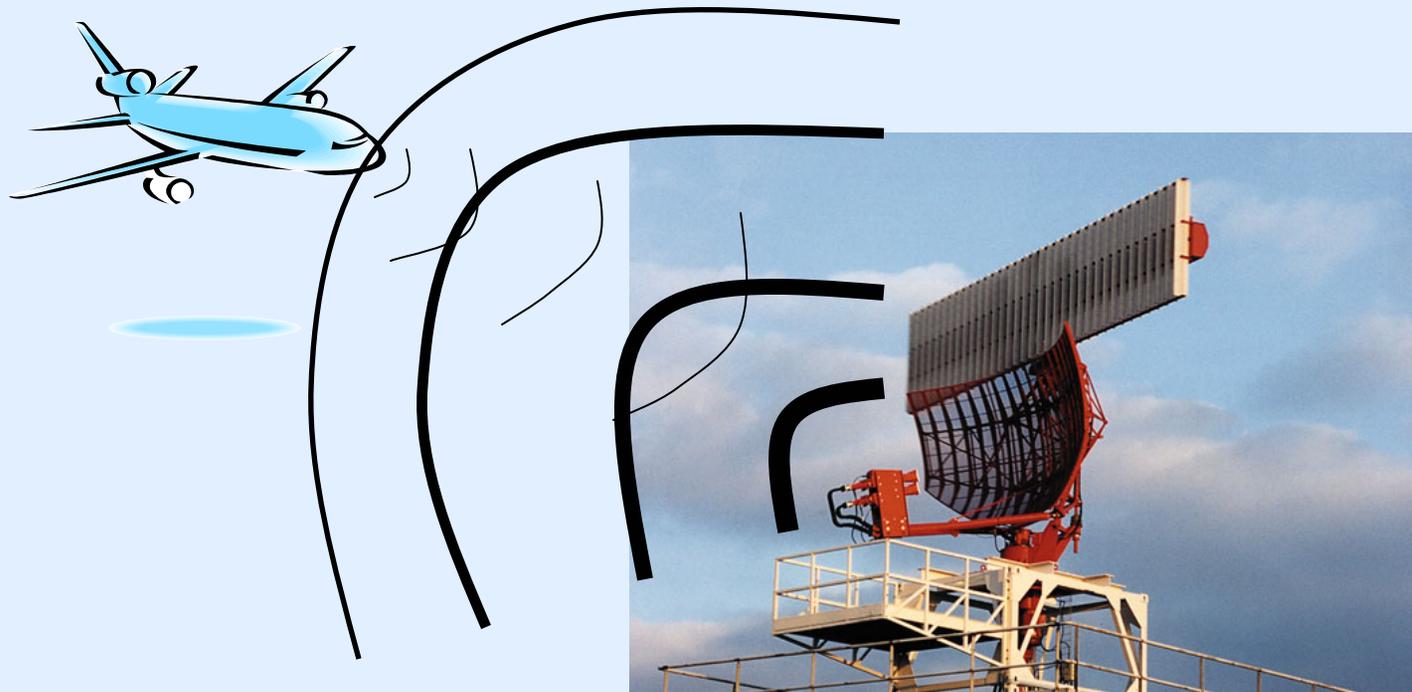


50 civil radars
increasing to
approximately 60
by end 2005

Short Explanation of the Technical Principles

Primary Surveillance Radar

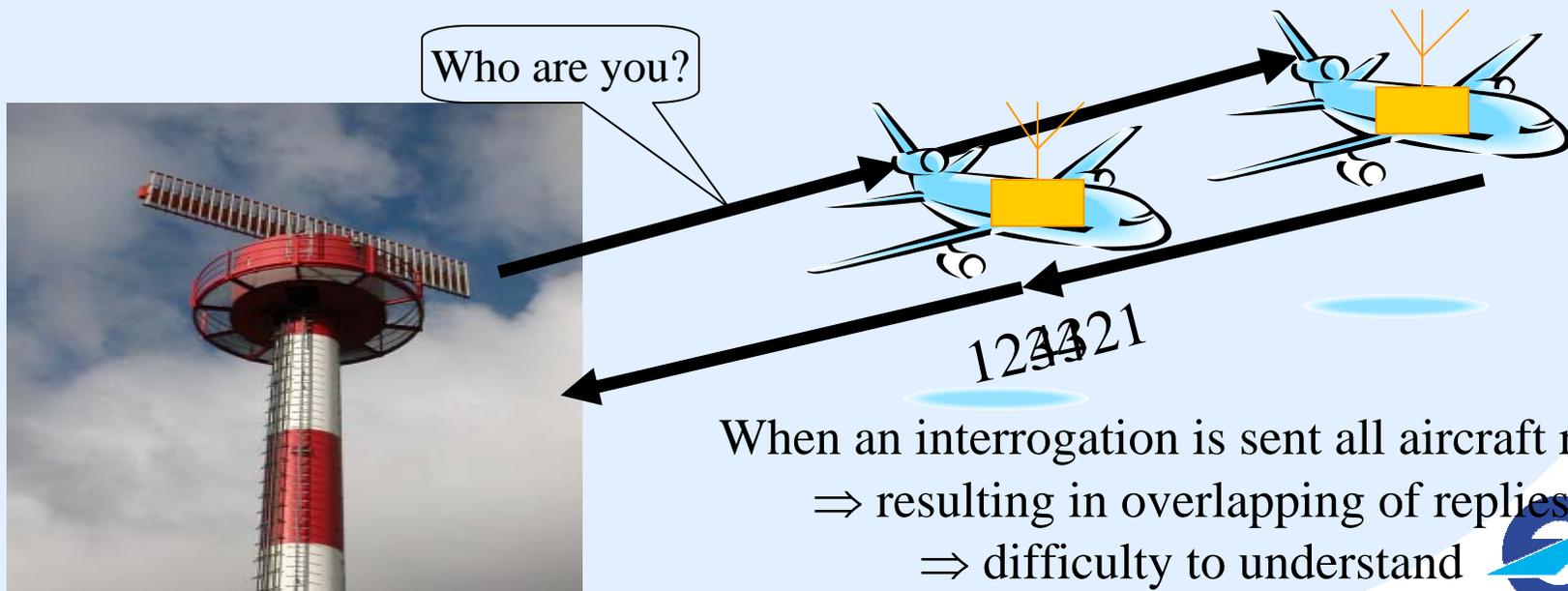
- Reflection of a high power pulse of Radio Frequency energy on the aircraft body >>> distance and bearing.
- Not always effective against small and poor reflective surfaces. Shielding by newly installed wind farms proving a problem.



SSR Mode A/C radar

- **Secondary Surveillance Radar (SSR)**

- radio equipment (a transponder) analyses the interrogations received on one frequency (1030MHz) and reply on another frequency(1090MHz)
- Distance, bearing as a radar + identification (who are you?) = Mode A code + Altitude = Mode C code
- Target acquisition capacity constrained

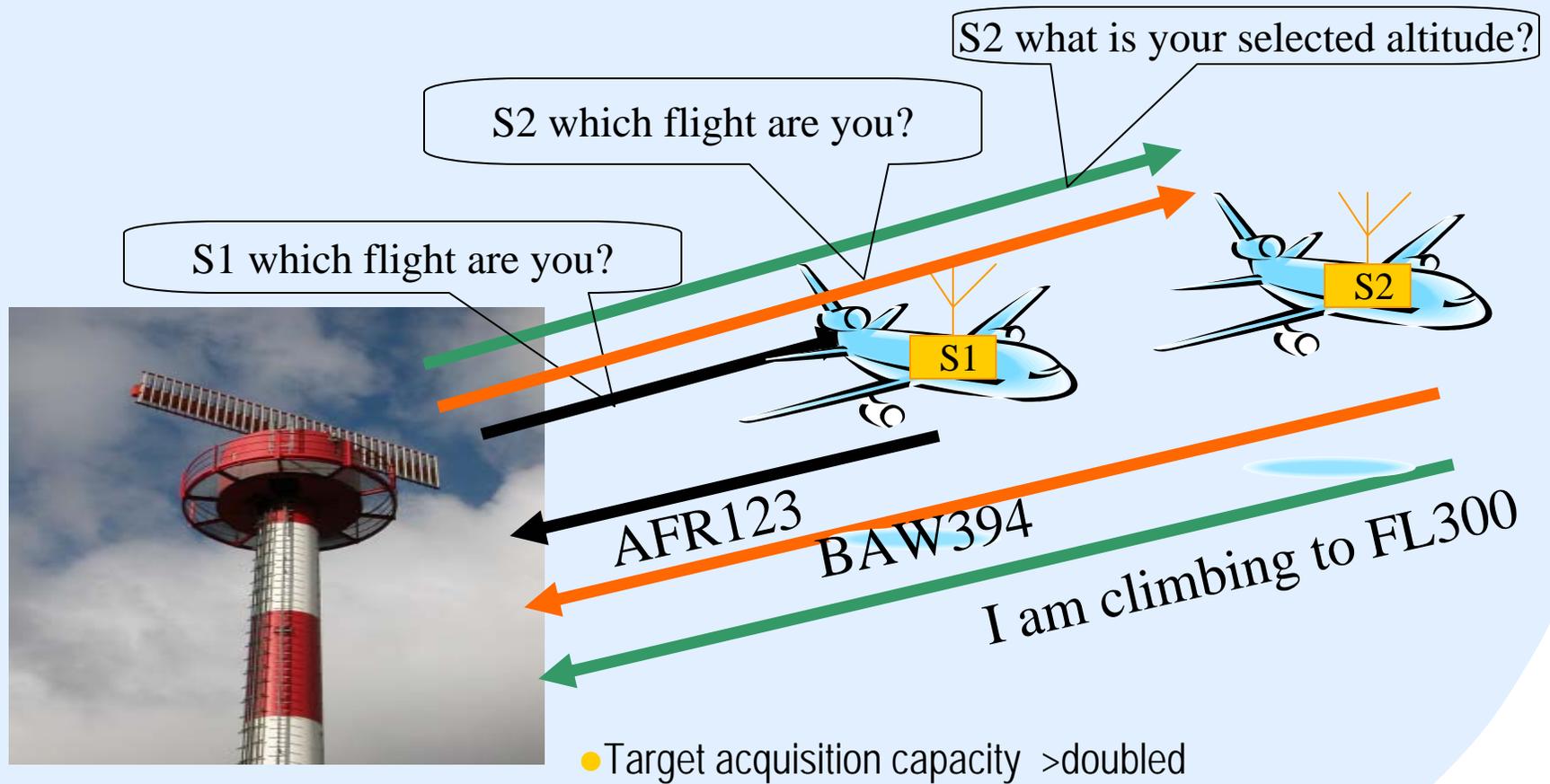


When an interrogation is sent all aircraft reply
⇒ resulting in overlapping of replies
⇒ difficulty to understand

SSR Mode S radar design principles

- **Compatible with SSR Mode A/C**
Same two frequencies used \Rightarrow only 1 transponder required
- **S = Select or Selective using a world-wide unique address for each aircraft**
(24 bits \Rightarrow almost 17 million unique addresses)
- **Air-ground or air-air point to point data-link**

SSR Mode S radar operation



Mode S from the GA Perspective

- **In high traffic density airspace, Mode S is needed, Why?**

- Current SSR was developed during WW II – now at the end of its operational capability.

It suffers from:

- RF congestion, code swaps, degradation of probability of detection, limitation of 4096 codes, inability for vertical plane surveillance.

- **Selective Addressing by Mode S overcomes all of these limitations**

And,

- ACAS is more effective and efficient against intruder aircraft with Mode S transponders

- **Why is GA required to equip with Mode S transponders?**

- Existing State regulations for Mode S ELS only apply where SSR transponders are already required

Mode S from the GA Perspective

- **What's the point, if ATC filter out my transponder reply?**
 - Misinformation. Where the reply is of value in the particular operating area, it is not filtered out (e.g. CAT at FL 350 yes, LARS at 3,500ft amsl no).
- **Why should the military get "unfair" preferential treatment?**
 - Originally rationale was to get military ac (IFR as GAT) through Europe to meet potential strategic operational objectives.
 - Modification to transition arrangements for civil ac has narrowed that gap.
 - Complementary transitional arrangements for military aircraft
- **Is Mode S just a "ruse" to apply route charges to GA?**
 - No

Mode S from the GA Perspective

- **Why can't we have ADS-B instead?**
 - The Mode S transponder extended squitter will permit ADS-B applications, whenever and wherever a ground infrastructure is in place.
 - Already happening (with multilateration) at major European Airports
 - TIS service under consideration.
- **GA members either believe that Transponder carriage is beneficial, or not , as each individual sees it**
 - ICAO Annex 6 requires all aeroplanes to be equipped with a pressure altitude reporting transponder (more efficient ACAS & ATM).
 - Alternative would be for GA to be further squeezed into ever decreasing uncontrolled airspace.
 - More extensive transponder carriage in high density traffic airspace would need to be Mode S (for target acquisition etc).

Questions?



ELS and EHS Requirements

ELS and EHS Requirements

- ELS is applicable to all aircraft that are required to carry SSR transponders – new or old, IFR/VFR, regardless of State of Registry
- EHS is also applicable to....
 - Fixed wing aircraft exceeding MTOM of 5700 kg OR a Maximum Cruising TAS greater than 250 Knots
 - Flying IFR / GAT in EHS airspace
 - Exemption possibilities
- **Transponder Requirements:**
 - ICAO Annex 10 SARP Amendment 77
 - Antenna diversity – as specified in ICAO Annex 10

Definition of EHS capable

- The ECC definition of 'EHS capable' is:
 - Fixed wing aircraft that can provide the list of 8 Downlink Aircraft Parameters (DAPs) are considered to be Mode S EHS capable. Where the parameter 'Track Angle Rate' cannot be provided, 'True Air Speed' should be used instead
 - If these conditions cannot be met the aircraft will not be considered EHS capable
 - Non-capable Aircraft are exempt from EHS requirements up to and beyond the transition period, subject to review by the regulatory authorities and a minimum of 5 years notice for cessation of exemption rules

Operational Deployment

- Why were the transition periods recently changed?
 - **In The Air**
 - Difficulties reported by operators to meet current deadlines
 - One-stop ELS/EHS retrofit requested
 - Disproportionate costs for 100% fleet compliance by 31/03/07
 - AMP Statistics – still over a third of flights not Mode S ELS compliant (Amendment 77)
 - **On the Ground**
 - Not all ANSPs could provide ELS by 31/03/05
 - Detection anomalies jeopardising early operational introduction

Transponder Anomalies

- Mode S Transponder fitted but not compliant with ICAO Annex 10 Amendment 77
- Dual transponder equipage – but each transponder wired with a different Mode S address
- Identified transponder anomalies:
 - Honeywell Primus II – revert to standby after 5 seconds, (TNL already available for short term fix)
 - Rockwell Collins, incorrect Mode A code (0607) broadcast,
 - TPR 720 and 900 component aging problems resulting in pulse shapes degraded beyond Annex 10 levels

Summary of Requirements for Civil flights as IFR/GAT.

- The transition arrangements for ELS are extended until 31 March 2007 (under a blanket exemption)
- Out of service dates for ELS and EHS aligned (31 December 2007)
- Require 90% of EHS applicable fleet to be compliant by 31 March 2007 and remaining 10% by 31 March 2009
- EHS exemption are required
- VFR flight - dates maintained

Exemption Routes

Exemption Routes

- Reason 1: The full set of DAPs cannot be provided by the aircraft. (Indefinite exemption)
- Reason 2: Genuine supply or installation problems. (Update plus 2 months)
- Reason 3: Out of operational service by 31 Dec 07
- Reason 4:
 - 4.1 Test, delivery or maintenance (3 days)
 - 4.2 Occasional access (until March 07 and then annually)
- See ECC section of eurocontrol.int/mode_s website

What do Aircraft Operators need to do?

- Familiarise themselves with the requirements and their aircraft capabilities
- Schedule upgrades if required
- Declare Compliance or apply for an Exemption by 30 June 2005
- Inform the ECC when compliant or if exceeding the 2 month grace period

Don't delay ELS equipage

- These changes have come about as a direct response to address existing problems which are delaying the operational roll-out of Mode S
- The changes to the transition periods should not be used as a pretext to delaying equipage by 24 months
- Note: The Regulators are adamant that there will be no exemptions with regard to the ELS transitional arrangements after March 2007 (whether it is out of your control or not) and that IFR/GAT flights without ELS compliant transponders in Mode S designated airspace after this date will not be allowed