Headquarters U.S. Air Force

Mode S Implementation

OVERALL BRIEFING CLASSIFICATION:
UNCLASSIFIED
Mode S

- Mode S Capabilities
- Current Mode S Coverage
- European Mode S Requirements
- Sample Flight Plan
Mode S Capabilities

- Air surveillance upgrade to legacy Mode 3/A/C system
- Transponder provides digital *air/air* and *air/ground* datalink
- Improved accuracy and *altitude* resolution (down to 25’)
- Reduced interference from closely spaced aircraft
- 5 levels of capability
  - 1: Basic capability with min features (not for ICAO)
  - 2: Elementary Surveillance (ELS) (*minimum* for ICAO)
  - 3: Enhanced Surveillance (EHS) (desired for ICAO)
  - 4/5: Extended datalink capabilities
Each aircraft assigned a unique 24-bit “Aircraft Address” (AA)

- RULE #1: No two aircraft should have the same AA!
- “Default” address assigned to specific tail numbers
- “Dynamic” address assigned only to military aircraft
  - Block of addresses to aid in day-to-day OPSEC
  - Distributed by DoD AIMS/PO to MAJCOMs
  - RULE #1 still applies!

Each aircraft uses a unique 7-character “Aircraft ID” (a.k.a. Flight ID)

- Flight Plan Callsign assigned to mission (i.e. EAGLE11)
- What ATC controllers see on their screens
- Allows for flight plan correlation to Mode S response
Mode S Capabilities

Overview of the Mode S Segments

- CAF & MAF
  - Air-to-Air Segment (ACAS)
- MAF Only
- Air-to-Ground Segment (Mode S Radar)
- Data-Handling & Display Segment

Integrity - Service - Excellence
Mode S Capabilities

What information is being sent?

**Elementary Surveillance**
1. Aircraft Address (AA)
2. Aircraft Identification (Callsign)
3. Mode 3/A Code
4. Transponder Capability Report
5. Active TCAS-II Resolution Report
6. Altitude
7. Flight Status (Air/Ground)

**Enhanced Surveillance**
(ELS Plus the following)
1. Mag Heading
2. Speed (IAS/TAS/Mach No)
3. Roll Angle
4. Track Angle Rate
5. Vertical Rate
6. True Track Angle
7. Ground Speed
8. Selected Flight Level (intentions)
9. Position Information
Current Mode S Coverage
European Requirements

- Currently: UK, BE, NE, LUX, GE, SWISS
- EUROCONTROL Mandate of ELS was 31 Mar 07
  - “State” (i.e. Mil) aircraft by 31 Mar 09
  - Mandatory yearly equipage report sent by AF/A3O
- Applies to Civil and Mil services (i.e. GAT & OAT)
  - Also applies to both IFR & VFR flight
- EHS “required” only for MAF fleet
  - Includes E-3, E-4, and EC-130
  - CAF, ISR, and helicopters only require ELS
- Usage requested once equipped to verify ATM system (both aircraft & ground stations)
European Requirements

- Must annotate Flight Plan (1801) correctly
  - Flt Plan must match Mode S Aircraft ID (i.e. EAGLE11)
    - 7 Characters
    - No spaces before or in between only after
  - Equipment code: /S
  - Mode S w/ Pressure Alt & Flight ID transmit