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SI-Code Extension

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Topics

- SI code extension
 - This presentation is provided to the group for consideration and comment
 - If there is agreement at this meeting and at the meetings John Seereither has with NATO, then we will present this to RTCA/EUROCAE and ICAO for adoption
- TCAS V7.1 in Europe for Military Aircraft
- Hybrid Surveillance for TCAS in Europe



SI Code Extension



- Interrogator Codes are assigned to Mode S Interrogators (e.g., ground sensors and airborne platforms) to help reduce unnecessary aircraft replies on 1090 MHz
- The original 15 Mode S Interrogator Identification (II) codes are inadequate
- The 63 Surveillance Identification (SI) codes were implemented to relieve this inadequacy
- 48 additional interrogator codes could be implemented



SI Code Extension Why do it?



- What is the issue?
 - States will field all interrogators necessary for national sovereignty and defense purposes.
 - Interrogators have to compete for code assignments
 - Currently, the agreement is that 5 codes can be used by the military (IC=15), but these are contested
 - “Kludges” have been proposed to help deal with the restriction to 5 codes
- Improved operational efficiency and better control of the 1090MHz spectrum would result with additional codes



SI Code Extension

How would it be used



- The concept is an extension of the current approach for using II and SI codes
- The use of the Extended Interrogator (XI) codes would be exactly the way II and IS code are used
 - The interrogator would be assigned an XI code
 - The interrogator would inform a transponder under coverage to “lock-out” replies to Mode S All-call interrogations with the specific XI code
 - The transponder would start a time-out timer on the XI values as it currently does for the II an SI values.



SI Code Extension

How does it work?



- The interrogator Mode S all-call message is



- The codes are determined as follows
 - IC – 4 bits with values 0 to 15
 - CL – 3 bits used as follows:
 - CL = 0 (000_2) indicates II codes (15 non zero values)
 - CL= 1 to 4 (001_2 to 100_2) is for current SI codes (63 non-zero values)
 - CL bit values 5,6,7 (101_2 , 110_2 , 111_2) are specified as “shall not be used”
- Use the CL=5,6,7 values to extend the codes to include the 48 additional “XI” values



SI Code Extension

How is Lock-out done?



- The lock-out procedure would be a simple extension of the current procedure
- The Mode S surveillance uplink interrogations (UF=4, 5, 20, 21) are:

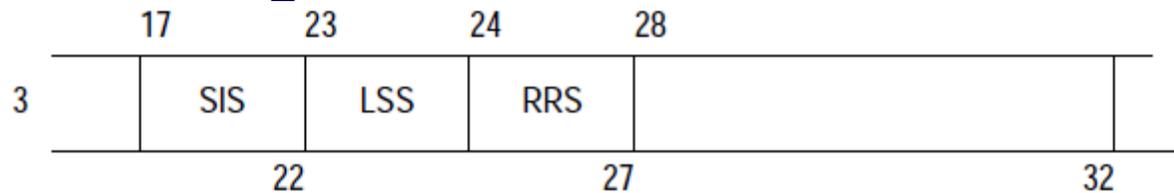
4	00100	PC:3	RR:5	DI:3	SD:16	AP:24 Surveillance, altitude request	
5	00101	PC:3	RR:5	DI:3	SD:16	AP:24 Surveillance, identify request	
20	10100	PC:3	RR:5	DI:3	SD:16	MA:56	AP:24 Comm-A, altitude request
21	10101	PC:3	RR:5	DI:3	SD:16	MA:56	AP:24 Comm-A, identify request



SI Code Extension Protocol



- Only the SD field definition when $DI = 3$ (011_2) would change. When $DI=3$, SD is



- SIS (Surveillance Identifier Subfield) is a 6 bit field containing the code and LSS (Lockout Surveillance Subfield) is a 1 bit field for Lockout
- Bits 28 to 32 are unassigned



SI Code Extension Protocol continued



- Possible protocol:
 - Allocate bit 28 to the extension
 - If $DI=3$, $LSS=1$, and bit 28 is 0
 - Transponder will lockout the SI code = IIS value
 - If $DI=3$, $LSS=1$, and Bit 28 is 1
 - Transponder will lockout XI code = IIS value
 - Note that in this case the IIS value must be less than 48
 - All other conditions are unchanged



SI code extension Interrogator issues



- Current interrogators work correctly without any modification to use II and SI codes
- To use the additional 48 XI codes, the interrogators would have to be modified to allow assignment of these values and possible protocol changes in the use of XI codes to provide backward compatibility
- It may be suitable to allocate some or all of these XI codes to military use (under agreement with the underlying States)

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SI Code Extension

What needs to be done?

- A formal request needs to be submitted with proposed SARPs and MOPS changes
 - Several details like transponder labeling, possible bit definition in Register 10₁₆ indicating XI Code processing ability, and test procedures need to be documented
- Compatibility with current transponders needs to be verified (this should be okay)
- Establish the procedures for use of XI codes
- EUROCAE, RTCA, and ICAO need to agree to change



SI Code Extension Why Now?



- Update to transponders takes decades – except now
- The ADS-B Out mandates in the US (2020) and expected in Europe (2015?) will necessitate transponder updates to the new standards: DO 181D and ED 73C change 1
- The final phases of work on Change 1 standards are in the final stages of development (meeting November 15 at EUROCAE)
- If this change is implemented now, it will be in place and useable consistent with ADS-B mandated equipage dates
- Otherwise, it will be around 2030 before it could be used

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