

3.3.3 Coding Aviation Protocols

The International Civil Aviation Organization (ICAO) has defined four coding methods which can be used to identify 406 MHz Emergency Locator Transmitters (ELTs) (Convention on International Civil Aviation, Annex 10, Appendix D to Part I - Emergency Locator Transmitter Coding).

The identification codes recommended by ICAO are in accordance with the general structure of Cospas-Sarsat user protocols shown in Figure 3.5 and described in the following sections:

- 3.3.3.1 Coding ELTs with the Beacon Serial Number;
- 3.3.3.2 Coding ELTs with the Aircraft Operator Designator and a Serial Number;
- 3.3.3.3 Coding ELTs with the Aircraft 24-bit Address; and
- 3.3.3.4 Coding ELTs with the Aircraft Nationality and Registration Marking.

All aviation coding methods include a country code based on ITU Radio Regulation Appendix 43 (see section 3.3.1). ICAO also recommends that "each beacon shall be assigned a unique coding and shall be registered" with the appropriate authority (Convention on International Civil Aviation, Annex 10, Volume I, Part I, Chapter 5. Emergency Locator Transmitter (ELT) for Search and Rescue).

3.3.3.1 Coding ELTs with the Beacon Serial Number

Protocol code bits 37 to 39 for this method of encoding identification data are set to "011" to designate the serial user protocol. Bits 40 to 42 are used to identify the beacon type and coding method (i.e. "000" to indicate an ELT serial number) since the same serial user protocol is used for several applications. If bit 43 is set to "1", the Cospas-Sarsat type approval certificate number is encoded in bits 74 to 83, as shown in Figure 3.10. This will help ensure that the serial identity of the beacon is unique (see also item 3.3.2.2).

Figure 3.10: Coding ELTs with the Beacon Serial Number

Bits	25	26	27	36	37 ..	39	40 ..	42	43	44	63	64	73	74	83	84	85				
	0	1	Country Code			0	1	1	0	0	0	C	(20 bits) Serial Number			All "0" or Nation. Use		C/S Cert.No or National Use		R	L
<ul style="list-style-type: none"> - bit 25: format flag set to "0" (short message); - bit 26: protocol flag set to "1"; - bits 27 to 36: country code = 3 digit decimal number encoded in binary notation (see section 3.2.3.2); - bits 37 to 39: protocol code, set to "011" (serial user protocol); - bits 40 to 42: beacon type set to "000" for ELTs with serial identification; - bit 43: (C) set to "1" to indicate that the Cospas-Sarsat type approval certificate number is encoded in bits 74 to 83, set to "0" otherwise; - bits 44 to 63: sequential number, allocated by manufacturers*, encoded in binary notation with the least significant bit on the right; - bits 64 to 73: all "0", unless designated otherwise by the responsible administration*; - bits 74 to 83: if bit 43 is set to "1", these bits contain the Cospas-Sarsat type approval certificate number for that beacon model (i.e. a unique number assigned by Cospas-Sarsat for each beacon model), encoded in binary notation with the least significant bit on the right; if bit 43 is set to "0", these bits are designated by the responsible administration *; - bits 84 and 85: (RL) set to "01" if a 121.5 MHz radio-locating transmitter is included in the beacon (see Table 3.6 to indicate other radio-locating devices). 																					

Note: (*) Alternative means of allocating and controlling serial numbers on a national basis may be adopted by administrations, but they must be compatible with the serial user protocol defined in document C/S T.001, and provide a unique beacon 15 Hex ID.

3.3.3.2 Coding ELTs with the Aircraft Operator Designator and a Serial Number

The 3-letter Aircraft Operator Designator (AOD), defined in ICAO DOC 8585, is a unique identification of Aircraft Operators. The AOD can be coded in the serial user protocol as shown in Figure 3.11.

Figure 3.11: Coding ELTs with the Aircraft Operator Designator and Serial Number

Bits	25	26	27	36	37 ..	39	40 ..	42	43	44	61	62	73	74	83	84	85
	0	1	Country Code			0 1 1	0 0 1	C		Operator 3-letter Designator			Serial Number		C/S Cert.No or National Use		R L
<ul style="list-style-type: none"> - bit 25: format flag set to "0" (short message); - bit 26: protocol flag set to "1"; - bits 27 to 36: country code = 3 digit decimal number encoded in binary notation (see section 3.2.3.2); - bits 37 to 39: protocol code, set to "011" (serial protocol); - bits 40 to 42: beacon type set to "001" for ELTs identified with the 3-letter aircraft operator designator and a serial number; - bit 43: (C) set to "1" to indicate that the Cospas-Sarsat type approval certificate number is encoded in bits 74 to 83, set to "0" otherwise*; - bits 44 to 61: 3-letter aircraft operator designator, encoded using the Modified-Baudot code (see Table C.1 of Annex C); - bits 62 to 73: serial number, as designated by the operator, is encoded in binary notation with the least significant bit to the right (No. 0001 up to 4096); - bits 74 to 83: if bit 43 is set to "1", these bits contain the Cospas-Sarsat type approval certificate number for that beacon model (i.e. a unique number assigned by Cospas-Sarsat for each beacon model), encoded in binary notation with the least significant bit on the right; if bit 43 is set to "0", these bits are designated by the responsible administrations ; - bits 84 and 85: (RL) set to "01" if a 121.5 MHz radio-locating transmitter is included in the beacon (see Table 3.6 to indicate other radio-locating devices). 																	

3.3.3.3 Coding ELTs with the Aircraft 24-bit Address

The Aircraft 24-bit Address is a unique 24-bit binary code assigned to the aircraft by national administrations in accordance with Annex 10 to the Convention on International Aviation. The Aircraft 24-bit Address is coded in the serial user protocol as shown in Figure 3.12.

Figure 3.12: Coding ELTs with the Aircraft 24-bit Address

Bits	25	26	27	36	37 ..	39	40 ..	42	43	44	67	68	73	74	83	84	85				
	0	1	Country Code			0	1	1	0	1	1	C	24-bit Aircraft Address			Specific ELT number		C/S Cert. No or National Use		R	L
<p>- bit 25: format flag set to "0" (short message);</p> <p>- bit 26: protocol flag set to "1";</p> <p>- bits 27 to 36: country code = 3 digit decimal number encoded in binary notation (see section 3.2.3.2);</p> <p>- bits 37 to 39: protocol code, set to "011"(serial protocol);</p> <p>- bits 40 to 42: beacon type set to "011" for ELTs identified with aircraft 24-bit address;</p> <p>- bit 43: (C) set to "1" to indicate that the Cospas-Sarsat type approval certificate number is encoded in bits 74 to 83, set to "0" otherwise;</p> <p>- bits 44 to 67: 24-bit aircraft address;</p> <p>- bits 68 to 73: 6 bit specific ELT number, in binary notation with the least significant bit on the right, if several ELTs are carried in the same aircraft and encoded with the same 24 bit address, or default to 0's when only one ELT is carried, see Notes (1) and (2) below;</p> <p>- bits 74 to 83: if bit 43 is set to "1", these bits contain the Cospas-Sarsat type approval certificate number for that beacon model (i.e. a unique number assigned by Cospas-Sarsat for each beacon model), encoded in binary notation with the least significant bit on the right; if bit 43 is set to "0", these bits are designated by the responsible administrations;</p> <p>- bits 84 and 85: (RL) set to "01" if a 121.5 MHz radio-locating transmitter is included in the beacon (see Table 3.6 to indicate other radio-locating devices).</p>																					

Notes: (1) Before attempting to encode an ELT with the serial user protocol using the aircraft 24-bit address, to avoid repeating an existing 15 Hex ID, manufacturers / programming facilities should request the inquirer / user to provide appropriate information on the specific number to be encoded in bits 68 to 73.

(2) Administrations should advise users to inform manufacturers / programming facilities on the number to be encoded in bits 68 to 73 each time they request the coding of an ELT with a specific aircraft 24-bit address.

3.3.3.4 Coding ELTs with the Aircraft Nationality and Registration Marking

The aircraft nationality and registration marking is a unique alphanumeric number assigned by national administrations in accordance with Annex 10 to the Convention on International Civil Aviation. This is coded in the aviation user protocol as shown in Figure 3.13.

Figure 3.13: Coding ELTs with the Aircraft Nationality and Registration Marking

Bits	25	26	27	36	37 ..	39	40	81	82	83	84	85
	0	1	Country Code		0	0	1	Aircraft Registration Marking (42 bits = up to 7 alphanumeric charact.)		ELT number	R	L
<ul style="list-style-type: none"> - bit 25: format flag set to "0" (short message); - bit 26: protocol flag set to "1"; - bits 27 to 36: country code = 3 digit decimal number encoded in binary notation (see section 3.2.3.2); - bits 37 to 39: protocol code, set to "001" (aviation user protocol); - bits 40 to 81: aircraft nationality and registration marking, containing up to 7 alphanumeric characters, is encoded using the modified-Baudot code (see Table C.1 of Annex C); if the aircraft nationality and registration marking include less than 7 characters, blank spaces should be encoded to the left of the characters using the modified-Baudot space symbol: "100100"; - bits 82 and 83: Specific ELT number where "00" indicates the first ELT on the aircraft coded with this protocol and "01", "10" and "11" identify additional ELTs on the same aircraft, all coded with the Aviation User protocol ¹; - bits 84 and 85: (RL) set to "01" if a 121.5 MHz radio-locating transmitter is included in the beacon (see Table 3.6 to indicate other radio-locating devices). 												

3.3.4 Coding PLBs with the Serial User Protocol

The serial user protocol is used to code beacons that have been designed as Personal Locator Beacons (PLB). These PLBs are coded as shown in Figure 3.14 using the serial user protocol with protocol code bits (40 - 42) set to "110".

¹ Effective as of 1 November 2011.