

**RTCA Special Committee 186, Working Group 3  
ADS-B 1090ES MOPS Maintenance  
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**Other Changes related to T=0 and T=1**

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#### 2.2.3.2.4.5 “TIME” (T) Subfield in ADS-B Surface Position Messages

The “TIME” (T) subfield is a 1-bit (“ME” bit 21, Message bit 53) field that **shall** be used to indicate whether or not the epoch of validity for the horizontal position data in a Surface Position Message is an exact 0.2 second UTC epoch. If the time of applicability of the position data is synchronized to an exact 0.2 second UTC epoch, the “TIME” (T) subfield **shall** be set to ONE (1); otherwise, the “TIME” (T) subfield **shall** be set to ZERO (0).

~~The “TIME” (T) subfield may be set to ONE (1) only for TYPE Codes 5 and 6 (see §2.2.3.2.3.1 and Table 2-16) when used to indicated synchronization as discussed in the previous paragraph.~~

##### Notes:

1. *An ADS-B Transmitting Subsystem that sets the “TIME” (T) subfield to ONE (1) must accept a GNSS TIME MARK input from the navigation data source in order to be able to update the position data from the navigation data source to an exact 0.2 second UTC epoch (see §2.2.5.1.6).*
2. *An arithmetic description of the intended synchronization implementation is provided in the “Commentary” paragraphs provided in §2.2.3.2.4.7.2 for precision Latitude Position Extrapolation and in §2.2.3.2.4.8.2 for precision Longitude Position Extrapolation.*

### 2.2.5.1.6.2 Case, where TIME (“T”) = 1

- a. If the ADS-B Transmitting Subsystem is capable of setting the TIME (“T”) subfield (see §2.2.3.2.3.5) to ONE in the Airborne Position Message (see §2.2.3.2.3) or in the Surface Position Message (see §2.2.3.2.4), then the ADS-B Transmitting Subsystem **shall** accept and process a GPS/GNSS Time Mark pulse or an equivalent time synchronization indication from the source of navigation data.
- b. The leading edge of the GPS/GNSS Time Mark pulse, or equivalent, **shall** indicate the exact moment (epoch of the UTC time scale) ~~±5 milliseconds~~ that represents the time of applicability of Position, Velocity, and Time (PVT) information that is received from the navigation source. **The ADS-B Transmitting Subsystem shall determine the leading edge to within ±5 milliseconds.** The PVT data **shall** ~~is assumed to~~ be provided by the navigation data source no later than 200 milliseconds after the leading edge of the GPS/GNSS Time Mark pulse, or equivalent.

**Note:** A possible implementation of the GPS/GNSS Time Mark pulse is illustrated in Figure 2-15.

- c. When the ADS-B Transmitting Subsystem sets the TIME (“T”) subfield to ONE in the Airborne Position Message (see §2.2.3.2.3), then the ADS-B Transmitting Subsystem **shall** use the GPS/GNSS Time Mark pulse to accomplish the following:
  - (1). Synchronize the loading of the Airborne Position Message such that the register is properly loaded 100 milliseconds ±50 milliseconds prior to the time of applicability of the data being loaded into the register.
  - (2). Establish the “Time” subfield in ADS-B Airborne Position Messages (see §2.2.3.2.3) as specified in §2.2.3.2.3.5,
  - (3). Establish the “CPR Format” subfield in ADS-B Airborne Position Messages (see §2.2.3.2.3) as specified in §2.2.3.2.3.6,
  - (4). Extrapolate Airborne Latitude Position in ADS-B Airborne Position Messages (see §2.2.3.2.3) as specified in §2.2.3.2.3.7.2.
  - (5). Extrapolate Airborne Longitude Position in ADS-B Airborne Position Messages (see §2.2.3.2.3) as specified in §2.2.3.2.3.8.2,
- d. When the ADS-B Transmitting Subsystem sets the TIME (“T”) subfield to ONE in the Surface Position Message (see §2.2.3.2.4), then the ADS-B Transmitting Subsystem **shall** use the GPS/GNSS Time Mark pulse to accomplish the following:
  - (1). Synchronize the loading of the Surface Position Message such that the register is properly loaded 100 milliseconds ±50 milliseconds prior to the time of applicability of the data being loaded into the register.
  - (2). Establish the “Time” subfield in ADS-B Surface Position Messages (see §2.2.3.2.4) as specified in §2.2.3.2.4.5,
  - (3). Establish the “CPR Format” subfield in ADS-B Surface Position Messages (see §2.2.3.2.4) as specified in §2.2.3.2.4.6,

- (4). Extrapolate Surface Latitude Position in ADS-B Surface Position Messages (see §2.2.3.2.4) as specified in §2.2.3.2.4.7.2, and
- (5). Extrapolate Surface Longitude Position in ADS-B Surface Position Messages (see §2.2.3.2.4) as specified in §2.2.3.2.4.8.2.

### 2.2.5.2.1 Airborne Position Message Latency

The ADS-B Transmission Device Message Processor function **shall** update the Airborne Position Message data fields specified in §2.2.3.2.3 as follows:

- a. Type information may change due to changes in the precision, quality, or integrity of received navigation information. As such, any change in the TYPE information identified in §2.2.3.2.3.1, or in the NIC Supplement information identified in §2.2.3.2.3.3, **shall** be reflected in the TYPE subfield of the next scheduled Airborne Position Message transmission provided that the change occurs and is detected at least 100 milliseconds prior to the next scheduled Airborne Position Message transmission.
- b. Any change in the Surveillance Status identified in §2.2.3.2.3.2 **shall** be reflected in the Surveillance Status subfield of the next scheduled Airborne Position Message transmission provided that the change occurs and is detected at least 100 milliseconds prior to the next scheduled Airborne Position Message transmission.
- c. Any change in the Altitude identified in §2.2.3.2.3.4 **shall** be reflected in the Altitude subfield of the next scheduled Airborne Position Message transmission provided that the change occurs and is detected at least 100 milliseconds prior to the next scheduled Airborne Position Message transmission.

~~d. CPR Format changes at 0.2 second intervals or more often as specified in §2.2.3.2.3.6. A change in the CPR Format **shall** be reflected in the CPR Format subfield of the next scheduled Airborne Position Message transmission provided that the change occurs at least “X” milliseconds prior to the next scheduled Airborne Position Message transmission. The time “X,” **shall** be dependent upon the  $NAC_p$  (see Table 2-71, §2.2.3.2.7.2.7 and §2.2.8.2.12) provided to the transmission device as follows:~~

~~(1). “X” is equal to 200 milliseconds if  $NAC_p \leq 8$~~

~~(2). “X” is equal to 50 milliseconds if  $NAC_p > 8$~~

~~**Note:** All efforts must be made to allocate the time necessary to update the actual transmission buffer within the 200 millisecond time frame allocated to the CPR Format changes. That is that no additional time can be added to the 200 milliseconds already allocated.~~

~~e. Encoded Latitude (specified in §2.2.3.2.3.7) must be extrapolated in accordance with §2.2.3.2.3.7.2 for precision systems. Likewise, Encoded Latitude must be updated in accordance with §2.2.3.2.3.7.3 for non-precision systems. Any change in the Encoded Latitude **shall** be reflected in the Encoded Latitude subfield of the next scheduled Airborne Position Message transmission provided that the change occurs at least “X” milliseconds prior to the next scheduled Airborne Position Message transmission. The time “X,” **shall** be dependent upon the  $NAC_p$  (see Table 2-71, §2.2.3.2.7.2.7 and §2.2.8.2.12) provided to the transmission device as follows:~~

~~(1). “X” is equal to 200 milliseconds if  $NAC_p \leq 8$~~

~~(2). “X” is equal to 50 milliseconds if  $NAC_p > 8$~~

~~**Note:** All efforts must be made to allocate the time necessary to update the actual transmission buffer within the 200 millisecond time frame allocated updating the Encoded Latitude. That is, that no additional time can be added to the 200 milliseconds already allocated~~

- d. Own Position Latitude Data (specified in §2.2.5.1.7) **shall** be reflected in the Encoded Latitude subfield (specified in §2.2.3.2.3.7) of the next scheduled Airborne Position Message transmission, extrapolated in accordance with §2.2.3.2.3.7.2 or §2.2.3.2.3.7.3, provided that the data is provided through the appropriate variable data input interface at least 50 milliseconds prior to the next scheduled Airborne Position Message transmission.
- ~~f. Encoded Longitude (specified in §2.2.3.2.3.8) must be extrapolated in accordance with §2.2.3.2.3.8.2 for precision systems. Likewise, Encoded Longitude must be updated in accordance with §2.2.3.2.3.8.3 for non-precision systems. Any change in the Encoded Longitude **shall** be reflected in the Encoded Longitude subfield of the next scheduled Airborne Position Message transmission provided that the change occurs at least “X” milliseconds prior to the next scheduled Airborne Position Message transmission. The time “X,” **shall** be dependent upon the  $NAC_p$  (see [Table 2-71](#), §2.2.3.2.7.2.7 and §2.2.8.2.12) provided to the transmission device as follows:~~
  - (1). “X” is equal to 200 milliseconds if  $NAC_p \leq 8$
  - (2). “X” is equal to 50 milliseconds if  $NAC_p > 8$

~~**Note:** All efforts must be made to allocate the time necessary to update the actual transmission buffer within the 200 millisecond time frame allocated updating the Encoded Latitude. That is, that no additional time can be added to the 200 milliseconds already allocated~~

- e. Own Position Longitude Data (specified in §2.2.5.1.8) **shall** be reflected in the Encoded Longitude subfield (specified in §2.2.3.2.3.7) of the next scheduled Airborne Position Message transmission, extrapolated in accordance with §2.2.3.2.3.8.2 or §2.2.3.2.3.8.3, provided that the data is provided through the appropriate variable data input interface at least 50 milliseconds prior to the next scheduled Airborne Position Message transmission.

## 2.2.5.2.2 Surface Position Message Latency

The ADS-B Transmission Device Message Processor function **shall** update the Surface Position Message data fields specified in §2.2.3.2.4 as follows:

- a. Type information may change due to changes in the precision, quality, or integrity of received navigation information. As such, any change in the TYPE information identified in §2.2.3.2.4.1 **shall** be reflected in the Type subfield of the next scheduled Surface Position Message transmission provided that the change occurs and is detected at least 100 milliseconds prior to the next scheduled Surface Position Message transmission.

- b. Any change in Movement (i.e., Ground Speed) identified in §2.2.3.2.4.2 **shall** be reflected in the Movement subfield of the next scheduled Surface Position Message transmission provided that the change occurs and is detected at least 100 milliseconds prior to the next scheduled Surface Position Message transmission.
- c. Any change in Ground Track identified in §2.2.3.2.4.3 and §2.2.3.2.4.4 **shall** be reflected in the appropriate Ground Track subfields of the next scheduled Surface Position Message transmission provided that the change occurs and is detected at least 100 milliseconds prior to the next scheduled Surface Position Message transmission.
- d. ~~CPR Format changes at 0.2 second intervals as specified in §2.2.3.2.4.6. A change in the CPR Format **shall** be reflected in the CPR Format subfield of the next scheduled Surface Position Message transmission provided that the change occurs at least “X” milliseconds prior to the next scheduled Surface Position Message transmission. The time “X,” **shall** be dependent upon the  $NAC_p$  (see Table 2-71, §2.2.3.2.7.2.7 and §2.2.8.2.12) provided to the transmission device as follows:~~
  - (1). “X” is equal to 200 milliseconds if  $NAC_p \leq 8$
  - (2). “X” is equal to 50 milliseconds if  $NAC_p > 8$

**Note:** ~~All efforts must be made to allocate the time necessary to update the actual transmission buffer within the 200 millisecond time frame allocated to the CPR Format changes. That is that no additional time can be added to the 200 milliseconds already allocated.~~
- e. ~~Encoded Latitude (specified in §2.2.3.2.4.7) must be extrapolated in accordance with §2.2.3.2.4.7.2 for precision systems. Likewise, Encoded Latitude must be updated in accordance with §2.2.3.2.4.7.3 for non precision systems. Any change in the Encoded Latitude **shall** be reflected in the Encoded Latitude subfield of the next scheduled Surface Position Message transmission provided that the change occurs at least “X” milliseconds prior to the next scheduled Surface Position Message transmission. The time “X,” **shall** be dependent upon the  $NAC_p$  (see Table 2-71, §2.2.3.2.7.2.7 and §2.2.8.2.12) provided to the transmission device as follows:~~
  - (1). “X” is equal to 200 milliseconds if  $NAC_p \leq 8$
  - (2). “X” is equal to 50 milliseconds if  $NAC_p > 8$

**Note:** ~~All efforts must be made to allocate the time necessary to update the actual transmission buffer within the 200 millisecond time frame allocated updating the Encoded Latitude. That is, that no additional time can be added to the 200 milliseconds already allocated.~~
- d. Own Position Latitude Data (specified in §2.2.5.1.7) **shall** be reflected in the Encoded Latitude subfield (specified in §2.2.3.2.4.7) of the next scheduled Surface Position Message transmission, extrapolated in accordance with §2.2.3.2.4.7.2 or §2.2.3.2.4.7.3, provided that the data is provided through the appropriate variable data input interface at least 50 milliseconds prior to the next scheduled Surface Position Message transmission.

~~f. Encoded Longitude (specified in §2.2.3.2.4.8) must be extrapolated in accordance with §2.2.3.2.4.8.2 for precision systems. Likewise, Encoded Latitude must be updated in accordance with §2.2.3.2.4.8.3 for non-precision systems. Any change in the Encoded Longitude **shall** be reflected in the Encoded Longitude subfield of the next scheduled Surface Position Message transmission provided that the change occurs at least “X” milliseconds prior to the next scheduled Surface Position Message transmission. The time “X,” **shall** be dependent upon the  $NAC_P$  (see Table 2-71, §2.2.3.2.7.2.7 and §2.2.8.2.12) provided to the transmission device as follows:~~

~~(1). “X” is equal to 200 milliseconds if  $NAC_P \leq 8$~~

~~(2). “X” is equal to 50 milliseconds if  $NAC_P > 8$~~

~~**Note:** All efforts must be made to allocate the time necessary to update the actual transmission buffer within the 200 millisecond time frame allocated updating the Encoded Longitude. That is, that no additional time can be added to the 200 milliseconds already allocated.~~

e. Own Position Longitude Data (specified in §2.2.5.1.8) **shall** be reflected in the Encoded Longitude subfield (specified in §2.2.3.2.4.7) of the next scheduled Surface Position Message transmission, extrapolated in accordance with §2.2.3.2.4.8.2 or §2.2.3.2.4.8.3, provided that the data is provided through the appropriate variable data input interface at least 50 milliseconds prior to the next scheduled Surface Position Message transmission.