

**RTCA Special Committee 209**

**ATCRBS / Mode S Transponder MOPS Maintenance**

**Meeting #11**

**In Joint Session with EUROCAE WG-49  
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**Register 08<sub>16</sub> and 20<sub>16</sub> Timeout Issues**

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**SUMMARY**

Working Paper **WP10-04** was first presented in response to an original email produced by Kevin Wilson of Honeywell as a question related to the timeouts of Registers 08<sub>16</sub> and 20<sub>16</sub>. The basic issue surfaced by the email is that Register 20<sub>16</sub> is cleared upon loss of data while Register 08<sub>16</sub> is not cleared in all cases. There are reasons for this, which based on the history of the definition and use of the two Registers is discussed in the following paper.

During discussion of **WP10-04** in the Paris meetings, it was agreed that the document should be reviewed for consistency and to check if any possible requirements have been missed.

This Working Paper **WP11-04** is submitted in response to **Action Item 10-03** and provides the resulting suggestions pursuant to completion of the consistency review. All new material added in this revision is enclosed in Boxes and highlighted in “yellow”.

This Working Paper **WP11-04** also addresses some remaining questions posed by Kevin Wilson, Honeywell, on July 13, 2010.

## REGISTER 08<sub>16</sub> AND 20<sub>16</sub> TIMEOUT ISSUES

### Introduction:

The email which follows this discussion was received in regards to issues with data termination and register timeout differences between Registers 08<sub>16</sub> and 20<sub>16</sub>. The email section is then followed by the appropriate applicable requirements sections taken from:

- a. RTCA DO-181D, Main Body
- b. RTCA DO-260B, Main Body
- c. ARINC 718A, Attachment 3A-1
- d. ICAO Doc. 9871, and
- e. RTCA DO-181D, Appendix B.

### Problem Discussion:

The basic issue surfaced by the email is that Register 20<sub>16</sub> is cleared upon loss of data while Register 08<sub>16</sub> is not cleared in all cases. There are reasons for this which based on the history of the definition and use of the two registers is discussed in the following paragraphs.

#### **a. Register 20<sub>16</sub>**

First, Register 20<sub>16</sub> is intended for Elementary Surveillance and is one of the original registers defined in the MOPS for Mode-S Transponders. Remember that the only registers specifically defined in early MOPS were Register 10<sub>16</sub>, Data Link Capability Report, and Register 20<sub>16</sub>, Flight Identification. A third register was then added as fundamental Register when TCAS came along and that was Register 30<sub>16</sub>, TCAS RA Report. All of the other registers were then defined first in the Manual of Mode-S Specific Services (ICAO Doc. 9688) and some earlier working papers. As such, Register 20<sub>16</sub> was defined and implemented for many years prior to the advent of Extended Squitter (later becoming ADS-B) and Register 08<sub>16</sub>.

With the premises of the previous paragraph in mind, Register 20<sub>16</sub> was intended primarily for Air Traffic Management by the various Air Navigation Service Providers. The requirements provided in RTCA DO-181D are completely consistent with the intent of the SARPs as presented in the Manual of Mode S Specific Services (Doc. 9688), later in ICAO Annex 10 Volume III, Chapter 5 Appendix, and now in ICAO Doc. 9871 and RTCA DO-181D. Likewise, the requirements are consistent with those entered into ARINC 718A with those requirements predominantly being driven by myself and the then Chairman of Eurocae WG-49.

Now, when one reviews the requirements for Register 20<sub>16</sub> to be cleared, it is obvious that the intent was to clear the Register within 10 seconds as required in RTCA DO-181D section 2.2.24.6.3, ICAO Doc. 9871 Table A.2.1 and section A.2.1.1, and RTCA DO-181D Appendix B Table B.2.1 and section B.2.1. More specifically, ARINC 718A Attachment 3A-1 Note 13.c requires that Register 20<sub>16</sub> be cleared if Flight Identification data is lost. This requirement was made such that the ground station was specifically advised that Flight Identification data was lost. Remember that when the data is lost, the transponder is required to change the Register, change the setting in the Data Link Capability Report, and to establish a Comm.-B Broadcast for 18 +/-1 seconds in order to announce the change to the ground station.

OK, so the intent was always to clear Register 20<sub>16</sub> as provided in the requirements. That brings us to the problem induced in regards to Register 08<sub>16</sub> in the note provided in DO-181D section 2.2.24.6.2.1. This problem is discussed in the following subsection "b".

**b. Register 08<sub>16</sub>**

ICAO Doc. 9871 Table A.2.1 clearly specifies a timeout of 15.0 seconds for Register 08<sub>16</sub>. Section A.2.1.1 then specifies that the data should be ZEROed after a period of twice the timeout specified. In other words, Register 08<sub>16</sub> should be ZEROed after 30 seconds.

RTCA DO-181D, Appendix B, Table B.2.1 and section B.2.1 then provide the same requirements as discussed in the previous paragraph.

Likewise, RTCA DO-260B Appendix A, Table A-1 and Section A.1.2 provide the same requirement as discussed in the last two paragraphs.

**However**, conflict is first evidenced with ICAO Doc. 9871 Appendix A, section A.2.4.2 then indicating in a note that Register 08<sub>16</sub> should not be cleared.

Likewise, RTCA DO-260B, Appendix A, section A.1.5.2.d provides the same indication in a note that Register 08<sub>16</sub> should not be cleared. This requirement is then specifically stated in RTCA DO-260B section 2.2.3.3.2.11.

As such, Appendix A of ICAO Doc. 9871 has a note that conflicts with the requirements given in Table A.2.1 and section A.2.1.1 of the same document.

Likewise, Appendix A of RTCA DO-260B section A.1.5.2.d has a note that conflicts with the requirements given in Table A-1 and Section A.1.2 of the same document.

Clearly, the drivers of Appendix A in ICAO Doc. 9871 and RTCA DO-260B intended that Register 08<sub>16</sub> not be cleared. The probable reasoning for this is that Register 08<sub>16</sub> is intended to provide Flight Identification in the ADS-B environment and such Flight Identification is subsequently used to do report tagging or track file management in the ADS-B environment.

**Recommendations and Conclusion:**

OK, there is conflict in the requirements as discussed above. Moving on by establishing the following premises:

1. Register **20<sub>16</sub>** is intended for use by the Air Traffic Management providers, is a part of Elementary Surveillance, and is intended to be **CLEARED** as specified in the requirements discussed herein.
2. Register **08<sub>16</sub>** is intended for ADS-B Surveillance, is a fundamental part of the ADS-B track file management, and is intended to **NOT BE CLEARED** as specified in the requirements discussed herein.

**Now, to make that happen, the following changes need to be made in the various applicable documents:**

**A. In RTCA DO-181D:**

1. Change the first note in section 2.2.24.6.2.1 to read as follows:

**Note:** *Aircraft Registration Data may also be used in Register 08<sub>16</sub> when Extended Squitter is implemented. As such, the **Data Selection** requirements inferred below will also apply to Register 08<sub>16</sub> when Extended Squitter is implemented.*

**For WP11-04:**

Pursuant to the consistency review, it was determined that the original note provided directly after the introductory paragraph of section 2.2.24.6.2.1 was creating confusion by inferring requirements to Register 08<sub>16</sub>. Although the note provided directly above attempted to clarify the situation, it still tends to couple Register 08<sub>16</sub> with Register 20<sub>16</sub>. Since Register 20<sub>16</sub> is ELS function and Register 08<sub>16</sub> is an ADS-B function, there is no real need to infer any coupling of these registers in RTCA DO-181D or EUROCAE ED-73C.

**Therefore, it is recommended that the existing original note be deleted. That is, DELETE the Note directly prior to section 2.2.24.6.2.1 of RTCA DO-181D.**

2. Add the following note directly after section 2.2.24.6.2.1.c.

**Note:** *Register 08<sub>16</sub> is not cleared when Extended Squitter is implemented since this Register is used to provide Flight Identification information for the ADS-B environment.*

**For WP11-04:**

Pursuant to the consistency review, it was determined Register 08<sub>16</sub> and Register 20<sub>16</sub> should not be coupled as discussed above.

**Therefore, in order to minimize confusion, it is recommended that the Note proposed directly above NOT BE ADDED. That is, make no changes to RTCA DO-181D section 2.2.24.6.2.1.c.**

3. Add the following note directly after section B.2.1 of Appendix B.

**Note:** *If Extended Squitter is implemented, then Register 08<sub>16</sub> is **not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is **not** cleared since it provides information that is fundamental to track file management in the ADS-B environment.*

**For WP11-04:**

Pursuant to the consistency review, it was determined that Table B-2-1 needs to call out the Maximum update interval for Register 08<sub>16</sub> for GICB purposes.

**Therefore, the Note proposed above needs to be added at the end of Table B-2-1 as a Note 2. That is, the notes provided after Appendix B, Table B-2-1 need to read as follows:**

**Note 1:** *The term “minimum update rate” is used in this document. The minimum update rate is obtained when data is loaded in one Register field once every maximum update interval.*

**Note 2:** *If Extended Squitter is implemented, then Register 08<sub>16</sub> is **not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is **not** cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See RTCA DO-260B, section 2.2.5.1.11.c). Refer to Appendix B, §B.4.3.3 for implementation guidelines regarding Register 20<sub>16</sub> and 08<sub>16</sub>.*

**For WP11-04: Add the following:**

4. Section 2.2.23.1.4.2, Note 2 currently reads as follows:

*“2. The Identification Register 08<sub>16</sub>, is not cleared since it contains data that rarely changes in flight and less frequently updated. The event-driven Register, 0A<sub>16</sub> does not need to be cleared since its contents are only broadcast once each time that the register is loaded.”*

**It is herein recommended that Note 2 of section 2.2.23.1.4.2 be changed to read as follows:**

2. *The identification Register, 08<sub>16</sub>, is not cleared since it contains data that rarely changes in flight and is not frequently updated. With Extended Squitter, Register 08<sub>16</sub> is **not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is **not** cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See RTCA DO-260B, section 2.2.5.1.11.c). Refer to Appendix B, §B.4.3.3 for implementation guidelines regarding Registers 20<sub>16</sub> and 08<sub>16</sub>.*

*The event-driven register, 0A<sub>16</sub> or equivalent transmit register, does not need to be cleared since its contents are only broadcast once each time that the register is loaded.*

5. Last, but not least, add the following section B.4.3.3 to Appendix B.

**B.4.3.3 Register 20<sub>16</sub> and 08<sub>16</sub> Implementation Considerations**

Detailed implementation requirements for Register 20<sub>16</sub> are provided in §2.2.24.6. §2.2.23.1.4.2 Note 2 and §B.2.1 Note 2 then provide introduction to Register 08<sub>16</sub> implementation. Implementation of Register 08<sub>16</sub> should also consider the following:

- a. If valid Flight Identification data is available, then the data **should** be used to populate the character subfields in Register 08<sub>16</sub>
- b. After using Flight Identification data to populate the character subfields in Register 08<sub>16</sub> in a given power-on cycle, if Flight Identification data becomes invalid or not available, then the last known valid Flight Identification data **should** be retained and used to continue population of the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- c. If valid Flight Identification data is not available, but valid Aircraft Registration data is available in a given power-on cycle, then the valid Aircraft Registration data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- d. If Register 08<sub>16</sub> has been populated using Aircraft Registration data in a given power-on cycle, and valid Flight Identification data becomes available, then the Flight Identification data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the remainder of the power-on cycle
- e. Once valid Flight Identification data has been used to populate Register 08<sub>16</sub> in a given power-on cycle, Aircraft Registration data **should not** be used to populate the character subfields of Register 08<sub>16</sub>, even if Flight Identification data becomes invalid or not available during the power-on cycle

## B. In ICAO Doc. 9871:

1. Add the following note directly after section A.2.1.1 of Appendix A.

**Note:** *If Extended Squitter is implemented, then Register 08<sub>16</sub> is not be cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is not cleared since it provides information that is fundamental to track file management in the ADS-B environment.*

### For WP11-04:

Pursuant to the consistency review, it was determined that the Table in section A.2.1 needs to call out the Maximum update interval for Register 08<sub>16</sub> for GICB purposes.

Therefore, the Note proposed above needs to be added at the end of the Table provided in section A.2.1 as a Note 2. That is, the notes provided after Appendix A, Table in section A.2.1 need to read as follows:

*Note 1:* The term “minimum update rate” is used in this document. The minimum update rate is obtained when data is loaded in one Register field once every maximum update interval.

*Note 2:* If Extended Squitter is implemented, then Register 08<sub>16</sub> is not cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is not cleared since it provides information that is fundamental to track file management in the ADS-B environment. Refer to §C.2.4.3.3 for implementation guidelines regarding Register 08<sub>16</sub>.

Then, section A.2.4.2, Note 2, currently reads as follows:

*Note 2:* The identification register, 08<sub>16</sub>, is not cleared since it contains data that rarely changes in flight and is less frequently updated. The event-driven register, 0A<sub>16</sub> or equivalent transmit register, does not need to be cleared since its contents are only broadcast once each time that the register is loaded (see §A.2.5.5).”

It is herein recommended that Note 2 of section A.2.4.2 be changed to read as follows:

*Note 2:* The Identification Register, 08<sub>16</sub>, is not cleared since it contains data that rarely changes in flight and is not frequently updated (see §A.2.1 Note 2). The event-driven register, 0A<sub>16</sub> or equivalent transmit register, does not need to be cleared since its contents are only broadcast once each time that the register is loaded (see §A.2.5.5). Refer to §C.2.4.3.3 for implementation guidelines regarding register 08<sub>16</sub>.

Last, but not least, add the following section C.2.4.3.3

### C.2.4.3.3 Register 08<sub>16</sub> Implementation Considerations

§A.2.1 Note 2 and §A.2.4.2 Note 2 provide introduction to Register 08<sub>16</sub> implementation. Implementation of Register 08<sub>16</sub> should also consider the following:

- a. If valid Flight Identification data is available, then the data **should** be used to populate the character subfields in Register 08<sub>16</sub>

- b. After using Flight Identification data to populate the character subfields in Register 08<sub>16</sub> in a given power-on cycle, if Flight Identification data becomes invalid or not available, then the last known valid Flight Identification data **should** be retained and used to continue population of the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- c. If valid Flight Identification data is not available, but valid Aircraft Registration data is available in a given power-on cycle, then the valid Aircraft Registration data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- d. If Register 08<sub>16</sub> has been populated using Aircraft Registration data in a given power-on cycle, and valid Flight Identification data becomes available, then the Flight Identification data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the remainder of the power-on cycle
- e. Once valid Flight Identification data has been used to populate Register 08<sub>16</sub> in a given power-on cycle, Aircraft Registration data **should not** be used to populate the character subfields of Register 08<sub>16</sub>, even if Flight Identification data becomes invalid or not available during the power-on cycle

### C. In RTCA DO-260B:

1. Add the following note directly after the last paragraph of section A.1.2 of Appendix A.

**Note:** *If Extended Squitter is implemented, then Register 08<sub>16</sub> is not be cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is not cleared since it provides information that is fundamental to track file management in the ADS-B environment.*

#### **For WP11-04:**

Pursuant to the consistency review, it was determined that the note discussed directly above does not need to go into section A.1.2. However, section A.1.5.2.d currently provides the following note:

**Note:** *The Aircraft Identification Message, is not cleared since it contains data that rarely changes in flight and is not frequently updated.*

**It is herein recommended that the Note of section A.1.5.2.d be changed to read as follows:**

**Note:** *The Aircraft Identification Message is not cleared since it contains data that rarely changes in flight and is not frequently updated. With Extended Squitter, Register 08<sub>16</sub> is not cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is not cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See §2.2.5.1.11.c). Implementation of Register 08<sub>16</sub> should also consider the following:*

- a. If valid Flight Identification data is available, then the data **should** be used to populate the character subfields in Register 08<sub>16</sub>
- b. After using Flight Identification data to populate the character subfields in Register 08<sub>16</sub> in a given power-on cycle, if Flight Identification data becomes invalid or not available, then the last known valid Flight Identification data **should** be retained and used to continue population of the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- c. If valid Flight Identification data is not available, but valid Aircraft Registration data is available in a given power-on cycle, then the valid Aircraft Registration data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- d. If Register 08<sub>16</sub> has been populated using Aircraft Registration data in a given power-on cycle, and valid Flight Identification data becomes available, then the Flight Identification data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the remainder of the power-on cycle
- e. Once valid Flight Identification data has been used to populate Register 08<sub>16</sub> in a given power-on cycle, Aircraft Registration data **should not** be used to populate the

#### D. In ARINC 718A Supplement 3:

1. Change Attachment 3A-1, Note 13.c to read as follows:

“c. If Extended Squitter is not implemented, then if flight identification data has been entered into registers 08<sub>HEX</sub> and 20<sub>HEX</sub> and then becomes not available, then the character subfields of the registers should all be set to “0”.

If Extended Squitter is implemented, then if flight identification data has been entered into register 20<sub>HEX</sub> and then becomes not available, then the character subfields of the register should all be set to “0”.

If Extended Squitter is implemented, then Register 08<sub>HEX</sub> **is not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the register during the current power-on cycle. Register 08<sub>HEX</sub> **is not** cleared since it provides information that is fundamental to track file management in the ADS-B environment.

Note that Aircraft Registration Data must not be used to fill the character subfields of the registers once flight identification data has been used during the transponder power-on cycle.”

#### **For WP11-04:**

Pursuant to the consistency review, it was determined that the change discussed directly above needs further work:

**Therefore, it is herein recommended that Attachment 3A-1, Note 13.c be changed to read as follows:**

- c. If Extended Squitter is not implemented, then if flight identification data has been entered into registers 08<sub>HEX</sub> and 20<sub>HEX</sub> and then becomes not available, then the character subfields of the registers should all be set to “0”.

If Extended Squitter is implemented, then if flight identification data has been entered into register 20<sub>HEX</sub> and then becomes not available, then the character subfields of the register should all be set to “0”.

If Extended Squitter is implemented, then Register 08<sub>HEX</sub> **is not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the register during the current power-on cycle. Register 08<sub>HEX</sub> **is not** cleared since it provides information that is fundamental to track file management in the ADS-B environment.

More specifically, Extended Squitter implementation of Register 08<sub>16</sub> should also consider the following:

- If valid Flight Identification data is available, then the data **should** be used to populate the character subfields in Register 08<sub>16</sub>
- After using Flight Identification data to populate the character subfields in Register 08<sub>16</sub> in a given power-on cycle, if Flight Identification data becomes invalid or not available, then the last known valid Flight Identification data **should** be retained and used to continue population of the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- If valid Flight Identification data is not available, but valid Aircraft Registration data is available in a given power-on cycle, then the valid Aircraft Registration data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the duration of the power-on cycle
- If Register 08<sub>16</sub> has been populated using Aircraft Registration data in a given power-on cycle, and valid Flight Identification data becomes available, then the Flight Identification data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the remainder of the power-on cycle
- Once valid Flight Identification data has been used to populate Register 08<sub>16</sub> in a given power-on cycle, Aircraft Registration data **should not** be used to populate the character subfields of Register 08<sub>16</sub>, even if Flight Identification data becomes invalid or not available during the power-on cycle

**Last, the alternative exists to change the requirements such that Register 08<sub>16</sub> is cleared at the same time as Register 20<sub>16</sub> is cleared. This alternative is not considered to be viable as it would then defeat the purpose of providing the ADS-B environment with Flight Identification information which is used by ADS-B to establish track file management in the operational environment.**

**For WP11-04:**

The paragraph directly above is considered to be **NOT** Applicable and is herein deleted.

**E. In EUROCAE ED-73C:**

1. Section 3.28.3.3.b, line 2, currently references ED-102/DO-260

**This should be changed to reference “ED-102A/DO-260B”.**

2. Section 3.28.3.3.b is currently followed by a note which reads as follows:

***“Note:*** *The identification message, is not cleared since it contains data that rarely changes in flight and is not frequently updated.”*

**For consistency with item A.4 above in regards to DO-181D section 2.2.23.1.4.2, the Note in ED-73C section 3.28.3.3.b should be changed to read as follows:**

***Note:*** *The identification register is not cleared since it contains data that rarely changes in flight and is not frequently updated. With ADS-B, Register 08 {HEX} is **not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08 {HEX} is **not** cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See ED-102A/DO-260B, section 2.2.5.1.11.c).*

*The event-driven register, 0A {HEX} or equivalent transmit register, does not need to be cleared since its contents are only broadcast once each time that the register is loaded.*

3. Section 3.28.4 Note 3 currently reads as follows:

***“NOTE 3:*** *The identification register, 08 {HEX}, is not cleared since it contains data that rarely changes in flight and is not frequently updated. The event driven register, 0A {HEX} does not need to be cleared since its contents are only used once each time that the register is loaded.”*

**For consistency with item A.4 above in regards to DO-181D section 2.2.23.1.4.2, the Note in ED-73C section 3.28.3.3.b should be changed to read as follows:**

***NOTE 3:*** *The identification register, 08 {HEX}, is not cleared since it contains data that rarely changes in flight and is not frequently updated. With ADS-B, Register 08 {HEX} is **not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08 {HEX} is **not** cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See ED-102A/DO-260B, section 2.2.5.1.11.c). Refer to Appendix B, §B.4.3.3 for implementation guidelines regarding register 20 {HEX} and 08 {HEX}.*

*The event-driven register, 0A {HEX} does not need to be cleared since its contents are only broadcast once each time that the register is loaded.*

4. Pursuant to the consistency review, it was determined that Table B-2-1 needs to call out the Maximum update interval for Register 08 {HEX} for GICB purposes.

**Therefore, the following note needs to be added to the two notes that currently follow Table B-2-1.**

*---If Extended Squitter is implemented, then Register 08<sub>16</sub> is **not** cleared or ZEROed once either Flight Identification or Aircraft Registration data has been loaded into the Register during the current power-on cycle. Register 08<sub>16</sub> is **not** cleared since it provides information that is fundamental to track file management in the ADS-B environment. (See ED-102A/DO-260B, section 2.2.5.1.11.c). Refer to Appendix B, §B.4.3.3 for implementation guidelines regarding register 20 {HEX} and 08 {HEX}.*

5. Last, but not least, add the following section B.4.3.3 to Appendix B.

#### **B.4.3.3 Register 20 {HEX} and 08 {HEX} Implementation Considerations**

Detailed implementation requirements for Register 20 {HEX} are provided in §3.29.6. §3.28.3.3.b and the §B.2.1 Note then provide introduction to Register 08 {HEX} implementation. Implementation of Register 08 {HEX} should also consider the following:

- a. If valid Flight Identification data is available, then the data **should** be used to populate the character subfields in Register 08 {HEX}
- b. After using Flight Identification data to populate the character subfields in Register 08 {HEX} in a given power-on cycle, if Flight Identification data becomes invalid or not available, then the last known valid Flight Identification data **should** be retained and used to continue population of the character subfields in Register 08 {HEX} for the duration of the power-on cycle
- c. If valid Flight Identification data is not available, but valid Aircraft Registration data is available in a given power-on cycle, then the valid Aircraft Registration data **should** be used to populate the character subfields in Register 08 {HEX} for the duration of the power-on cycle
- d. If Register 08 {HEX} has been populated using Aircraft Registration data in a given power-on cycle, and valid Flight Identification data becomes available, then the Flight Identification data **should** be used to populate the character subfields in Register 08<sub>16</sub> for the remainder of the power-on cycle
- e. Once valid Flight Identification data has been used to populate Register 08 {HEX} in a given power-on cycle, Aircraft Registration data **should not** be used to populate the character subfields of Register 08 {HEX}, even if Flight Identification data becomes invalid or not available during the power-on cycle

This concludes review and recommendations in regard to the identified Register 08<sub>16</sub> and 20<sub>16</sub> conflicts. Members of the ICAO ASP TSG, RTCA SC-209, and EUROCAE WG-49 are invited to review the discussion and recommendations and come to appropriate conclusion as to how to resolve the conflict.

Best Regards,

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**For WP11-04:**

Additional Questions Received from Kevin Wilson, Honeywell, on July 13, 2010:

**Responses are provided in “red” “bold” font and are not highlighted.**

“DO-181D, section 2.2.24.6.2.1.c states: “If Flight Identification data has been entered into Register 20<sub>16</sub> and then becomes NOT available, then the character subfields of the registers **shall** be set to all ZERO’s.” This requirement applies to Register 08<sub>16</sub> (if Extended Squitter is implemented) according to the note.”

**Discussion given previously in this document clarifies that Register 08<sub>16</sub> is NOT Cleared.**

“Test 2.6.6.2, Note 1 states: “This Part 2 validates that character data in Register 20<sub>16</sub> is set to zero when Aircraft Identification data is lost and not replaced by Aircraft Registration data if such data is available”, yet the actual test verifies that Register 20 is zeroed when the Flight Id is stopped (even though Aircraft Registration is available).”

**Discussion given previously in this document clarifies that Register 20<sub>16</sub> is Cleared. Therefore, the Test Procedure is correct as is.**

“DO-260B, section 2.2.5.1.11.c states: “Only if Aircraft Identification or Flight Number Data, and Aircraft Registration Data is not available to the ADS-B Transmitting Subsystem, **shall** the device enter ALL ZEROS into the character fields specified in §2.2.3.2.5.3.”

**Section 2.2.3.2.5.3 provides requirements for Register 08<sub>16</sub>. As such, the requirements called out in 2.2.5.1.11.c are consistent with the requirements provided in the updated discussion given previously in this document.**

“I assume that DO-260B is the requirement that should be met, i.e., if you have something to put into 08/20, then the registers should be filled in, otherwise they should be zero. If that is the case, then Change 1 to DO-181D, should include text to remedy the inconsistency.”

**Discussion given previously in this document has established and clarified the differences in the requirements for Register 20<sub>16</sub> and Register 08<sub>16</sub>.**

## **Email Received Regarding Registers 08<sub>16</sub> and 20<sub>16</sub>:**

To: Gary CTR Furr/ACT/CNTR/FAA  
From: "Wilson, Kevin (CNS COE)" <kevin.s.wilson@honeywell.com>  
Date: 05/06/2010 04:53PM  
Subject: DO-260B / DO-181D issue

Gary,

Here's another one for you:

DO-181D (2.2.24.6.3.b) has specific requirements to zero the 20h register after a 10 second timeout.

However, 08h has no specific requirements and conflicting notes. The Note in DO-181D (2.2.23.1.4.2) says that 08h should not be cleared on timeout. But the Note in DO-181D (2.2.24.6.2.1) says that following requirements (for 20h) should also apply to 08h...and part c. goes on to say that on timeout the register should be cleared.

DO-260B, 2.2.3.3.2.11.d states: "The ADS-B Transmitting Subsystem shall not clear the Aircraft Identification Message (see 2.2.3.2.5). Note: The Aircraft Identification message, is not cleared since it contains data that rarely changes in flight and is not frequently updated."

We need the documents to be consistent on the clearing of the Aircraft Identification Registers (08 and 20) and they should probably be handled the same way.

Take care,  
Kevin Wilson  
Honeywell Aerospace  
CNS Engineering  
phone/FAX 913.712.2832

## **From RTCA DO-181D:**

### **2.2.23.1.4.2 Register Timeout**

The transponder **shall** clear all 56-bits of the airborne position, surface position, squitter status and velocity GICB Registers 05<sub>16</sub>, 06<sub>16</sub>, 07<sub>16</sub> and 09<sub>16</sub> if these registers are not updated within two seconds of the previous update. This timeout **shall** be determined separately for each of these registers. The internal insertion of data by the transponder into these registers (altitude and surveillance status) **shall** not qualify as a register update for the purposes of this timeout condition.

#### **Notes:**

- 1. These registers are cleared to prevent the reporting of outdated position, velocity and squitter rate information.*
- 2. The Identification Register 08<sub>16</sub>, is not cleared since it contains data that rarely changes in flight and less frequently updated. The event-driven Register, 0A<sub>16</sub> does not need to be cleared since its contents are only broadcast once each time that the register is loaded.*

Transponder data insertion and squitter transmission **shall** not be affected by a register timeout event except as specified in §2.2.23.1.3.a.

**Note 3:** *During a register timeout event, the ME field of the Extended Squitter may contain all zeroes, except for any data inserted by the transponder.*

## 2.2.24.6.2 Register 20<sub>16</sub> -- Data Requirements

### 2.2.24.6.2.1 Data Selection Priority

Use of Flight Identification or Aircraft Registration Data in Register 20<sub>16</sub> **shall** comply with the following guidelines:

**Note:** *Aircraft Registration Data may also be used in Register 08<sub>16</sub> when Extended Squitter is implemented. As such, the requirements inferred below will also apply to Register 08<sub>16</sub> when Extended Squitter is implemented.*

- a. If Flight Identification data is available at anytime during unit operation, then flight identification data **shall** be inserted into the character subfields of Register 20<sub>16</sub>.

**Note:** *Flight Identification data is normally provided via ARINC Labels 233 through 237 or by Label 360 for block transfer data. Available data means that the status of the data is not set to No Computed Data (NCD).*

- b. If Flight Identification data is NOT available then Aircraft Registration, if available, **shall** be inserted into the character subfields of Register 20<sub>16</sub>.

**Note:** *If the transponder has no input from the Aircraft installation that could be used to service Register 20<sub>16</sub>, then the Register 20<sub>16</sub> Character subfields are set to ZERO (0) and Register 10<sub>16</sub> (Data Link Capability Report) bit 33 is set to ZERO (0).*

- c. If Flight Identification data has been entered into Register 20<sub>16</sub> and then becomes NOT available, then the character subfields of the registers **shall** be set to all ZERO's.

- d. In all of the above cases, encoding of the character subfields in Register 20<sub>16</sub> **shall** conform to the following:

- (1). All characters will be left justified prior to encoding the Character fields.
- (2). Characters will be coded consecutively without intervening SPACE codes.
- (3). Any unused character spaces at the end of the subfield should contain a SPACE character code.

**Note that there is a spelling error in the original test for item "(3)" where "contain" is spelled as "conatain".**

- (4). Any extra characters shall be truncated.

### 2.2.24.6.3 Register 20<sub>16</sub> – Flight Identification Update Rates

- a. The minimum update interval at which Register 20<sub>16</sub> **shall** be reloaded with valid data is 5.0 seconds.

**Note:** *Effectively, Register 20<sub>16</sub> must be updated every 5.0 seconds or sooner.*

- b. If Register 20<sub>16</sub> cannot be updated within a 10.0 second timeframe (e.g., twice the specified minimum update interval of 5.0 seconds), then:

- (1). The contents of of the character field of Register 20<sub>16</sub> **shall** be set to ZERO (0).
- (2). Bit 7 of Register 17<sub>16</sub> **shall** be set to ZERO (0).
- (3). Bit 33 of Register 10<sub>16</sub> **shall** be set to ZERO (0). (see §2.2.24.3.2.4.)

- (4). Bit 25 of Register 18<sub>16</sub> **shall not** change state if Register 20<sub>16</sub> has been properly serviced during the power-on cycle. If Register 20<sub>16</sub> has not been properly serviced during the power-on cycle, then bit 25 of Register 18<sub>16</sub> must be verified as being set to ZERO (0) (see §2.2.24.5.1 and §2.2.24.5.2.4).
- c. The time between availability of data that causes a change in Register 20<sub>16</sub> and the time that the change is made to Register 20<sub>16</sub> **shall** be less than the minimum update interval specified as 5.0 seconds.

**Note:** *The time between establishing availability of data and the time of updating Register 20<sub>16</sub> should be minimized (e.g., data latency should be minimized).*

### **From RTCA DO-260B:**

#### **2.2.3.3.2.11 ADS-B Message Timeout**

- “d. The ADS-B Transmitting Subsystem shall not clear the Aircraft Identification Message (see 2.2.3.2.5).

**Note:** The Aircraft Identification message, is not cleared since it contains data that rarely changes in flight and is not frequently updated.”

#### **Appendix A, Table A-1**

Specifies time out for Register 08<sub>16</sub> as 15.0 seconds

Specifies time out for Register 20<sub>16</sub> as 5.0 seconds

#### **Then the last paragraph of Section A.1.2, provides:**

“The details of the data to be entered into the registers assigned for Extended Squitter will be as defined in this Appendix. Table A-1 specifies the minimum update rates at which the appropriate transponder register(s) will be reloaded with valid data. Any valid data will be reloaded into the relevant field as soon as it becomes available at the Mode S Specific Services Entity (SSE) interface regardless of the update rate. **If data are not available for a time no greater than twice the specified “maximum update interval”, or 2 seconds (whichever is the greater), then the status bit (if provided) will indicate that the data in that field are invalid, and the field will be ZEROed.”**

#### **Section A.1.5.2.d provides:**

- “d. The ADS-B Transmitting Subsystem shall not clear the Aircraft Identification Message (see 2.2.3.2.5).

**Note:** The Aircraft Identification message, is not cleared since it contains data that rarely changes in flight and is not frequently updated.”

### **From ARINC-718A: Attachment 3A-1, Notes for Attachment 3A.**

12. Registers 08<sub>HEX</sub> and 20<sub>HEX</sub> allow for encoding only 8 characters. On certain airframe configurations this information may be provided within ARINC 429 Labels 233-237 or Label 360. In all cases, encoding of these register subfields should conform to Annex 10, Volume IV section 3.1.2.9 where:

- All characters will be left justified prior to encoding the Character fields.
- Characters will be coded consecutively without intervening SPACE codes.
- Any unused character spaces at the end of the subfield should contain a SPACE character code.
- Any extra characters will be truncated

The Sign Status Matrix (SSM) of labels 233 through 237 should be treated by the transponder as follows:

<b>SSM 233 - 237</b>		
BIT		MEANING
31	30	
0	0	Normal Operation
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

It is recommended that control panels and other devices supplying these labels do so by setting the SSM of labels 233 through 237 to 1,1 for normal operation in accordance with ARINC 429 Part 1.

### COMMENTARY

The following information is provided to clarify the confusion that has existed in the industry in regards to definition of the SSM for labels 233 through 237. This document now establishes the SSM to be consistent with ARINC 429 Part 1 as given below. Implementers should take note that this reflects a change from what was previously defined in ARINC 718 and EUROCAE ED-86.

ARINC 429 Part 1 Attachment 1 identifies labels 233 through 237 as ACMS data having binary (BNR) format. Word structure for labels 233 through 237 is provided in ARINC 429 Part 1, Attachment 6. ARINC 429 Part 1, Section 2.1.5.2 defines the SSM for binary words as follows:

<b>BNR SSM</b>		
BIT		MEANING
31	30	
0	0	Failure Warning
0	1	No Computed Data
1	0	Functional Test
1	1	Normal Operation

Previous definitions of ARINC 429 labels 233 through 237 provided in ARINC 718 and subsequent documents identified the SSM for both BCD and discrete data. The SSM for these words include information from the following two tables:

<b>BCD SSM (Old)</b>			<b>DISCRETE SSM</b>		
BIT		MEANING	BIT		MEANING
30	31		31	30	
0	0	VALID	0	0	Normal Operation
0	1	No Computed Data	0	1	No Computed Data
1	0	Functional Test	1	0	Functional Test
1	1	Not Defined	1	1	Failure Warning

13. Flight Identification or Aircraft Registration data usage should adhere to the following guidelines:

- a. In accordance with the intent of ICAO Annex 10, Volume IV, Section 3.1.2.9, if Flight Identification data (Labels 233 – 237, respectively or Label 360) is available (i.e., proper labels received and SSM is not set to No Computed Data (NCD)) at anytime during unit operation, then flight identification data should be inserted into the character subfields of registers 08<sub>HEX</sub> and 20<sub>HEX</sub>.
- b. If flight identification data is not available (i.e., no labels received or SSM set to NCD) then Aircraft Registration should be inserted into the character subfields of registers 08<sub>HEX</sub> and 20<sub>HEX</sub>.

On certain airframe configurations Aircraft Registration data may be provided within ARINC 429 Labels 301 – 303.

- c. If flight identification data has been entered into registers 08<sub>HEX</sub> and 20<sub>HEX</sub> and then becomes not available, then the character subfields of the registers should all be set to “0”.

Note that Aircraft Registration data must not be used to fill the character subfields of the registers once flight identification data has been used during the transponder power-on cycle.

- d. In all of the above cases, encoding of the character subfields in registers 08<sub>HEX</sub> and 20<sub>HEX</sub> should conform to ICAO Annex 10, Volume IV, section 3.1.2.9 where:
- All characters will be left justified prior to encoding the Character fields.
  - Characters will be coded consecutively without intervening SPACE codes.
  - Any unused character spaces at the end of the subfield will contain a SPACE character code.
  - Any extra characters will be truncated.

### **From ICAO Doc. 9871:**

Appendix A, Table A.2.1

Specifies time out for Register 08<sub>16</sub> as 15.0 seconds

Specifies time out for Register 20<sub>16</sub> as 5.0 seconds

Section A.2.1.1 then provides the following:

“A.2.1.1 The details of the data to be entered into the assigned registers shall be as defined in this appendix. The above table specifies the minimum update rates at which the appropriate transponder register(s) shall be reloaded with valid data. Any valid data shall be reloaded into the relevant register field as soon as it becomes available at the Mode S specific services entity (SSE) interface regardless of the update rate. If data are not available for a time no greater than twice the specified maximum update interval or 2 seconds (whichever is the greater), the status bit (if specified for that field) shall indicate that the data in that field are invalid and the field shall be zeroed.”

Section A.2.4.2 then provides the following note:

*“Note 2.— The identification register, 08<sub>16</sub>, is not cleared since it contains data that rarely changes in flight and is less frequently updated. The event-driven register, 0A<sub>16</sub> or equivalent transmit register, does not need to be cleared since its contents are only broadcast once each time that the register is loaded (see §A.2.5.5).”*

### **From RTCA DO-181D, Appendix B:**

Appendix B, Table B.2.1

Specifies time out for Register 08<sub>16</sub> as 15.0 seconds

Specifies time out for Register 20<sub>16</sub> as 5.0 seconds

Section B.2.1 then provides the following:

#### **B.2.1 Register Allocation**

Applications shall use the allocated Register numbers as shown in the Table B-2-1. The details of the data to be entered into the assigned Registers are defined in §B.3. Table B-2-1 specifies the minimum update rates at which the appropriate transponder Register(s) shall be reloaded with

valid data. Any valid data shall be reloaded into the relevant Register field as soon as it becomes available at the Mode S Specific Services entity (SSE) interface, regardless of the update rate. If data is not available for a time no greater than twice the specified maximum update interval or 2 seconds (whichever is the greater), the status bit (if specified for that field) shall indicate that the data in that field is invalid and the field shall be ZEROed. The Register number shall be equivalent to the Comm-B data selector (BDS) value used to address that Register. The data link capability report (Register 10<sub>16</sub>) shall be updated within one second of the data changing and at least every four (4) seconds thereafter.

**END OF DOCUMENT:**