| **Page** | **Section** | **Line** | **Type** | **Comment/ Rationale** | **Source of Comment (Name/Agency)** | **Suggested Disposition** | **Disposition****(Completed by Principal Editor)** |
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| 3-4 | Table 3-3 | 3 |  | I don’t completely understand the Description for the Epoch, particularly the Spacecraft Event Time. What if there is no Event (and by Event does that mean a maneuver)? The maneuver block has its own epic. | J.Thienel/NASA GSFC | Suggest making the wording clearer? | OKtext " denotes a spacecraft event time" removed(which was part of ADM 1)  |
| 3-5 | Table 3-3 |  |  | In Q1, Q2, Q3 define e1, e2, e3. Theta is defined but not the euler axis. | J. Thienel/NASA GSFC | Recommendation | OK |
| 3-5  | Table 3-3 |  |  | In the text before the Euler block, move the sentence ‘All mandatory elements …’ to a new line. Remove the next line ‘All obligatory elements …’ since it is redundant. | J. Thienel/NASA GSFC | Fix | OK |
| 3-6 | Table 3-3 |  |  | In the text before the angular velocity block capitalize Angular Velocity for consistency with the other blocks. Change ‘All obligatory elements…’ to ‘All mandatory elements …’ for consistency with the other blocks. | J. Thienel/NASA GSFC | Fix | OK |
| 3-7 | Table 3-3 |  |  | In the text before Spin and Inertia, change ‘All obligatory elements…’ to ‘All mandatory elements …’ for consistency with the other blocks. | J. Thienel/NASA GSFC | Fix | OK |
| 3-8 | Table 3-3 |  |  | In the text before Maneuver Parameters, change ‘All obligatory elements…’ to ‘All mandatory elements …’ for consistency with the other blocks. | J. Thienel/NASA GSFC | Fix | OK |
| 3-8 | Table 3-3 |  |  | Typo in 2nd column of Block\_Start. Should say MANEUVER not INERTIA. In Block\_stop change MAN to MANEUVER for consistency. | J. Thienel/NASA GSFC | Fix | OK |
| 3-12 | Figure 3-3 |  |  | The inertias are labeled I11, I22, etc. In the APM Data Table IXX, IYY, etc. are used. Fix for consistency with Table 3-3. Similarly for MAN\_TOR\_1, 2, 3, Table 3-3 uses MAN\_TOR\_X,Y,Z. | J. Thienel/NASA GSFC | Fix | OK Example was not up to date |
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| 5-3 | 5.6.9 | 3, 5, 7 | Editorial | The optional fractional seconds print with a strange character (in the PDF version). Between the two “d”, a Greek capital “Pi” appears. | Frank Dreger/ESOC | I propose to place three periods “.d...d” to indicate an arbitrary number of decimal places. (Word tends to automatically replace them with “…” which may be reason for the strange character.) | OK Strange character changed to '→' as in ODM for instance  |
| 5-1 | 5.1 | 2 | Editorial | Sections 5.2 to 5.6 are mentioned, but not 5.7 and 5.8, which are applicable, too. | Frank Dreger/ESOC | I propose to change the text to “…in subsections 5.2 through 5.8.”. | OK |
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| 4-13 | 4.1.1 | 3 | Ed | “The message recipient must have a means of interpolating” | NASA/JPL | Suggest, “The message recipient must have a suitable means of interpolating” | OK |
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| 4-15 | 4.2.3.2 | Top | Te | ATTITUDE\_DIR: “Rotation direction of the attitude specifying from which frame the transformation is to:” | NASA/JPL | Suggest, “Direction of the attitude transformation:” | OK |
| 4-16 | 4.2.3.2 | Top | Te | “A2B specifies a transformation from the REF\_FRAME\_A to the REF\_FRAME\_B” | NASA/JPL | Suggest removing the “the” words, i.e., “A2B specifies a transformation from REF\_FRAME\_A to REF\_FRAME\_B” | OK |
| 4-17 | 4.2.3.2 | 15 | Te | Suggest that “START\_TIME” and “STOP\_TIME” be optional | NASA/JPL |  | Accepted |
| 2-2 | 2.2.2 | 5 | GE | “conjunction” can be confusing, due to CDM | NASA | Suggest, “... then an APM must be accompanied by a corresponding Orbit …” | OK |
| F-1 & F-2 | Table F-1 |  | ED | Some links are broken in rows 7, 8, 12 and 14 | DLR/GSOC |  | OK Updated |
| 1-3 | 1.5 | Ref [2] | te | Spacewarn Bulletin obsolete. | David S. Berry / NASA | Replace reference [2] with pointer to UNOOSA Registry of space objects. (See ODM for example) | OKAlready done |
| 1-3 | 1.5 | Ref [4] | te | Obsolete reference | David S. Berry / NASA | The document is now at issue 4. (301.0-B-4) | OK: updated |
| 1-3 | 1.5 | Ref [7] | te | Obsolete reference | David S. Berry / NASA | The document is now at issue 2. (502.0-B-2) | OK: updated |
| 3-2 | Table 3-1 |  | te | It is not clear why the DOY example of the CREATION\_DATE was removed. | David S. Berry / NASA | Consider not deleting this. | OK: Initially removed to simply the examples but added again |
| 3-2 | Table 3-1 |  | te | CCSDS/CESG suggests that value for "ORIGINATOR" come from SANA | David S. Berry / NASA | Indicate that the value for "ORIGINATOR" keyword "should" (not "shall") come from the SANA Registry | OK. Done |
| 3-3 | Table 3-2 |  | te | Use of Spacewarn Bulletin for OBJECT\_NAME and OBJECT\_ID is obsolete. | David S. Berry / NASA | Replace reference to Spacewarn with reference to UNOOSA Registry of space objects. (See ODM for example) | OKAlready done |
| 3-8 | Table 3-3 |  | te/ed | MAN\_TOR\_1, \*\_2, \*\_3 seem inconsistent with changes elsewhere in the document to go to \*\_X, \*\_Y, \*\_Z. | David S. Berry / NASA | I don't know if this was intentional on your part to leave 1,2,3, or if it was just missed. NOTE: \*\_1,2,3 is consistent with what was done in the ODM, even from version 1. I don't know why this was chosen when the analogy to X,Y,Z seems so obvious. | OKIt was a mistake. Has been changed to X,Y,Z |
| 3-9 | 3.2.5.2.1 |  | te/ed | Retains old notation I21, I12, I31, I13, I32, I23 | David S. Berry / NASA | Change to new IXY, IYX, etc. notation. | OK Same as above. New notation adopted: IXY... |
| 4-4 | Table 4-3 |  | te | Use of Spacewarn Bulletin for OBJECT\_NAME and OBJECT\_ID is obsolete. | David S. Berry / NASA | Replace reference to Spacewarn with reference to UNOOSA Registry of space objects. (See ODM for example) | OKAlready updated |
| 4-8 | Table 4-4 |  | te | The table contains several ephemeris data lines that contain X\_RATE, Y\_RATE, Z\_RATE, but those keywords have been removed. | David S. Berry / NASA | Modify ephemeris lines to be consistent. | OKUpdated |
| H-1 | Annex H | [H3] | ed | The document has been replaced. | David S. Berry / NASA | Change to *Organization and Processes for the Consultative Committee for Space Data Systems*, CCSDS A02.1-Y-4. Yellow Book. Issue 4. Washington, D.C.: CCSDS, April 2014. | OK Done |
| H-1 | Annex H | [H4] | ed | The document has been updated. | David S. Berry / NASA | Change to 500.0-G-3, Issue 3, May 2010. | OK Done |
| I-4 | Annex I, A2 |  | ed/te | Text on the material that will be in SANA needs to be updated. | David S. Berry / NASA | On the first bullet, change "PRM" to "APM and AEM", "schema" to "schemas". | OKHas already been changed |
| I-4 | Annex I, A2 |  | ed/te | Text on the material that will be in SANA needs to be updated. | David S. Berry / NASA | On the second bullet, change "PRM XML" to "PRM KVN". | OKHas already been changed |
| I-4 | Annex I, A2 |  | ed/te | Text on the material that will be in SANA needs to be updated. | David S. Berry / NASA | On the third bullet, remove "and CATALOG\_NAME and" | OKHas already been changed |
| I-4 | Annex I, A2 |  | ed/te | Text on the material that will be in SANA needs to be updated. | David S. Berry / NASA | Delete the fourth bullet (applicable to CDM, not ADM) | OKHas already been changed |
| 3-15 | Fig 3-6 |  | te/ed | The caption indicates "Euler Angle Rates", but all the "\*\_RATE" keywords are stricken. | David S. Berry / NASA | Consider if the example is still relevant. | Check I think this figure has been removed.  |
| 3-3 | Table 3-2 |  | te | Use of "CONTENTS" keyword is not clear. | David S. Berry / NASA | Specify if the keywords can be in any order, or if there are any prohibited combinations, etc. | OK Keyword removed as not essential.  |
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| **Frames / Time scales / SANA** |
| 4-14 | 4.2.3.2 | Bottom | Te | (I just note that the reference frames contained in reference H4 are missing a number of key reference frames that are in the (draft) ODM.  | NASA/JPL | We should perhaps infuse those into the Nav Data Def document as a separate exercise | Discuss Which frames should be present ? Related to discussion about SANA registry  |
| B-2 | B-3 | 15 | TE | Suggest that we align the ADM and ODM reference frames.  | NASA/JPL | In particular, ITRF and ICRF should be replaced by ITRFyyyy and ICRFyyyy etc. But we should discuss. Ideally, these should be moved over to SANA registry or Definitions doc. | Discuss   |
| B-1 | B2 | 10 | Te | These timing systems are not synchronized with the ODM, and the ODM is not synchronized with the NavWg Definitions doc or SANA | NASA/JPL | Suggest we move to SANA registry | Discuss |
| 4-17 | 4.2.3.2 | 10 | Te | Time system - - as noted above, these are not synch’d w/other docs | NASA/JPL | “” | Discuss |
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| **Quaternion / conventions** |
| 4-17 | 4.2.3.2 | Bottom | TE | Let’s discuss, but I think we should have it as an optional switch,  | NASA/JPL | … because folks just think differently. I typically see it ordered as Epoch, Q1, Q2, Q3, QC, Q1\_DOT, Q2\_DOT, Q3\_DOT, QC\_DOT (as you state above) | DiscussNot everybody has the same optinion. I think the best option would be to remove the possibility. Increases simplicity and limits error risksBut the order should be always the same in the message.  |
| 4-17 | 4.2.3 | ~40 | TE |  Agree that one definition should suffice, if clearly defined and standardized. | NASA | Eliminate. | Is it about ATTITUDE\_DIR ? OR Quaternions ? |
| 4-17 | Table 4-3 |  | TE | QUATERNION\_TYPE should be properly defined instead of letting the user choose it; Rationale: this would ease software implementation (reduction of cases to be considered) | DLR/GSOC | QUATERNION\_TYPE: As with APM, one should have a fixed definition. One should use the scalar part as 4th value. 🡺 Afterwards, table 4-4 on page 4-20 can be strongly simplified. | Agree Has to be approved Removed in new versionOrder has to be approved |
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| **BLOCK\_START ...**  |
| 3-4 | 3.2.4.4 | ~9 | TE | BLOCK\_START seems slightly confusing | NASA | Suggest using “ATT\_START” rather than BLOCK\_START (in all instances). OR, something like DATA\_START (??) | Discuss New version includes DATA\_START  |
| 3-5 to 3-7 | 3.2.4.4 | ~~ | TE | Suggest ATT\_START, SPIN\_START, INERTIA\_START, etc | NASA |  | Discuss DATA\_START adopted. OK? |
| 3-5 | 3.2.4.4 | ~~ | TE | Agree that no value should be required for any of the “\_STOP” keywords | NASA |  | Discuss  |
| 3-8 | 3.2.4.4 | 4 | TE | Again recommend something like MAN\_START | NASA |  | Discuss |
|  | Table 3-3 |  | ed/te | The DATA\_START and DATA\_STOP repeats for every single block in the data section. This is not consistent with the use of these tags in other messages. As far as the other tags are unique (e.g. MAN\_EPOCH\_START) it is not necessary to use the DATA tags many times. The DATATYPE tag may be affected if this is taken on board but it may not be necessary if the tags are really unique.Note that in the XML version it will also generate some conflict as the use of <data> in the XML representation is very specific. | Fran / GMV/ESA | Remove the multiple use of DATA\_START and DATA\_STOP in favour of unique KVN tags (most are already unique if not all).Consider removing the DATATYPE tag if previous is assumed. Probably except for a unique tag identifying the type of data in the message (move it back to the METADATA section also consistently with the AEM)Consider also introducing the METDATA\_START and \_STOP tags as in other messages. |  |
| 3-4 | 3.2.4.3 | 1 | te | States that as many logical blocks "as necessary" may be used... as necessary for what? | David S. Berry / NASA | Specify | OKReason : To give for attitude quaternion relative to several frames, or define sensor frames for many sensors ...Details added |
| 3-4 | Table 3-3 |  | te | The APM version 1 required at least the quaternion. What is the logic for making it optional? In theory, you could create a completely empty, but "valid" APM by having zero required logical blocks. | David S. Berry / NASA | We should discuss at San Antonio. | DiscussThe reason is that the contents of the message is up to the user. If the message contains spin data, the user may not want to send quaternion information inside the same message.  |
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| **Transformation direction**  |
| 3-5 | 3.2.4.4 | ~20 | TE | Agree that Q\_DIR is not needed | NASA | Suggest removing that, but then adding additional text to clarify the mapping from A to B. Also remember to remove other instances of this keyword from the rest of the document. | OK / DiscussRemoved in new version  |
| 3-5 | 3.2.4.4 | ~40 | TE | EULER\_DIR is (equivalently) also not needed | NASA | Suggest removing that, but then adding additional text to clarify the mapping from A to B. Also remember to remove other instances of this keyword from the rest of the document. | OK (same as above)Removed in new version  |
| 3-6 | 3.2.4.4 | ~40 | TE | ANGVEL\_DIR is (equivalently) also not needed | NASA | Suggest removing that, but then adding additional text to clarify the mapping from A to B. Also remember to remove other instances of this keyword from the rest of the document. | OK (same as above)Removed in new version  |
| 3-6 | 3.2.4.4 | ~80 | TE | SPIN\_DIR is (equivalently) also not needed | NASA | SPIN\_DIR could be removed everywhere  | OK (same as above)Removed in new version  |
| 3-7 | 3.2.4.4 | ~120 | TE | Could eliminate SPIN\_DIR as well, if FRAME\_A is always mapped to FRAME\_B | NASA | SPIN\_DIR could be removed everywhere  | OK (same as above)Removed in new version  |
| 4-17 | 4.2.3 | 1 | TE | Same comment on ATTITUDE\_DIR | NASA | Could potentially eliminate \*if\* direction is defined in body of text | Discuss / OK |
| 3-5 | Table 3-3 |  | TE | Q\_DIR not really needed, when using a proper definition; Rationale: this would ease software implementation (reduction of cases to be considered) | DLR/GSOC | Remove Q\_DIR and always transform from reference frame A to B. | OKSee previous remarks  |
| 4-17 | Table 4-3 |  | TE | ATTITUDE \_DIR: same issue as with Table 3-3, Q\_DIR, page 3-5 as described above | DLR/GSOC | Remove ATTITUDE \_DIR and always transform from reference frame A to B. | Discuss Same as above  |
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| **FRAME\_A / FRAME\_B** |
| 4-16 | Table 4-3 |  | ED | Reference frames are named REF\_FRAME\_A/B, compared to Q\_FRAME\_A/B in table 3-3 | DLR/GSOC | One could use one name for reference frames, i.e. either REF\_FRAME\_A/B or Q\_FRAME\_A/B, preferably REF\_FRAME\_A/B | Agree(was based on previous version) New name is REF\_FRAME\_A / REF\_FRAME\_B |
| 4-16 | Table 4-3 |  | ed | Shouldn’t REF\_FRAME\_A be simply FRAME\_A consistently with the APM? | Fran / GMV/ESA | Correct |  |
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| **VERSION 1 / 2 - compatibility**  |
| 3-4 | 3.2.4.4 | 1 | te | This statement constitutes a major divergence from the APM design of a single state with single epoch. | David S. Berry / NASA | We should discuss at San Antonio. | DiscussI dont' think so the date/time appears only once.  |
| C-4 | Annex C | Title | te | The annex is listed as "NORMATIVE" but should be "INFORMATIVE". | David S. Berry / NASA | Change "NORMATIVE" to "INFORMATIVE" in subtitle. | Discuss. Could be informative. But the intent was to make it normative so that that the meaning the data in the message could be as unambiguous as possible |
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| **Miscellaneous - editorial**  |
| 4-18 | 4.2.3.2 | 8 | Ed | See Erreur ! Source du renvoi introuvable. fo | NASA/JPL | Broken link | Problem due to paragraph names. I don't think I'm able to solve the problem(no problem in 1.4)  |
| 5-1 | 5.4.1 |  | ED | Minor issue: 254 ASCII chars plus 2 line termination chars are more than 255 chars (which is considered as limit) | DLR/GSOC | It should say "... must not exceed 255 ASCII characters and spaces (including line termination character(s)", cause the line termination characters can be more than one char. Additionally, when using 255 chars per line, one cannot read them very well on screen or printed, thus it should be less (e.g. 80 chars). | Discuss(Other books impacted) Is the limit 255 ou 256 characters ? (256 - 2 = 254) Line termination characters are not part of the standard so should not be included.  |
| 3-7 | Table 3-3 |  | te/ed | For "SPIN\_ANGLE\_VEL", the full "ANGLE\_VEL" is spelled out. However, for most of the document you have used "ANGVEL". | David S. Berry / NASA | Consider if "SPIN\_ANGVEL" would be more consistent. | DiscussThe data are not exactly the same : one is a vector, the other is not. SPIN\_ANGLE\_VEL is to be understood as the velocity (derivative) of the SPIN ANGLE |
| 3-5 | Table 3-3 |  | te | On description of several keywords, the statement about an excerpt appearing in the Units/Values column was removed, but should not be because the "Normative" qualification indicates it is the full set of values. | David S. Berry / NASA | Consider restoring the note about there being an excerpt in that column. | DiscussI'm not sure for which keywords you think the note is missingProposal Add a note in the text giving the meaning of the columns |
| 4-5 | Table 3-3 |  | te | On description of several keywords, the statement about an excerpt appearing in the Units/Values column was removed, but should not be because the "Normative" qualification indicates it is the full set of values. | David S. Berry / NASA | Consider restoring the note about there being an excerpt in that column. | Discuss(same as above)I'm not sure for which keywords you think the note is missing Proposal Add a note in the text giving the meaning of the columns |
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| **Minor remarks / additional information wanted**  |
| 4-18 | 4.2.3.2 | 20 | Te | I’m curious about how these interpolation degrees & methods are applied… This is not a straight interpolation of Qs etc, correct ? | NASA/JPL |  | DiscussThe methods are only examples anyway.Straight interpolation could be OK, I suppose (if quaternion is normalized after interpolating)Add another example: SLERP ?  |
| 4-18 | 4.2.3 | ~25 | TE | Improper to interpolate quaternions; would have to be interpolating on an Euler axis/angle basis | NASA | Suggest modifying for quaternions to always be Euler axis/angle interpolation. E.g., higher-order interp could lead to sin(phi/2) values that have absolute magnitudes > 1.0. We should discuss further. | DiscussBut standard only about the data and not about how they should be used.  |
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| **Other / extensions** |
| 2-1 | 2.1.3 and others |  | GE | Why not include several S/C in one AEM file? | DLR/GSOC | With the current AEM format, it should be possible without changing something. Example:META\_STARTOBJECT\_NAME = OBJ\_1…META\_STOPDATA\_START…DATA\_ENDMETA\_STARTOBJECT\_NAME = OBJ\_2…META\_STOPDATA\_START…DATA\_END | DiscussThis is a general question concerning all standards  |
| 3-7 | Table 3-3 |  | GE | INERTIA block: For APM, an inertia matrix can be given, but there is no possibility to specify a time-varying moment of inertia for the AEM (which may be needed, if one wants to calculate an angular momentum from the angular rates with a non-constant moment of inertia). | DLR/GSOC | Include moment of inertias in AEMs. | Discuss |
| 5-5 | 5.8.3.2 | 1 | GE | Writing the attitude ephemeris accuracy / residuals into the comments section is not recommended since comments sections shall provide only additional information, which is not necessarily needed for an automated and complete reading of ADM files. | DLR/GSOC | Add fields for describing attitude ephemeris accuracy / residuals. It also may make sense to globally specify the machine precision. | Discuss  |
| 3-3 | Table 3-2 |  | TE | Regarding CENTER\_NAME: There could be a different origin for both reference frames Q\_FRAME\_A and Q\_FRAME\_B | DLR/GSOC | CENTER\_NAME belongs to the coordinate frame, thus either use CENTER\_NAME\_A and CENTER\_NAME\_B together with Q\_FRAME\_A and Q\_FRAME\_B or define the coordinate systems unambiguously (i.e. use EME2000 really only for Earth-centered reference frames and use something else when using the EME2000 orientation with e.g. Mars in the center). | DiscussBut : The center has no impact on the attitude transformation??? |
| 4-16 | Table 4-3 |  | TE | CENTER\_NAME: same issue as with Table 3-2, CENTER\_NAME, page 3-3 as described above | DLR/GSOC |  | Discusssee above |
| 3-4 | 3.2.4.1, Table 3-3 |  | TE | For block QUATERNION, the quaternion is given along with its derivative, but the rate needs to be given in a separate block. | DLR/GSOC | For compliance with AEM, one could use the values from ATTITUDE\_TYPE from table 4-3 here as well, i.e. use one block QUATERNION/DERIVATIVE and one block QUATERNION/ANGVEL. | DiscussDon't understand : The derivatives are optional. So what is the problem exactly ?  |
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