| **Page** | **Section** | **Line** | **Type** | **Comment/ Rationale** | **Source of Comment (Name/Agency)** | **Suggested Disposition** | **Disposition**  **(Completed by Principal Editor)** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Many | Many | Many | ed/te | The CESG has recently blocked Agency Review of the PRM for several reasons, one of which is the use of the word "obligatory". The stated preference is for the word "mandatory". This issue arose given the relatively new requirement for an "Implementation Conformance Statement" Annex in which features of the standard are characterized by a single letter: either "M" for "mandatory" or "O" for "obligatory". The objection was that in an ICS, "obligatory" and "optional" could not be distinguished. Note that this will affect ALL Nav WG books in progress (including revisions to the ODM as well as the ADM and TDM, and the new issues of PRM and NHM). | David S. Berry / NASA | Throughout the document, change "obligatory" to "mandatory". We could also consider changing "non-obligatory" to "optional" where it appears, since "non-mandatory" sounds a bit awkward. |  |
| 3-2  4-2  5-3  6-3 | OPM, OMM, OEM, OHM Header |  | te | The CESG has recently blocked Agency Review of the PRM for several reasons, one of which is the specification of the value of the "ORIGINATOR" keyword... it has been suggested that this be a value in the SANA "Organization" registry. | David S. Berry / NASA | Change "(value should be specified in the ICD)" to "(value should be drawn from the SANA "Organizations" registry." Discuss at Darmstadt. |  |
| 2-2 | 2.5 | 1-2 | te | Regarding the "en masse parent/child deployment scenario". I think it should be made more clear here that a given OHM is only really applicable to the parent... the child spacecraft deployed would require their own OHM once released. | David S. Berry / NASA | Clarify |  |
| 2-3 | 2.6 | 5 | te | This line implies to some extent that a single OHM could apply to both parent and child spacecraft, which I think is ambiguous given the specification of a single metadata section in the OHM. It should be clarified here that once released, each child spacecraft would require its own OHM to describe the ephemeris. | David S. Berry / NASA | Clarify. |  |
| 3-6 | Table 3-3 |  | ed | Uses the abbreviation "S/C" for spacecraft, but this is not in the abbreviations annex. (Legacy issue in ODM not previously found). | David S. Berry / NASA | Add "S/C" to the Annex B. |  |
| 6-1 | 6.1.5 | NOTE | ed | The note here regarding syntax rules is a duplicate of the note at 6.1.3 | David S. Berry / NASA | Delete duplicate NOTE. |  |
| 6-2 | 6.2.1(4) | 1 | te | Given the emphasis on file size asserted for the OHM, I think user-defined data should not be supported. The user-defined data was perhaps not such a great idea in general (though it is known that some use is being made of it). | David S. Berry / NASA | Discuss relevance of user-defined data at Darmstadt. |  |
| 6-3 | Table 6-2 |  | ed | CCSDS\_OHM\_VERS: suggestions for Examples | David S. Berry / NASA | From: 2.0  To: 3.0 (this version)  0.1 (for testing) |  |
| 6-3 | Table 6-2 |  | ed/te | The ORIGINATOR\_POC, POSITION, PHONE, EMAIL are in the CDM metadata, not the header. For consistency, we should move to the metadata. In general we have tried to keep the Header structure the same in all of the Nav WG messages. To date the CDM is the only exception. | David S. Berry / NASA | Move fields to Metadata Section. |  |
| 6-3 | Table 6-2 |  | ed | ORIGINATOR\_POC: Typo | David S. Berry / NASA | From: "Programmaic"  To: "Programmatic" |  |
| 6-3 | Table 6-2 |  | ed | ORIGINATOR\_POC: Acronym spell out on first instance | David S. Berry / NASA | From: "PoC"  To: "Point of Contact (PoC)" |  |
| 6-3 | Table 6-2 |  | ed | ORIGINATOR\_POSITION: Incomplete Description | David S. Berry / NASA | Description is not completed (though PoC is implied). |  |
| 6-3 | Table 6-2 |  | ed | ORIGINATOR\_EMAIL: Description should be revised | David S. Berry / NASA | Description suggests "phone number, email, address, website, etc." but from the keyword just the email should be described. |  |
| 6-4 | 6.2.3.4 | 1 | te | In all other Nav WG messages, if any value of the metadata changes, a new metadata section must be included. | David S. Berry / NASA | Add statement to the effect that if any of the metadata items changes value, then an entire new OHM is required. |  |
| 6-4 | 6.2.3.4 | 1 | te | Not phrased with "requirements language". | David S. Berry / NASA | From: "Only a single metadata section is permitted..."  To: Something like "Only a single metadata section shall appear ..." |  |
| 6-4 | Table 6-3 |  | te | OBJECT\_NAME, OBJECT\_ID: The CESG is placing a lot of emphasis on using the SANA Registry for all kinds of things. In particular, they have invested a lot of effort in a "Spacecraft Identities" registry. | David S. Berry / NASA | Discuss at Darmstadt. I think this could be troublesome. |  |
| 6-4 | Table 6-3 |  | te | OBJECT\_NAME: The description here is what we have used for OBJECT\_ID in the OPM, OMM, OEM | David S. Berry / NASA | In the CDM, we used "OBJECT\_DESIGNATOR" for the NORAD ID. Earlier in the ODM (OMM) we used "NORAD\_CAT\_ID". |  |
| 6-4 | Table 6-3 |  | te | OBJECT\_ID: The description here is inconsistent with the OPM, OMM, OEM, and CDM. | David S. Berry / NASA | In the CDM, we used "OBJECT\_DESIGNATOR" for the NORAD ID. Earlier in the ODM (OMM) we used "NORAD\_CAT\_ID". |  |
| 6-4 | Table 6-3 |  | ed | OBJECT\_ID: The comment at the bottom of the Description (in all caps) is self-referential | David S. Berry / NASA | Review/revise comment as applicable. |  |
| 6-4 | Table 6-3 |  | te | Both OBJECT\_NAME and OBJECT\_ID are listed as optional. This would seem to limit the utility of a given OHM. To what object does it apply? | David S. Berry / NASA | Make either OBJECT\_NAME or OBJECT\_ID mandatory. Based on comments in prior CRM and this version of the OHM, there has been an argument that name is not necessary when building a catalog of objects. This would argue then that some type if OBJECT\_ID would be mandatory (even if it is just RA/DEC at EPOCH\_TZERO). |  |
| 6-4 | Table 6-3 |  | te | TIME\_SYSTEM: This has been made optional with the rationale "to minimize file size". This strikes me as a spurious argument given (a) the fact that it is a single important line in a single metadata section, (b) the emphasis elsewhere on encouraging comments throughout the OHM, and (c) the general growth in potential file size represented by arbitrarily dimensioned matrices allowed in the OHM. | David S. Berry / NASA | Make the TIME\_SYSTEM a mandatory metadata element. |  |
| 6-4 | Table 6-3 |  | te | The orbit center is not identified in the metadata. There are numerous OHM elements that apply to the central body that are specified prior to the mention of the orbit center (e.g., Table 6-5) before the orbit center is specified in Table 6-7. | David S. Berry / NASA | Move the "CENTER\_NAME" keyword to the metadata, |  |
| 6-4 | Table 6-3 |  | te | The EPOCH\_TZERO is listed as optional. If this data item is not included, the utility of the OHM is truly very limited given that so much of it is referenced to the EPOCH\_TZERO. | David S. Berry / NASA | Make the EPOCH\_TZERO a mandatory data element. |  |
| 6-5 | Table 6-3 |  | te | START\_TIME is listed. Is it the same as EPOCH\_TZERO? | David S. Berry / NASA | Explain. |  |
| 6-5 | Table 6-3 |  | te | START\_TIME. The note at bottom of Description regarding UTC epochs within one second of the leap second introduction excludes the "day of year" time format option. | David S. Berry / NASA | Include the "XXXX-XXXT" format in the note. |  |
| 6-5 | Table 6-3 |  | ed/te | TAIMUTC\_TZERO: I do not understand the parenthetical portion of the Description, and its use of the phrase "this epoch" makes it ambiguous. | David S. Berry / NASA | Delete parenthetical text after "EPOCH\_TZERO". Stating the number of leap seconds modeled by the originator at EPOCH\_TZERO should be sufficient, and in general I think it would be risky to make an OHM for which the EPOCH\_TZERO was exactly at the time of the leap second event. |  |
| 6-5 | Table 6-3 |  | ed/te | UT1MUTC\_TZERO: I do not understand the parenthetical portion of the Description, and its use of the phrase "this epoch" makes it ambiguous. | David S. Berry / NASA | Delete parenthetical text after "EPOCH\_TZERO". Stating the number of leap seconds modeled by the originator at EPOCH\_TZERO should be sufficient, and in general I think it would be risky to make an OHM for which the EPOCH\_TZERO was exactly at the time of the leap second event. |  |
| 6-6 | 6.2.4.3 | 1 | te/ed | Three of the four tables referred to in the first line refer to material that is not discussed in Section 6.2.4. It is possible that the requirement may be missed by implementers. | David S. Berry / NASA | There seem to be 2 options: (1) move the entire statement into the dicsussion of metadata 6.2.3, or (2) restrict the statement in 6.2.4.3 to the spacecraft physical characteristics and put an analogous statement into 6.2.6, 6.2.7, 6.2.8, and 6.2.9 (note that STMs are not specifically referenced in 6.2.4.3, but the requirement applies to STMs in 6.2.9 as well). |  |
| 6-6 | 6.2.4.3 | 3 | ed | Double period at end of sentence | David S. Berry / NASA | Remove duplicate |  |
| 6-6 | 6.2.4.4 | 1 | ed/te | Not phrased with "requirements language". | David S. Berry / NASA | From: "... is permitted"  To: Something like "Only one space object physical characteristics section shall appear in any OHM." Alternative: "Only a single..." |  |
| 6-6 | Table 6-4 |  | ed/te | MASS\_TZERO: for consistency w/OPM, this would be simply "MASS". Since all values in the OPM are "at epoch", the "\_TZERO" is implied. Is it sufficient to call this "MASS" in the OHM? or is the "\_TZERO" required. | David S. Berry / NASA | Consider. |  |
| 6-6 | Table 6-4 |  | ed/te | MASS\_TZERO: The description states "S/C Mass at reference epoch". The implication is that "TZERO" is the reference epoch. Earlier in 2.5, the phrase "... at a nearby (relevant) reference epoch" is used. It is not clear this "nearby (relevant) reference epoch" is in fact EPOCH\_TZERO. | David S. Berry / NASA | Probably the description in 2.5 needs to be modified appropriately. |  |
| 6-6 | Table 6-4 |  | ed | PHYSDIM\_FRAME: The description contains the first instance of the acronym "OEB". First instance should be spelled out. | David S. Berry / NASA | From: "PHYSDIM OEB"  To: "PHYSDIM Optimally-Encompassing Box (OEB)" |  |
| 6-6 | Table 6-4 |  | ed | PHYSDIM\_FRAME: "EOB" is not in the acronyms annex. | David S. Berry / NASA | Add "EOB" to Annex B. |  |
| 6-6 | Table 6-4 |  | ed | PHYSDIM\_FRAME\_EPOCH: Units column doesn't contain units. | David S. Berry / NASA | From: "(CCSDS Time Format)"  To: "n/a" |  |
| 6-7 | Table 6-4 |  | te | I'm not sure "Vmag" is an actual unit. I think this is a dimensionless number. | David S. Berry / NASA | From: Units column "Vmag"  To: Units column "n/a" |  |
| 6-8 | 6.2.5.3 |  | ed | Maybe a good idea to refer the reader to the Table in which the parameter is described, since it's not in the Table in this section. | David S. Berry / NASA | Add "(see Table 6-4)" to the end of the requirement. |  |
| 6-8 | 6.2.5.4 |  | ed | Maybe a good idea to refer the reader to the Table in which the parameter is described, since it's not in the Table in this section. | David S. Berry / NASA | Add "(see Table 6-4)" to the end of the requirement. |  |
| 6-8 | 6.2.5.5 | 1 | ed/te | Not phrased with "requirements language". | David S. Berry / NASA | From: "Only a single force model data section is permitted"  To: "Only a single force model data section shall appear in any OHM." |  |
| 6-9 | Table 6-5 |  | ed | INTERP\_METHOD\_EOP: The "Examples of Values" contains the Description. | David S. Berry / NASA | Move the description info 2 columns to the left. |  |
| 6-11 | 6.2.6.4 |  | te | I think the delta mass must always be negative, regardless of whether it is a decrement due to propellant usage or deployment of a child spacecraft. The states and everything else in the OHM must only apply to the "parent" spacecraft since there is only one metadata section, and once there is a deployment, a new OHM must be created for the "child" spacecraft, with EPOCH\_TZERO equal to the deployment time. After that deployment. The delta-V's in the OHM can only apply to the parent vehicle. | David S. Berry / NASA | Revise text to indicate that the delta mass is always negative. |  |
| 6-11 | 6.2.6.5 |  | te | It's not clear how the ΔVx, ΔVy, ΔVz should be indicated in the deployment scenario... it seems that this must be the total resultant of the deployment and the retrograde ΔV. | David S. Berry / NASA | Clarify text. |  |
| 6-11 | 6.2.6.6 | 5-6 | ed/te | Not stated in requirements language. | David S. Berry / NASA | From: "The eight parameters are time..."  To: "The eight parameters shall be time... |  |
| 6-12 | 6.2.6.7 | 1 | ed/te | It is stated that there are 5 parameters in the acceleration time series, but the description lists 6. | David S. Berry / NASA | From: "... a single line that contains 5 parameters: ... "  To: "... a single line that contains 6 parameters: ..." |  |
| 6-12 | Table 6-6 |  | ed/te | MAN\_TYPE: For impulsive ΔV, the value is shown as "DV", but in principle all of the maneuver types impart a ΔV. | David S. Berry / NASA | From: MAN\_TYPE=DV  To: MAN\_TYPE=IMPULSIVE or MAN\_TYPE=IMPULSE or MAN\_TYPE=IMP |  |
| 6-12 | Table 6-6 |  | ed | MAN\_PURPOSE: The Example is not applicable. | David S. Berry / NASA | From: SOLVED  To: One of the values listed in "Description" text |  |
| 6-12 | Table 6-6 |  | ed | MAN\_PURPOSE: The list of purposes from which a selection must be made is insufficiently extensive. While the items in the list apply beyond Earth orbit, there are a number of other maneuver purposes used in interplanetary missions. | David S. Berry / NASA | Consider adding selections for maneuvers such as trajectory correction, orbit trim, period reduction, aerobraking, science objective, flyby targeting, cleanup. Lumping all these into "OTHER" seems inaccurate. Even this may not be complete enough. For example, the Cassini mission has done nearly 400 maneuvers in orbit for orbit trim, flyby targeting, and maneuver error cleanup. |  |
| 6-14 | 6.2.7.3 | 3 | te | Suggests that operational sections can be separated by comments, which makes comments operational... not an especially good idea. | David S. Berry / NASA | Isn't the ORBEPH\_START and ORBEPH\_STOP keyword pair sufficient (as shown in Fig 6-3)? |  |
| 6-14 | 6.2.7.3 | 1) thru 6) | te | This list of uniqueness indicators contains some that appear impossible to detect by a recipient, e.g., "(2) the orbit determination or navigation solution" is not identified by keyword. | David S. Berry / NASA |  |  |
| 6-14 | 6.2.7.4 | 1 | ed | Refers to "two new keywords". The novelty is irrelevant to a first time ODM reader. | David S. Berry / NASA | From: "...two new keywords..."  To: "...two keywords..." |  |
| 6-15 | Table 6-7 |  | te | MEAN\_ELEMENTS: Only lists one example, and doesn't specify a selection in the Description. | David S. Berry / NASA | Expand "Description" to include possible values |  |
| 6-16 | 6.2.8.3 | 1) thru 6) | te | This list of uniqueness indicators contains some that appear impossible to detect by a recipient, e.g., "(2) the orbit determination or navigation solution" is not identified by keyword. Also, for (1) and (5) the correspondence between the orbit state time history and covariance time history is not clear. Note that these issues do not pertain to the "traditional" OEM structure where there are segments that make the correspondence clear. | David S. Berry / NASA | Consider. Probably discuss at Darmstadt. |  |
| 6-17 | 6.2.8.4 | 2 | ed | This may be a matter for the CCSDS Editor to resolve, but there are three different quotation mechanisms on the 3 COV\_\* keywords in this line... double, none, and single. | David S. Berry / NASA | Consider consistency here. |  |
| 6-17 | 6.2.8.5 | 1 | te | Requirements language. | David S. Berry / NASA | From: "...keyword is followed..."  To: "...keyword shall be followed..." |  |
| 6-17 | 6.2.8.6 | 1 | te | Requirements language. | David S. Berry / NASA | From: "...data are time-tagged..."  To: "... data shall be time-tagged..." |  |
| 6-17 | 6.2.8.12 | 2 | ed/te | Refers to the "EPOCH" keyword, but that keyword is not present in the OHM. Examples have "T=" as the apparent time indicator. Note that "T" is also not defined as a keyword in the Table 6-8. | David S. Berry / NASA | Consider use of "EPOCH" which would be more consistent with the previous issues of ODM. If not, "T=" is OK, but it should be added to the Table 6-8. |  |
| 6-17 | 6.2.8.12 | 2 | ed/te | Refers to "COV\_FRAME" keyword but "COV\_REF\_FRAME" appears in Table 6-8 | David S. Berry / NASA | From: "COV\_FRAME"  To: "COV\_REF\_FRAME" |  |
| 6-18 | 6.2.8.16 | All | ed | Based on the reference to the matrix representation, I think this section should appear before 6.2.8.13. | David S. Berry / NASA | Consider moving section. |  |
| 6-18 | Table 6-8 |  | ed/te | COV\_REF\_FRAME: Description refers to a "given Covariance Time History segment". Use of "segment" in this context is ambiguous given that "segment" has a specified meaning in the ODM. | David S. Berry / NASA | Consider changing "segment" to "section" here. |  |
| 6-19 | Table 6-8 |  | ed | COV\_FRAME\_EPOCH: Units column doesn't contain units. | David S. Berry / NASA | From: "(CCSDS Time Format)"  To: "n/a" |  |
| 6-19 | 6.2.9.1 | 2 | ed | Refers to Table 6-8 but it should be 6-9 | David S. Berry / NASA |  |  |
| 6-19 | 6.2.9.3 |  | te | This section has the same issues as identified for 6.2.8.3 | David S. Berry / NASA | Consider issue. |  |
| 6-19 | 6.2.9.4 | 1 | te | Requirements language. | David S. Berry / NASA | From: "...are indicated..."  To: "...shall be indicated..." |  |
| 6-19 | 6.2.9.4 | 2 | ed | This may be a matter for the CCSDS Editor to resolve, but there are three different quotation mechanisms on the 3 STM\_\* keywords in this line... double, none, and single. | David S. Berry / NASA | Consider consistency here. |  |
| 6-20 | 6.2.9.4 | 4 | ed/te | Requirements language. | David S. Berry / NASA | From: "...keyword is followed..."  To: "...keyword shall be followed..." |  |
| 6-20 | 6.2.9.5 | 1 | ed/te | Requirements language. | David S. Berry / NASA | From: "...data are time-tagged..."  To: "... data shall be time-tagged..." |  |
| 6-20 | 6.2.9.11 | 2 | ed/te | Refers to the "EPOCH" keyword, but that keyword is not present in the OHM. There are no STM examples, but covariance matrix examples have "T=" as the apparent time indicator. Note that "T" is also not defined as a keyword in the Table 6-9. | David S. Berry / NASA | Consider use of "EPOCH" which would be more consistent with the previous issues of ODM. If not, "T=" is OK, but it should be added to the Table 6-8. |  |
| 6-20 | 6.2.9.12 | 3 | ed/te | Requirements language. | David S. Berry / NASA | From: "...rows of the state transition matrix each contain..."  To: "...rows of the state transition matrix shall each contain..." |  |
| 6-22 | Table 6-9 |  | ed/te | STM\_REF\_FRAME: The bold text at bottom of description refers to "...the selected covariance set...". | David S. Berry / NASA | Modify appropriately to refer to the STM. |  |
| 6-22 | Table 6-9 |  | te | STM\_N: I've already indicated that I think this keyword (as defined) is dangerous, and we've agreed to discuss at Darmstadt. But the example value "6" illustrates my fundamental problem. The description says that it is the number of elements in the NxN, but "6" is not a square of an integer. So perhaps you mean dimension of the STM? 6 would make sense then. If it is truly the number of elements, that is a problem because 9 is the closest square, implying that there are 3 missing elements from the STM. Which 3 are they and how would the recipient know? | David S. Berry / NASA | Is this meant to be the dimension of the matrix (makes sense given your earlier response to the objection regarding STM\_N and COV\_N)? If so, change "Number of elements" to "Dimension". If this is truly the number of elements, then I think this keyword needs to be deleted. |  |
| 6-22 | 6.2.10 | Entire | te | I'd like to entertain the notion of deleting the possibility of "User Defined Parameters" from the OHM. This is consistent with many other inconsistencies with ODM precedent that have been proposed in the OHM. | David S. Berry / NASA | Discuss at Darmstadt. |  |
| A-1 | Intro |  | ed/te | The list of applicable keywords does not include STM\_REF\_FRAME, ORB\_REF\_FRAME, and PYSDIM\_FRAME | David S. Berry / NASA | Add these keywords. Alternatively, refer to them generically as "reference frame related kewyords" or something like that. |  |