

**MINUTES OF NAVIGATION WORKING GROUP FALL 2016 WORKSHOP**      **16-Nov-2016**  
**David S. Berry / Chair**

The CCSDS Fall 2016 Meetings were conducted at the Headquarters of the Agenzia Spaziale Italian (ASI) in Rome, Italy during the week of 17-Oct-2016 through 21-Oct-2016. ASI hosted the meetings. This is a summary of the activities of the Navigation Working Group (WG) during the week. The Navigation WG is an element of the Mission Operations and Information Management Services (MOIMS) Area in the CCSDS organization.

**ON-SITE PARTICIPANTS**

Kyohei Akiyama (JAXA), David Berry (NASA/JPL), Dale Force (NASA/GRC), Cheryl Gramling (NASA/GSFC), Ralph Kahle (DLR), Reinhard Kiehling (DLR), Alain Lamy (CNES), Alexandru Mancas (ESA/ESOC), Francisco Martinez (ESA/ESOC/GMV), Dan Oltrogge (NASA (AGI, SDC, and ISO TC20/SC14)), Julie Thienel (NASA), Patrick Zimmerman (NASA/JSC).

Unfortunately, Frank Dreger, who had been planning to attend, was ill and could not participate.

**TELECON PARTICIPANTS**

Not applicable.

**AGENDA**

The final agenda for the WG meetings is available on the Navigation WG CWE at: <http://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2016/Fall/navwg-agenda-201610.pdf> . In the meeting proceedings below, the detailed agenda for each meeting day is included in the minutes to provide context.

**CURRENT ACTION ITEMS**

The following action items were produced during the meetings. They are also available on the CWE at <http://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2016/Fall/navwg-action-items-201610.pdf> . The due dates below reflect the status as of the end of the meetings; the list on the web page will be updated periodically between now and the next meeting series and will thus reflect relative completion progress.

**New Action/Outstanding Action Items**

<b>##</b>	<b>Action Item</b>	<b>Actionee</b>	<b>Due Date (Original)</b>	<b>Due Date (Current)</b>
33	Produce ADM P1.3	Alain Lamy	28-Oct-2016	28-Oct-2016
34	Absolute/Relative Time Requirements for "Event", including use cases.	Fran, Dan, Dale, Alain	28-Oct-2016	28-Oct-2016
27	Produce PRM Test Plan Draft #3 (Final?)	Fran Martinez	31-Oct-2016	31-Oct-2016
35	Prepare review assignments for ADM P1.3	David Berry	02-Nov-2016	02-Nov-2016

##	Action Item	Actionee	Due Date (Original)	Due Date (Current)
36	Prepare review assignments for Definitions and Conventions Green Book 3.3	David Berry	02-Nov-2016	02-Nov-2016
37	Prepare review assignments for RDM White Book 1	David Berry	02-Nov-2016	02-Nov-2016
38	Setup Nav WG telecon (maneuver reqts) for 16-Nov-2016	David Berry	02-Nov-2016	02-Nov-2016
39	Produce final PRM Prototyping Test Plan	Fran Martinez	04-Nov-2016	04-Nov-2016
40	Produce PRM R1.2 (changes from Fall Meetings)	Fran Martinez	04-Nov-2016	04-Nov-2016
20	Produce TDM P1.0.4	David Berry	15-Jun-2016	15-Nov-2016
41	Prepare review assignments for TDM P1.0.4	David Berry	16-Nov-2016	16-Nov-2016
42	Set up Nav WG telecon (maneuver reqts) for 30-Nov-2016	David Berry	16-Nov-2016	16-Nov-2016
43	Review ADM P1.3	All, as assigned	28-Nov-2016	28-Nov-2016
44	Remove SMM project from the CCSDS Project Framework	David Berry	30-Nov-2016	30-Nov-2016
45	Refine Maneuver Description Requirements	Cheryl Gramling	30-Nov-2016	30-Nov-2016
46	Discuss SM&C Parameter and Conversion Services with Dan Smith for possible use in NHM	Julie Thienel	30-Nov-2016	30-Nov-2016
47	Setup Nav WG telecon for 14-Dec-2016	David Berry	30-Nov-2016	30-Nov-2016
48	Produce ODM P2.36	Dan Oltrogge	01-Dec-2016	01-Dec-2016
49	Prepare Review Assignments for ODM P2.36	David Berry	02-Dec-2016	02-Dec-2016
10	Produce CDM corrigendum for "N_BODY_PERTURBATIONS" keyword	David Berry	13-Jan-2016	15-Dec-2016
22	Produce NDM/XML P1.1	David Berry	31-Jan-2016	15-Dec-2016
50	Send PRM Prototype Test Messages to Fran Martinez	All, as specified in PRM Test Plan	15-Dec-2016	15-Dec-2016
51	Review Green Book 3.3	All, as assigned	21-Dec-2016	21-Dec-2016
13	Determine agencies for "Prototype 2" for NHM	David Berry	30-Apr-2016	31-Dec-2016
21	CDM Corrigendum for element form default on schema (to be done as part of general change from 'elementFormDefault="unqualified"' to "qualified" for all NDM/XML schemas)	David Berry	31-Jan-2016	31-Dec-2016
52	XML Section for ADM	David Berry	31-Dec-2016	31-Dec-2016
53	XML Section for ODM	David Berry	31-Dec-2016	31-Dec-2016
54	Review RDM White Book 1	All, as assigned	31-Dec-2016	31-Dec-2016

##	Action Item	Actionee	Due Date (Original)	Due Date (Current)
55	Review ODM P2.36	All, as assigned	10-Jan-2017	10-Jan-2017
56	Next available number	N/A	31-Dec-2050	31-Dec-2050

### **Completed Action Items**

##	Action Item	Actionee	Status	Completion Date
31	Review ODM P2.35 Sections 2, 6, 7	All	Complete (during Fall Meetings)	18-Oct-2016
32	Update PRM templates on SANA candidate registry.	SANA Operator	Complete (during Fall Meetings)	19-Oct-2016

### **CANCELLED Action Items**

##	Action Item	Actionee	Reason
19	Produce SMM White Book 5	Cheryl Gramling	Group decision during Fall Meetings: discontinue SMM.

## **WORKSHOP PROCEEDINGS**

### **DAY 1, MONDAY 17-OCT-2016**

0800 0845 Registration  
0845 1015 CCSDS Opening Plenary  
1015 1145 MOIMS Opening Plenary  
1145 1230 Admin: Agenda, Intro to Nav WG, Guidelines, Prev Action Items  
1230 1330 Lunch  
1330 1730 Pointing Request Message Prototyping Plan and Test Report (PRM)

### **0845 1015 CCSDS Opening Plenary**

The CCSDS Fall 2016 Meeting series started with a CCSDS Opening Plenary attended by all participating CCSDS members. Nestor Peccia chaired the meeting. We had a very brief opening statement from Enrico Russo of Agenzia Spaziale Italiana (ASI) Headquarters (workshop hosts) welcoming everyone to the meetings. Afterwards Nestor introduced David Ross of the CCSDS Secretariat who spoke on the traditional set of various logistical matters and items of general interest (e.g., details of start/stop times, break times, lunch logistics, wireless access, etc.). Later on (during the Area Director presentations), Professor Roberto Battiston (President of ASI) spoke to welcome all the attendees to the meetings, and discussed a few of the technical activities of the ASI.

There were some important announcements made in this meeting, as follows:

1. The CCSDS is planning the following upcoming meetings (with plans farther out fuzzier than those close in):
  - a) Spring 2017 hosted by NASA at San Antonio, Texas, USA (5-day), 08-May-2017 to 12-May-2017
  - b) Fall 2017 hosted by ESA at TBD, Europe (4-day), 06-Nov-2017 to 09-Nov-2017
  - c) Spring 2018 hosted by NASA at TBD, USA, dates TBD
  - d) Fall 2018 hosted by DLR at TBD, Germany, dates TBD
  - e) Spring 2019 hosted by NASA at TBD, USA, dates TBD
  - f) Fall 2019 hosted by ESA at TBD, Europe (4-day), dates TBD
2. The "Boot Camp" session will be on Friday from 0845-1200. David Ross pointed out that those who are editing CCSDS documents must attend the Boot Camp (at least once).
3. The CCSDS currently has 150 active publications, 92 of which are normative (Blue/Magenta), and 58 of which are informative (Green).
4. The number of missions that have used CCSDS standards in some respect is now up to 825.
5. The CCSDS now has 23 WGs and 1 Special Interest Group (SIG); this is approximately the number of entities reported at Cleveland, Spring 2016 (one BOF has been closed). One WG (Telerobotics) continues to be in danger of being disbanded due to lack of progress.
6. The number of people registered for the meetings is 223.

During his presentation, Nestor highlighted a few things of importance to the Navigation WG, notably, the fact that the CMC Poll required for project approval will now be rejected if the Prototype 2 commitment is not included as part of the request (this item is a repeat from the Cleveland meetings). The Navigation WG was cited as currently having three active projects with the characteristic that the Prototype 2 responsibility has not been assigned (PRM, NHM, SMM).

Nestor highlighted a number of activities in which the CESG has been engaged since the Spring 2016 Cleveland meetings:

- Monitoring the document status queue
- Monitoring polls which have concluded with conditions not resolved
- Trying to improve industry participation in CCSDS
- Monitoring the MOIMS Telerobotics WG status
- Monitoring of SLS Optical WG Near Earth HDR status (could be headed for Orange Book...)
- Production of new WG/Area templates for reports to CESG; Nestor is expecting feedback this week
- Provision of comments on the IOAG approved SC#1 and Draft SC#3 (MOSSG Draft Report)
- Made decision regarding the suggestion to include Security section boilerplate in the Blue/Magenta Book templates. (Result = "NO. Every WG chair can contact the Security WG")
- Made decision regarding the suggestion to provide a template for a CCSDS Concept Paper. Result = "NO. It shall comply with the Procedures & Organization YB").

At the upcoming CESG Meeting, Nestor indicated that the group would:

- Make a decision regarding the radiometric service (offline validated radiometric service?)
- Review approved projects that have disproportionate delays
- Review CMC Agency priorities for Draft projects
- Discuss feedback received on the RID System Requirements
- Discuss the acceptable scope of CESG Poll conditions

- Discuss the apparent overlap of CCSDS with the OMG Space Domain Task Force
- Make a decision regarding the Iranian requests for subscription to CCSDS mailing lists
- Discuss feedback received from WGs/Areas on the new presentation templates

After these announcements and opening proceedings, the final portion of the General Plenary involved the Directors of the six CCSDS Areas presenting the detailed plans for the week for their respective areas. One item of special note was the System Engineering Area's statement that the XML Standards and Guidelines SIG (Special Interest Group) would not be meeting due to lack of resources. Navigation WG has participated in this SIG since its creation in 2005.

### **1015 1145 MOIMS Opening Plenary**

The overall CCSDS Plenary was followed immediately by the MOIMS Opening Plenary meeting, which was chaired by Deputy Area Director Brigitte Behal. In general, Brigitte's portion of the MOIMS Plenary was very succinct. She announced that the MOIMS Dinner would be held on the evening of Wednesday 19-Oct-2016 at 2000 at LO SCOPETTARO, Lungotevere Testaccio 7, Roma Tel 06 5742408.

Brigitte then turned over the meeting to Roger Thompson, who delivered a presentation on MOIMS Services/Inputs to the CCSDS System Engineering Area Reference Architecture. There exists already a CCSDS Communications Systems Reference Architecture covering the SLS, CSS and SIS Areas. Some time ago MOIMS and SOIS received a request from Peter Shames (System Engineering Area Director) to produce a similar document for Application and Support Layer Services. Roger explained that his document will eventually encompass five views: Functional, Service, Information, Protocol, and Deployment. David Berry and Dan Oltrogge had provided inputs to Roger on the material as it related to the Navigation Working Group documents, but he had not yet received them because David had forwarded them using an invalid email address (Roger recently "retired", and has a new email address). During the session David sent the inputs to the correct email address.

### **1145 1230 Admin: Agenda, Intro to Nav WG, Guidelines, Previous Action Items**

The Navigation WG meeting was started immediately after the close of the MOIMS Opening Plenary. In attendance this day were Kyohei Akiyama, David Berry, Dale Force, Cheryl Gramling, Ralph Kahle, Reinhard Kiehling, Alain Lamy, Fran Martinez, Dan Oltrogge, Julie Thienel, Patrick Zimmerman.

Given that the plenary meetings had taken so long, there was little time before lunch for the customary Navigation WG administrative matters. We made introductions around the room, reviewed the agenda for the week, presented the "Introduction to the Navigation WG" material (we had 2 new members this time), went through the Working Group Guidelines, and looked at previous Action Items from Cleveland. David sent the Intro presentation slides to the group since there was not time to go over the document details. This presentation highlighted the progress since the Spring 2016 meetings and set the priorities for the week. The presentation is also available on the CWE at <http://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2016/Fall/navwg-intro-201610.pdf> . Review of the action items from Cleveland showed that as of the start of the meetings, 20 of 32 were completed (63%), 9 remain outstanding (28%), and 3 were cancelled (9%). Overall, the percentage of action item completion was quite good (and a few more were completed/closed during the meetings).

### **1330 1730 Pointing Request Message Prototyping Plan and Test Report (PRM)**

After lunch the WG initiated a review of the PRM Test Plan. David explained that he and Fran had iterated on a few drafts of the plan, and that Fran had designed the plan such that no software development is necessary. The purpose of this is to reduce the required commitment from agencies; it also

recognizes the fact that the processing of the message, and determining whether the pointing can be accomplished, is not part of the standard. The standard provides a way (for example) for a principal investigator to describe a pointing they wish to execute. It is for the spacecraft team to validate the request taking into account all the flight rules and other mission constraints that exist, which exist external to the standard, and about which the requestor need have no knowledge. The concept of having Fran act as a neutral test judge was discussed, and there was no stated objection. In the process of reviewing the test plan draft, there were a number of questions from members of the working group trying to clarify the language used by Fran in the body of the PRM standard. The process of going through the 10 tests involving templates consumed the entire period, and we did not get to the "build from scratch" scenario. We also did not assign any test duties (other than that of Fran the "Test Judge"). David proposed that the most challenging test be postponed until Tuesday morning, and that the ODM revisions take priority over the ADM revisions discussion. Fran, Dan, and Alain agreed with this agenda revision. Consequently, the first 2 hours or so of the Tuesday meeting will be devoted to continuing the PRM Test Plan discussions, and assignment of the responsibilities for the 22 messages (2 each for the 10 templates, plus 2 for the "build from scratch" scenario).

## **DAY 2, TUESDAY 18-OCT-2016**

0845 1045 Pointing Request Message Prototyping Plan and Test Report (PRM)  
1045 1230 Orbit Data Messages V.3 (ODM P2.35)  
1230 1330 Lunch  
1330 1600 Attitude Data Messages V.2 (ADM P1.2)  
1600 1630 Events Message (EVM) Topics  
1630 1715 Joint Meeting with CSSM Regarding Events

In attendance this day were Kyohei Akiyama, David Berry, Dale Force, Cheryl Gramling, Ralph Kahle, Reinhard Kiehling, Alain Lamy, Alexandru Mancas, Fran Martinez, Dan Oltrogge, Julie Thienel, Patrick Zimmerman.

### **0845 1045 Pointing Request Message Prototyping Plan and Test Report (PRM)**

We continued discussion of the PRM prototyping plan. Fran started off with the test of Section 5 of the PRM, where a PRM is built from scratch. After some discussion, David proposed that it may be possible to not test this case explicitly, given that this section of the PRM essentially documents the process by which the templates used in the other 10 tests were produced. We thus have an "existence proof" that the process works (else we would not have any templates). This idea was accepted by the group, but Fran suggested an improvement. Specifically, we have the sample operations file from the Rosetta mission. The pointing requests for Rosetta were in essence the inspiration for the PRM standardization. Fran suggested converting this Rosetta file to PRM (perhaps not the whole thing, given that it's quite large, but enough to be a significant test). All thought this was a good idea. Having decided how we would approach the "build from scratch" PRM, we started accepting volunteers to encode the messages specified in the test plan. Fran was assigned the task of "neutral judge" for all of the test cases, and also as the person who will convert the Rosetta file. Once the table of test case volunteers was filled out, we discussed dates for the several action items involved: (a) provide updated PRM document, (b) provide updated PRM test plan, (c) provide updated templates on the SANA registry site. We determined that the test period would start 07-Nov-2016, and encoded PRMs should be sent to Fran by 15-Dec-2016.

### **1045 1230 Orbit Data Messages V.3 (ODM P2.35)**

Dan led the group in discussion of the few comments he had received in review of the ODM P2.35, and started working on the P2.36 version. David expressed the opinion that it almost seemed that the OCM

could be a separate document given its significant departure from the ODM legacy. Dan expressed the counterargument that there are many components of the OCM that would have to be duplicated in a new document if the OCM were split off from the ODM. David agreed that would be the case, and cited that when the CDM was started we faced that same issue; one of the proposals for the CDM was that it be another message in the ODM. We ultimately decided in that case to make the CDM a separate document, for better or for worse, and did in fact have to re-create many constructs in the CDM that were already in the ODM. In this day's discussion we ultimately decided to stick with the OCM as the fourth message in the ODM document. Dan expressed his opinion that the OCM is maturing to the point that he feels it may be near readiness for Agency Review. We discussed this for a bit, and David noted that we will need to do a full document scrub before that Agency Review can occur to make sure we aren't overlooking places in the document that need to be corrected due to changes since its most recent publication in 2009. We also have not yet factored the XML versions of the OPM, OMM, and OEM into the Pink Book, the ICS is not filled out, etc. Dan did indicate that he was not planning to add any more sections to the OCM, so at least in that sense, the OCM is converging. On the topic of XML, we discussed a bit whether or not it was necessary to produce an XML version of the OCM. David couldn't immediately find the text of the CMC decision that the Navigation WG would produce XML versions of its messages. The actual statement may be open to interpretation or ambiguous as to whether EVERY Navigation WG message would need to have an XML format provided.

We also spoke briefly about the concept of the "universal, modular" navigation message that has risen in the past few meetings. We are not yet in a position to be able to act on that idea, but the OCM work is suggesting that the complexity of such a message would be balanced by a great deal of flexibility. Dan also brought up the fact that he was concerned about the message integrity, and that we had not yet done anything yet to improve it. Checksums or some other mechanism such as "protobuf" (Google's data exchange format) should be considered as we move forward. Related to these future (futuristic) concepts was also the potential for maintaining registries of approved reference frames and time scales on the SANA.

Cheryl raised some questions about the Orbit Determination (OD) section of the OCM, and wondered if it was really practical. Dan responded that it was not intended to describe all aspects of the orbit determination that went into the creation of the ephemeris data, but it would be informative. He also stated that the fields in the OCM OD section for the most part duplicated keywords that had been added to the CDM and were intended to improve confidence in the conjunction prediction. Dan encouraged WG members to send him suggestions for other fields that might make the OD section more useful. David noted that the group had discussed this topic previously and felt that it was not something that should be incorporated in a KVN message, but rather in an ICD or some type of technical report. Several years ago, there was an effort via the ISO TC20/SC14/WG3 that originally intended to standardize orbit determination, but that effort turned into an ISO Technical Report instead.

### **1330 1600 Attitude Data Messages V.2 (ADM P1.2)**

After lunch we took up discussion of Alain's Attitude Data Messages P1.2 document. Alain showed the group the various changes he had made that were intended to remove ambiguity in the document. Some of the changes involved allowing multiple blocks in the APM Data Section. He recommended changes to the Euler Angles representation that he feels will make the data structures more consistent, though it represents a major change to the current standard. He explained his rationale for the changes in both the APM and the AEM. The most significant changes are in the APM, but there are some changes in the AEM too (e.g., a new ephemeris line format). Alain will make some additional changes to the document in the next few days and distribute them as ADM P1.3 (see Action Items).

### **1600 1630 Events Message (EVM) Topics**

In preparation for a joint meeting with the CSS/Service Management WG on the topic of "events", we reviewed briefly the data structure that had been provided by Erik Barkley. The class structure had evolved somewhat since we met at Cleveland. In particular, the "relative time" had been added as requested at the last joint meeting, and the ability to reference a variety of parameters associated with an event had been added. The group had a few concerns, e.g.:

- The relative time class also contained explicitly an epoch time. In principle, it is often desirable to have many events be relative to some fixed epoch time.
- The absolute time class had a "timeType" attribute, but it was not clear what this was (could it be the time scale?)
- The relative time class did not have a timeType attribute, though this would likely be necessary (if in fact timeType was meant to be the time scale).

### **1630 1715 Joint Meeting with CSSM Regarding Events**

After the brief preparation period described above, most of the members of the Navigation WG joined the Service Management WG for a discussion on "events". The various concerns discussed in our preparation session were raised, and Colin Haddow (member of SM WG conducting the meeting) indicated that he was very willing to entertain the requirements of the Navigation WG, but needed to have a clear specification thereof. Several members of the Nav WG were allocated an action item to specify the requirements for the event time. This joint meeting concluded our day.

### **DAY 3, WEDNESDAY 19-Oct-2016**

0845 1230 Spacecraft Maneuver Message Direction/Decision (SMM)  
1230 1330 Lunch  
1330 1700 Navigation Hardware Message Direction/Decision (NHM)  
2000 ??? Mario's MOIMS Area Dinner

In attendance this day were Kyohei Akiyama, David Berry, Dale Force, Cheryl Gramling, Ralph Kahle, Reinhard Kiehling, Alain Lamy, Alexandru Mancas, Fran Martinez, Dan Oltrogge, Julie Thienel, Patrick Zimmerman.

### **0845 1230 Spacecraft Maneuver Message Direction/Decision (SMM)**

The group started the day with discussion of the SMM. For context, we discussed the current working plan of quickly producing a first SMM Blue Book consisting only of a Maneuver Planning Message (MPM) followed by a second Blue Book adding a Maneuver Design Message (MDM) and Maneuver Analysis Message (MAM). Some of the material considerations involved the ever present issue of consistency (or lack thereof), overlap/duplication with other messages, and use cases. We also have an issue that the maneuver related material has been neglected for an inordinate amount of time. A table of "Maneuver Description Options" containing the pros/cons of three options for proceeding was prepared to help us arrive at a decision. The table is shown immediately below. The options shown in strike out text were rejected.

#### Navigation WG Maneuver Description Options

Pre-Requisite: Regardless of which option is selected, they all presuppose a refinement of the maneuver description requirements currently expressed in the Spacecraft Maneuver Messages White Book version 4 (distributed) or 5 (not distributed). This refinement is necessary because the requirements development



was never fully completed, and we observed in just a quick review a few obvious places where modifications should be made before proceeding. As the current custodian of the SMM draft, Cheryl Gramling will lead the refinement process.

~~Option 1: Continue with the SMM family of messages as conceived ((MPM)/(MDM/MAM)) over 2 BB issues, and continue the OCM work in the ODM~~

<b>PRO</b>	<b>CON</b>
<del>Tailorable specific to maneuver design requirements</del>	<del>Another family of messages to develop, prototype, maintain, and ensure consistency with OCM/ACM</del>
<del>Work to get to a WB4 has been invested</del>	<del>Having too many documents becomes a drain on Agency resources (and "lack of resources" is a continual lament in the CCSDS).</del>
<del>There's a certain logic to look in a book called "...Maneuver..." for information about maneuvers.</del>	<del>Need a second prototyping Agency</del>
<del>SMM could copy from the work already done in the OCM (continue from ODM)</del>	<del>The mythical "ACM" needs to be produced. (1) as part of current ADM revisions, (2) as a separate work project later, (3) as part of current ODM revisions.</del>
<del>SMM could steal from the work already done in the OCM (discontinue from ODM)</del>	

~~Option 2: Continue with the SMM MDM/MAM since the MPM is largely covered by the OPM/APM, and continue the OCM work in the ODM.~~

<b>PRO</b>	<b>CON</b>
<del>One less section in the SMM (but it would have been the simplest section and could largely have been lifted from OPM/APM).</del>	<del>Segregates the maneuver information into multiple documents and messages (OPM, OCM, APM, MDM, MAM)</del>
	<del>Another family of messages to develop, prototype, maintain, and ensure consistency with OCM/ACM</del>
	<del>Having too many documents becomes a drain on Agency resources (and "lack of resources" is a continual lament in the CCSDS).</del>
	<del>Doesn't address the notion of producing the SMM on a "rapid" basis.</del>
	<del>Need a second prototyping Agency</del>

Option 3: Continue with the ODM/OCM maneuver section, pursue an analogous ADM/"ACM" for attitude maneuvers, and discontinue the SMM effort. (However, the OCM/ACM material should be informed by the maneuver description requirement set started for the SMM.)

<b>PRO</b>	<b>CON</b>
There exist use cases for having the maneuver information in the ODM.	ODM is getting rather large and complicated... its heritage was somewhat less complex.
OCM is more along the notion of the "modular	Incorporating the "SMM" requirements set could

message structure" that has been proposed.	slow down development of the ODM and ADM revisions. Degree of slowdown could be significant (or insignificant).
Maneuver requirements already indicate a tie with orbit state and/or attitude state, so OCM/ACM elaborations of maneuvers have a logic to them.	Minor: don't have a second prototyping agency for the mythical "ACM".
Orbit/attitude states imply reqt to define reference frames, element sets, and timing systems... these are already in the ODM/ADM	
We have a second prototyping Agency for OCM	

As illustrated with the absence of strikeout text in Option 3, the WG concluded with a decision to cancel the SMM project. David will convey the decision to Mario Merri. Cheryl's open action item to produce an SMM White Book was cancelled, and a new one to lead refinement of the maneuver description requirements was added.

When we concluded discussion of the maneuver description options, we had a few minutes before lunch. We used that time to begin the review/refinement of the maneuver description requirements that had been extracted from the SMM, so they could be used to inform the development of the OCM Maneuver Section. This analysis also included a discussion of regarding the maneuver material in the ODM/OPM and ADM/APM, though this was a bit inconclusive; because of the short amount of time, and the fact that this activity hadn't been pre-planned, we didn't use copies of the ODM or ADM requirements. The object of including the ODM/ADM considerations was to ascertain whether or not the SMM requirement was already present in the ODM/ADM requirements, but sometimes we ended up discussing whether or not it was already in fact implemented in the ODM/ADM. This also included discussions of whether or not the SMM requirement was implemented in the ODM/ADM in the absence of a specific requirement. We also discussed an analogous "ACM", or "Attitude Comprehensive Message", though we acknowledged the need for caution in discussing this "theoretical" message. It may or may not be possible to include such a message in the ADM updates currently in progress. It was not possible to finish the requirements refinement work prior to lunch. David indicated that he thought this requirements refinement work could continue over focused telecons in the next few months, but we will want to clarify the questions we ask about ODM/ADM requirements and implementations. Dan indicated that we should complete this effort as soon as possible in order to not inordinately delay development of the OCM; we may have telecons every 2 weeks in order to complete the requirements refinement process expeditiously.

**1330 1700 Navigation Hardware Message Direction/Decision (NHM)**

After lunch the group entertained another discussion of direction/decision with respect to a work in progress, this time for the NHM. This discussion centered on discussion of two resolutions that David had prepared in during the summer of 2016 and distributed to the WG for comments. The first resolution addressed an argument that would discontinue work on the NHM, and the second resolution addressed an argument that would keep/continue work on the NHM. Both arguments received a few comments from WG members, and the revised versions published 05-Sep-2016 were reviewed and discussed during the afternoon session. The material appears immediately below; the two resolutions were combined and paired because for each point of the argument to discontinue the NHM, there is generally a counterpoint that argues it should be continued. Because of the point/counterpoint pairing by rows in the table, the material is not in the same order as originally distributed, but the arguments are the same.

<b>RESOLUTION: "DISCONTINUE NHM"</b>	<b>RESOLUTION: "CONTINUE/KEEP NHM"</b>
Whereas the Navigation Hardware Message (NHM) is currently an Approved Project of the	Whereas the Navigation Hardware Message (NHM) is currently an Approved Project of the

RESOLUTION: "DISCONTINUE NHM"	RESOLUTION: "CONTINUE/KEEP NHM"
CCSDS Navigation Working Group in the CCSDS Management Framework;	CCSDS Navigation Working Group in the CCSDS Management Framework;
Whereas the Book Editor for most of the NHM development was a NASA/GSFC contractor, and the Space Data Standards Manager in NASA's Space Communications and Navigation Division has determined that the NASA/GSFC ratio of contractors to civil servants was too high, necessitating the assignment of a new Book Editor for the NHM;	Whereas the new Book Editor of the NHM is a NASA civil servant;
Whereas the CCSDS Management Council (CMC) has recently (approximately April 2016) established a policy that new CCSDS projects will not be approved unless they are proposed with a Book Editor and two prototyping Agencies identified;  Whereas the CCSDS Engineering Steering Group (CESG) and CMC have been actively seeking to cancel previously approved projects that do not have a second prototyping Agency identified;	
Whereas the NHM is still a White Book as of the date of this Resolution, and thus a CCSDS Agency Review has not yet been conducted;	Whereas the NHM White Book has been developed and refined over several years, and by some measures can be considered an "advanced" White Book nearly ready for the required CCSDS Agency Review;
Whereas the new NHM Book Editor has only recently been assigned and has not yet invested significant time into the further elaboration of the NHM;	Whereas the recently assigned new NHM Book Editor has exhibited significant enthusiasm for the project, and has advanced several ideas designed to address some of the design point challenges affecting the further elaboration of the NHM;
Whereas a second prototyping Agency commitment for the NHM has not yet been obtained, despite efforts over the past few months to obtain one;	Whereas significant efforts have been made since April 2016 to obtain a second prototyping Agency commitment for the NHM, in accordance with new policies of the CCSDS Management Council (CMC) and CCSDS Engineering Steering Group (CESG);
Whereas the current technical approach for the NHM has been acknowledged to <b>require</b> an Interface Control Document (ICD);  Whereas the CESG has recently been encouraging decreased reliance on the use of ICDs in CCSDS standards;	Whereas the Navigation WG has been discussing ways in which the NHM might be designed so it does not <b>require</b> the use of an Interface Control Document (ICD), in order to satisfy new requirements levied by the CESG;
Whereas there is still a question as to the proper direction for the NHM even within the CCSDS Working Group;	Whereas the <i>Organization and Processes for the Consultative Committee for Space Data Systems Yellow Book</i> (A02.1-Y-4) allows for the possibility of an "Experimental Specification" (aka "Orange Book") with relaxed requirements

RESOLUTION: "DISCONTINUE NHM"	RESOLUTION: "CONTINUE/KEEP NHM"
	<p>regarding Agency Review, agency involvement in development, and prototyping;</p> <p>[NOTE: This point only relates to "Option #2" below.]</p>
<p>Whereas the NHM has been in development since 29-Sep-2010 and the project schedule has been revised several times; and</p>	<p>Whereas the agencies of the CCSDS have invested significant resources since 29-Sep-2010 in bringing the NHM to its current level of development;</p>
	<p>Whereas the interface for the provision of attitude and orbit data from the Attitude &amp; Orbit Control System (AOCS) to the flight dynamics system is a recurrent implementation, historically requiring specific implementations, that would benefit from the operational robustness and cost efficiency of a standardized and well-defined exchange mechanism;</p>
<p>Whereas the original proposer and Book Editor of the NHM has expressed skepticism that the NHM would ever be widely implemented...</p>	<p>Whereas the members of the Nav WG continue to believe that the concept behind the NHM has value, even though it might not ever be widely implemented...</p>
<p>THEREFORE, BE IT RESOLVED:</p> <ol style="list-style-type: none"> <li>1. That further development of the NHM shall be discontinued, effectively immediately; and</li> <li>2. That the NHM project shall be withdrawn from the Technical Program of the CCSDS Navigation Working Group.</li> </ol>	<p>OPTION #1: THEREFORE, BE IT RESOLVED:</p> <ol style="list-style-type: none"> <li>1. That further development of the NHM Blue Book shall continue, per existing plans; and</li> <li>2. That the NHM project shall continue to be a component of the Technical Program of the CCSDS Navigation Working Group.</li> </ol> <p>OPTION #2: THEREFORE BE IT RESOLVED:</p> <ol style="list-style-type: none"> <li>1. That further development of the NHM shall continue, with a conversion to Orange Book</li> <li>2. That the NHM project shall continue to be a component of the Technical Program of the CCSDS Navigation Working Group.</li> </ol>

During discussion of the arguments, a few additional points were raised by the Working Group:

- Julie Thienel stated that the complexity of the NHM shouldn't be a determinant as to whether or not the project is retained.
- Julie pointed out that missions won't necessarily retrofit to the NHM, but going forward the use would be easier to promote, as missions build telemetry databases, simulators, and other elements of the ground system are put together.
- During discussion, Ralph Kahle suggested possible use of one of the SM&C services dealing with telemetry as a way forward; Julie took an action item to research with Dan Smith how the SM&C Parameter Service and/or Conversion Service might be used in support of the NHM goals. Note that there was some discussion of investigating the SM&C WG Parameter Service for the NHM a few meeting series ago (Cleveland 2012). At that time, we met with the SM&C WG to discuss this

service, in which data items are extracted from telemetry and provided to subscribers to the service. Julie will look into this.

In the end, a decision was made to provisionally "keep/continue" the NHM, though David indicated that we would likely face continued pressure to cancel the project due to the lack of a second prototyper (subsequent to the meeting, David inquired of Mario what is the deadline for finding a second prototyper, and he indicated that he was not aware of a deadline). We discussed the possibility of the Orange Book option, but that is generally a last attempt to keep a project alive (there are only 4 Orange Books in the CCSDS publication list). Their existence often indicates an inability to achieve consensus in a Working Group.

### **2000 ???? Mario's MOIMS Area Dinner**

After the meeting, several members of the Working Group were due to attend Mario's MOIMS Area Dinner.

### **DAY 4, THURSDAY 20-Oct-2016**

0845 1115 Re-Entry Data Message White Book (RDM WB 0)  
1115 1230 Navigation Data & Conventions Green Book V.4  
1230 1330 Lunch  
1330 1415 Navigation Data & Conventions Green Book V.4  
1415 1600 Tracking Data Message V.2 (TDM P1.0.4)  
1600 1700 Prep Closing Report, 5 Year Plan, Action Items, Set Next Telecon  
1700 1700 End of Navigation WG Meeting

In attendance this day were Kyohei Akiyama, David Berry, Dale Force, Cheryl Gramling, Ralph Kahle, Reinhard Kiehling, Alain Lamy, Alexandru Mancas, Dan Oltrogge, Julie Thienel, Patrick Zimmerman. For the afternoon session, we were joined by Mario Merri (MOIMS/AD) and Brigitte Behal (MOIMS/Deputy AD).

### **0845 1115 Re-Entry Data Message White Book (RDM WB 0)**

We started the day with a review of the initial White Book of the new Re-Entry Data Message. Alexandru walked us through the White Book version 0, and also showed us the CRM that had been prepared by Julie (these were the only changes he had received to date). At the conclusion of the session, some revisions to White Book 0 had been made to White Book 1, and Alexandru sent them to David so they could be posted on the CWE. The RDM has a heavy inheritance from the CDM standard, which is somewhat to be expected given the close relationship of the CDM and RDM as facilitating space situational awareness applications. We focused briefly on one particular instance of inheritance, specifically, the MESSAGE\_ID in the CDM header; this field may have broader application than just in the CDM. In the earlier Navigation WG standards, the requirement to be able to uniquely identify a message was met by a combination of the CREATION\_DATE and ORIGINATOR keywords. However, at one time the frequency of messages instantiations was somewhat lower, and stronger means of uniquely identifying a message were not seen as necessary. For the CDM, it was seen as possible that a larger number of messages could be issued on a single day, and a stronger means of uniquely identifying them was seen as necessary. Alexandru pointed out that the SANA registry named "Conjunction Data Message CATALOG\_NAME" might also have broader applicability than to just the CDM, and that a name change to "Navigation Data Message CATALOG\_NAME" might be in order. In general, the topic of inheritance as illustrated by the CDM led us back to the topic of maximizing consistency and

minimizing duplication, and the notion of a "modular message" that had emerged at the London meetings in Fall 2014. Based on this discussion, David made a note to include the a "modular message" topic as an agenda item on the Spring 2017 meetings; we don't have time to elaborate the concept at this time.

**1115 1230 Navigation Data - Definitions & Conventions Green Book V.4**  
**1330 1415 Navigation Data - Definitions & Conventions Green Book V.4**

Dale showed the various changes that had been made in the Green Book draft. There was discussion of the history of the Green Book and also the rationale for the two different Green Books we have now (until recently, the Navigation Data - Definitions & Conventions (D&C) was the only Navigation Green Book). We discussed what would be the best way to handle the possibly duplicated material in the two Green Books; there was general agreement that we wanted to avoid duplication of material where possible. The duplication was introduced when the Navigation Data Messages Overview (NDMO) document was started, and Sections 2 and 3 of the D&C had been copied into the NDMO Green Book. From that point, the material in NDMO was subject to various modifications because it was under development. We have already removed most if not all of the Section 3 material from the D&C Green Book. Discussion took a while but we ultimately decided that the Chapter 3 material belonged the NDMO document (its current location), and the Chapter 2 material would be placed in the D&C document. The discussion of Green Book modifications continued after lunch. At that time there was discussion of changes to the NDMO document that would be necessary in the not too distant future. Specifically, we will need to move the PRM from "Not Published" to "Published" status. We will also need to remove the SMM from the NDMO, and modify or delete drawings/diagrams that refer to it. Mario recommended removing the distinction of "published/not published" from the NDMO, since this status information would require updating the document on a regular basis, but David wondered how often that would realistically be... perhaps once per year but not more often. Dale mentioned that he might be able to pick up Lead Editor responsibilities for the NDMO updates after he completes the D&C Green Book updates.

**1415 1600 Tracking Data Message V.2 (TDM P1.0.4)**

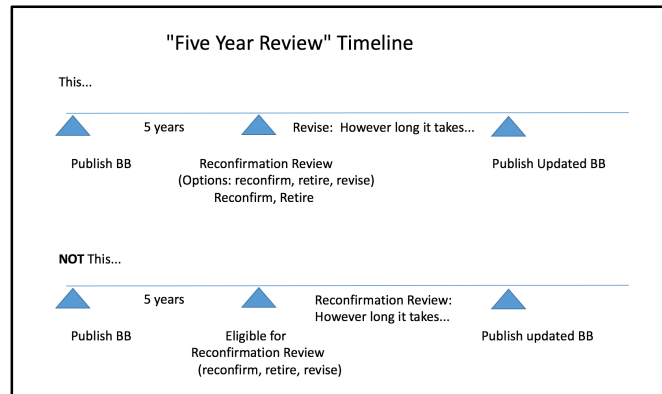
With Mario and Brigitte still in attendance, we started discussion of the TDM. David presented his "TDM Blue Book Approach Plan" for the TDM Version 2, shown immediately below:

Basic Plan for TDM Version 2

1. Complete TDM Version 2 based on changes to date, as soon as possible.
2. Immediately upon publication of Version 2, open discussions for Version 3.

Rationale for Basic Plan

1. The TDM was originally published in November 2007, and was eligible for the 5 Year Review in November 2012.
2. Based on various desired changes presented to the WG, revisions of the TDM informally commenced in April 2012 while the WG was still very much consumed by preparation of the CDM. Consequently, very little progress was made for some time.
3. The TDM Five Year Revision project was formally approved 09-Oct-2013, shortly after publication of the CDM. The first Pink Book version was finally distributed 08-Jan-2014. We formally concluded the reconfirmation review process with a decision of "revise" at the Spring 2014 Meetings (this conclusion was already strongly implied by previous actions as documented here; the confusion is entirely due to misunderstandings of the process by the WG Chair... see diagram below):



**4. Key Point: Proposed revisions received starting in 2012 have not yet been made available to requestors, 4 years later.**

5. Recent proposed revisions to the TDM will re-open discussions upon which decisions were made during the development of TDM Version 1 from 2004-2007. This is understandable given that almost no one currently involved in the WG was a participant during the initial TDM development.

6. Re-opening old discussions will delay production of the TDM Version 2 Blue Book even further than it has already been delayed, possibly for 2-3 more years given the current workload in the WG.

7. If more changes are made to the book we might have to address RIDs on the entire book, whereas with "Pink Sheets" we only need to accept RIDs on changed material. Last time Tom Gannett reviewed the proposed changes, he felt that the only material that needed to be reviewed was new material (i.e., "Pink Sheets", not the entire TDM document (i.e., "Pink Book").

8. We are not required to wait 5 years to discuss reviews of or changes to the TDM. We can start immediately based on "new requirements" (both internal to the Navigation WG and external, e.g., from the "Validated Radiometric Service" folks). This is consistent with historical practice on the ODM standard.

**Conclusion:** Enactment of the "Basic Plan" will (a) provide requested revisions previously incorporated to those who have requested them, and (b) allow for wide-open discussions of the features of the TDM, though with some delay (i.e., that required from now until the publication of TDM Version 2).

After presenting this plan, there were some questions and possible nuances of scheduling suggested by Mario and Brigitte (e.g., were some of the future changes urgent, or easy to make thus not taking much time, etc.). In general, David stated that there is no problem revisiting material in the current TDM, however, next year will be 10 years since the publication of the first TDM (nearly time for a second 5 Year Review!). It is understandable that new members of the WG have new ideas that they would like to explore given that there will soon be only one person in the WG who participated in the development of the original TDM.

After a bit more discussion, no opposition to David's proposal was registered by the members of the WG, and it was therefore adopted. However, Cheryl indicated that there was a particular topic that needs to be discussed as part of proceeding with the plan.

### **1600 1700 Prep Closing Report, 5 Year Plan, Action Items, Set Next Telecon**

We completed the list of action items, target dates, and assignees (shown above in the minutes). We reviewed and completed the group's report to the Area Director for the MOIMS Closing Plenary (shown below in the minutes). Due to lack of time we could not review the Charter, and also postponed the 5 Year Plan for telecon discussions (though these will not take place until after the maneuver description requirements are refined).

Document project schedules on the CWE Framework were not reviewed during the meeting; however, in the CWE Management Framework they all show as "On Schedule". These schedules form the basis for the consolidated Five Year Plan, which as noted above we will review in telecons.

### **1700 1700 End of Navigation WG Meeting**

After completing all the closing matters, the Navigation WG meeting was concluded (though several WG members were planning to attend the Lead Editors' Boot Camp on Friday). The group congratulated and thanked Reinhard for his many years of service to the CCSDS (~17), all were thanked for a productive meeting week, we bid each other "arrivederci", and we started making plans for the next meetings in San Antonio, Texas, USA, in May 2017.

All materials from the meetings (agenda, introductory presentation, action items, report, and minutes) are available on the CWE at the following link:

<http://cwe.ccsds.org/moims/docs/Forms/AllItems.aspx?RootFolder=%2Fmoims%2Fdocs%2FMOIMS-NAV%2FMeeting%20Materials%2F2016%2FFall&View={8E605C3A-1DB4-4034-B479-91C6E2A03139}&>

Draft documents are in their respective directories on the CCSDS CWE:

<http://cwe.ccsds.org/moims/docs/Forms/AllItems.aspx?RootFolder=%2fmoims%2fdocs%2fMOIMS-NAV%2fDraft%20Documents&FolderCTID=&View={8E605C3A-1DB4-4034-B479-91C6E2A03139}>

### **DAY 5, FRIDAY 21-OCT-2016**

There was no meeting of the Navigation WG this day in order to enable support of the Lead Editors' Boot Camp, XML Standards & Guidelines (XSG) Special Interest Group (SIG), and SANA Steering Group. As it turned out, the XSG SIG had been cancelled due to lack of resources (and it may be cancelled for good). It was also the case that the MOIMS Closing Plenary was scheduled concurrently with the SANA Steering Group Meeting.

0845 1230 Technical Editor Boot Camp (attendance optional/req'd for editors)

1230 1330 Lunch

1330 1600 MOIMS Closing Plenary (attendance optional)

### **0845 1230 Technical Editor Boot Camp (Attendance Optional/Required for Lead Editors)**

In attendance at this meeting were Peter Shames (CESG), Tom Gannett (Secretariat), Wallace Tai (CESG Deputy Chair), Dale Force (NASA/GRC), Cheryl Gramling (NASA/GSFC), Julie Thienel (NASA/GSFC), David Berry (NASA/JPL), and 3 others from other Agencies.



Peter Shames led the first half of the meeting. The primary focus of this half of the session was discussion of one of the most important documents in the CCSDS, the "Organizations and Processes" document A02.1-Y-4. This document describes the CCSDS organization and defines procedures used by the CCSDS. He reiterated the old saying attributed to Emerson that "A foolish consistency is the hobgoblin of little minds...", but indicated that consistency is an important task in CCSDS standards development. David noted that the Navigation WG has discussed this concept previously, and decided that the operative word in the saying is "foolish". Peter went on to explain that CCSDS Standards by design are normative, directly implementable, and testable interoperable/cross-support specifications. He drew a distinction between "interoperability" (the ability of systems elements developed by one organization to integrate and operate successfully with elements developed by a different organization) and "cross-support" (to permit expensive ground and space assets to be shared and re-used among different agencies and different organizations within an agency).

One very important concept stated by Peter is that one cannot generally "paint a book a different color". This means that the "color" (or track) of a book is generally set very early in its development, and much work must be conducted to overcome any error in document type assignment (e.g., much work to change Magenta to Blue, or Green to Blue/Magenta). Peter discussed also the growing importance of the SANA Registry in the operations of the CCSDS, recommended reading the Registry Management Policy (RMP, CCSDS 313.1-Y-1) which describes policies for the SANA registry. He spent some time going over the concepts of the SANA re-engineering effort currently in progress, and let attendees know that prior to requesting a new registry, there is a requirement to become familiar with existing registries to determine if they can satisfy the requirements, or if an existing registry can be extended to satisfy the new requirements. Per Tom Gannett, it is best to start the interaction with the SANA Operator as early as possible during internal development rather than waiting until the document is "ready for publication".

Tom Gannett (the CCSDS Chief Editor) led the second half of the meeting. Some of the material in this section repeated material that was already presented by Peter Shames, but Tom explained that is due to the fact that Peter borrowed material that was formerly in Tom's presentation. There were however a great number of useful tips and pointers of use to Lead Editors. A selection follows (for the full presentation, one can reference the following link: <http://cwe.ccsds.org/cesg/docs/Boot%20Camp%20Slides/2016-10%20Technical%20Editor%20Boot%20Camp%20Slides.pptx> ).

- Tom has a large document queue, and maintains a prioritization scheme as follows: (1) Red & Pink Books have the highest priority (because they keep document reviews going), (2) Blue & Magenta, (3) Orange & Some Yellow, (4) Green, (5) Remaining Yellow.
- The document production process has some built-in bureaucracy. Two polls are required (for CESG and CMC, 2 weeks each, add a month total), and these two polls are required at several points in the process (project start, conversion to Red, conversion to Blue/Magenta). The short period of time between Fall and Spring Meetings (plus holidays) makes progress slow in the winter.
- Working Groups do not publish CCSDS documents. Once the WG delivers a book to the Secretariat, they lose control of the process. Tom takes over from the time of submission to the Secretariat to the end of the Agency Review. He mentioned that in the past there have occasionally been some "Rogue Standards" in circulation due to WGs not understanding their role in the process.
- In the discussion of "Procedures: Why the Book You Delivered Yesterday Hasn't Been Published Yet...", Tom cited:
  - He has a massive queue of books to be worked on... one must be patient.
  - There is a protocol for delivering books: Tom needs the version of the document proposed for Agency review, original graphics files for figures in the document, and an Area Director's Resolution requesting formal Agency review.

- At least 6 weeks to 60 days will elapse between delivery of a document to the Secretariat and its release... 2 weeks for Tom, and a month of polling. Generally the delay is greater than 6 weeks given his queue and the relative prioritization of documents in the queue.
- The Secretariat prepares the PDF file to be used for the review, prepares forwarding and RID initiation forms, and initiates approval process
- Quote from Tom: "If you are a document editor, there is no substitute for going through the Publications Manual".
- "Text shall be written in terse style"... authors must limit non-normative text as much as possible. "Terse style" is a specification in which normal text is limited to a concise statements of requirements. It is "easy" for a document's original author to write terse style, but it is not easy for Tom to fix non-terse style (and the fixing extends document production delays). For a good example of terse style, Tom suggested becoming familiar with the CCSDS Publications Manual A20.0-Y-4 because it is written in terse style.
- Tom drew a distinction between "not normative" and "not a requirement".
- Normative references must now provide explicit references to relevant sections/clauses/etc. in the referenced document. (Apparently this requirement has been in place for a while, but David stated that this is the first he'd heard of it.)
- Tom suggested that authors keep reference lists short! List reference documents only as needed. Tom has to check them all.
- In a discussion of Pitfalls, Tom cited "Definitions". He suggested trying to stay away from the creation of ad hoc terms, and checking the CCSDS Glossary of standardized terms before inventing a new one (but he acknowledged that the Glossary is currently a mess).
- Use the third person discourse (not "Note that...", but "It should be noted that...")

In response to Dan Oltrogge's question that arose during the Navigation Working Group meetings ("Will the \*.doc templates ever be updated to \*.docx templates?"), Tom explained that he continues to use Word 2003 formats because he feels they allow him better control of page layouts in the standards documents. He explained that no matter what the WG presents to him (\*.docx, Google docs, something else), the first thing he does is convert it to Word 2003 formats.

In response to a question from Cheryl Gramling regarding the Security section requirements, and their boilerplate nature (at least in the Navigation WG documents), Tom stated that the CCSDS Security WG has volunteered to write security sections for groups.

In response to a question from David "When is the ideal time (from Tom's perspective) for the WG to submit a document to the Secretariat?", he responded "as soon as possible after the latest Meetings". He added that if a WG submits something within 100 days of the next Meetings, "forget it" (interpretation... it won't be out before the next Meeting). So in essence WGs must use knowledge of the customary delays along with Tom's prioritization queue to estimate dates. From the Navigation WG perspective, this is most important from the standpoint of trying to have Agency Reviews complete just prior to CCSDS Meetings, so there are RIDs to evaluate during the meetings. Experience shows that RID disposition is generally more expeditious when attempted during the face-to-face meetings.

### **1330 1600 MOIMS Closing Plenary**

In attendance at this meeting were Brigitte Behal (ESA, MOIMS), Mario Merri (CNES, MOIMS), James Afarin (NASA, CMC), David Berry (Nav), Dan Smith (SM&C), Mehran Sarkarati (MPS), Steve Chien (MPS), David Giarretta (DAI), Roger Thompson (SM&C, MPS), John Grant (DAI), Mike Kearney (DAI), and 3 others (probably from SM&C or MPS).

The reports of the Mission Planning & Scheduling (MPS), Spacecraft Monitor & Control (SM&C), Digital Archive Ingest (DAI), and Navigation WGs were presented; the Telerobotics WG did not meet during this meeting series. First David presented for Navigation; the report is shown immediately below (note for those who were present when we prepared the report... there were some comments from WG members that the tone of the free form text was too negative, so the language was moderated to be less negative; Dan's question about templates was removed since it had been answered in the Boot Camp). No new action items for Navigation were received during the Plenary. In addition, David had provided feedback prior to the Plenary to Mario on the two topics as requested by Nestor Peccia: (1) comments on the RID tool automation, and (2) feedback on the new WG report templates. A resolution to cancel the SMM was added to the report. After the Plenary, the Technical Meeting week concluded...

NOTE: During the Plenary, when someone indicated 4 work months to complete a Green Book update, Mario stated that a Green Book update should take no more than one month (!).

## MOIMS CLOSING PLENARY / NAVIGATION WORKING GROUP REPORT

### Navigation WG Executive Summary

**Goals for this meeting cycle:** Discuss PRM prototyping plan, ODM Pink Book, TDM Pink Book, ADM Pink Book, Green Book Version 4 update, RDM White Book, determine future direction for SMM & NHM; complete joint meeting on "Events" with CSS/SM WG

### **Working Group Status: OK!**

- Completed review and direction for PRM Test Plan, prototyping agencies identified
- Completed discussion of ODM revisions, ADM revisions, TDM plan, RDM first WB
- Agreed to cancel Spacecraft Maneuver Messages project. Maneuver info => ODM, ADM
- Discussed options for Navigation Hardware Message: discontinue? keep? migrate? Orange?

### **Problems and Issues:**

- No particular technical problems with the Working Group

### **Planning:**

Area and WG Name	CCSDS Ref #	Activity	Document Title	Status	Start and/or Target Publication Date	Comments
MOIMS NAV	500	Green	Definitions & Conventions	OK: Reviewed draft 3.3	Publish 11/2017	Good progress
MOIMS NAV	502	Pink	Orbit Data Messages	OK: Reviewed P2.35	Publish 07/2018	Good progress
MOIMS NAV	503	Pink	Tracking Data Message	OK: Discussed strategy plan	Publish 11/2017	Approved plan for publication
MOIMS NAV	504	Pink	Attitude Data Messages	OK: Reviewed P1.2	Publish 07/2018	Acceptable progress
MOIMS NAV	509	Red	PRM	OK: Prepared Test Plan Draft, arranged second prototypers	Blue Book 03/2017	Nearly ready to publish
MOIMS NAV	510	White	NHM	Caution: need more time to decide 2nd prototyper	Blue Book 04/2018	New Lead Editor working on ideas to continue project
MOIMS NAV	511	White	SMM	Resolved Problem... to be cancelled	N/A	We will cancel this project
MOIMS NAV	???	White	Re-Entry Data Message	OK: Reviewed WB version 0	Blue Book 09/2018	Good progress
MOIMS NAV	N/A	Draft	EVM	Positioning for start in progress	Start in 2017?	Poll not yet requested

### **Interaction with other WGs:**

- Met with CSS/SM WG regarding their definition of Event structure and classes

### **Resolutions:**

- Resolution 1: Thanks to ASI for hosting the meetings!

- Resolution 2: Request MOIMS/AD to issue resolution cancelling SMM project (re-use 511.0 for RDM?)

**Navigation WG Additional Viewgraphs**

- **PRO**
- Very nice facility
- Room was spacious and conducive to productivity
- Internet access was appreciated and non-problematic
- Gracious hosts
  
- **CON**
- Plenary Meetings are now taking quite a bit longer than they formerly did... this detracts valuable time from WG activities. Do we really need to hear the detailed plans of every Area Director?
- Nav WG Meeting Room was quite warm... we opened a window frequently.
- We experienced early in the week the refreshments/lunch running out before we got to the table (e.g., people getting seconds before some had firsts). This situation improved through the week.
- Remote location of the meetings was a subject of frequent discussion
- Taxi arrangements suffered from some of the same etiquette problems experienced in lunch line
  
- **Registrants by Meeting**
- Mon: Registered=12, Actual=11 (-1 sick) 92%
- Tue: Registered=14, Actual=12 (-1 sick, -1 non-regular no-show) 86%
- Wed: Registered=14, Actual=12 (-1 sick, -1 non-regular no-show) 86%
- Thu: Registered=13, Actual=13 (-1 sick, -1 left early, +2 AD/DAD) 100%
- Fri: Not Meeting

**NAVIGATION STANDARDS 5 YEAR PLAN**

Given that our closing preparation time was reduced a bit due to longer discussions on Green Book and the TDM than were allocated in the agenda, there was insufficient time to update the 5 Year Plan. We will address this plan in monthly telecons between now and the Spring 2017 meetings in San Antonio.

**NEXT TELECON:**

As established in the Action Items, the WG established Wednesday 16-Nov-2016 @ 1300 UTC as a next telecon date. A meeting invitation will be sent. The tentative will focus on refinements of maneuver specification requirements that can be implemented in the ODM or ADM standards. Status on Action Items due before the telecon or up to one week after will be solicited.