MINUTES OF NAVIGATION WORKING GROUP FALL 2020 WORKSHOP   23-Nov-2020
David S. Berry / Chair

The CCSDS Fall 2020 Navigation Working Group Meetings were conducted "virtually" via audio/videoconferencing during the period of 26-Oct-2020 through 10-Nov-2020, with a MOIMS Closing Plenary on 11-Nov-2020. Nominally CNES hosted the meetings, which were to have been held at Toulouse, France, but the responsibilities of "hosting" were more or less undefined in the virtual meeting situation. This is a summary of the activities of the Navigation Working Group (WG) during the Meetings. The Navigation WG is an element of the Mission Operations and Information Management Services (MOIMS) Area in the CCSDS organization.

ON-SITE PARTICIPANTS

Not applicable.

TELECON PARTICIPANTS

Brigitte Behal (CNES), David Berry (NASA/JPL), Julien Bernard (Viagenie/SANA), Guillaume Blanchet (Viagenie/SANA), Marc Blanchet (Viagenie/SANA), Vitali Braun (ESA/ESOC), Frank Dreger (ESA/ESOC), Cheryl Gramling (NASA/GSFC), Julie Halverson (NASA/GSFC), Hideaki Hinagawa (JAXA), Ralph Kahle (DLR/GSOC), Alain Lamy (CNES), Jose Miguel Lozano(GMV/ESA/ESOC), Mario Merri (ESA/ESOC), Dan Oltrogge (NASA (AGI, SDC, ISO TC20/SC14)), Vincent Schaeffer (CNES), Brian Swinburne (Airbus/UKSA), Elena Vellutini (ASI), Patrick Zimmerman (NASA/JSC).

AGENDA

The final agenda for the WG meetings is available on the Navigation WG CWE at: https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/navwg-agenda-fall-202010.pdf . In the meeting proceedings below, the detailed agenda for each meeting day (as realized) is included in the minutes to provide context.

CURRENT ACTION ITEMS

The following action items were produced during the meetings, or carried forward from previous meetings if they had not yet been completed. They are also available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/navwg-action-items-202010.pdf . The action items and due dates below reflect the status as of the end of the meetings; the list on the CWE will be updated periodically between the end of this meeting series and the beginning of the next meeting series. The list on the CWE will thus reflect relative completion progress and any new action items added after the virtual meetings. NOTE: Several action items have "TBD" dates that we will attempt to resolve at the first telecon.

New Action/Outstanding Action Items

If "Status" = "Open", then "Date" = "Target Date"
If "Status" = "Complete", then "Date" = "Completion Date"
If "Status" = "Cancelled", then "Date" = "Cancellation Date"
Sort by "Status" (Descending), "Date" (Ascending)

##	Action Item	Actionee	Status	Due Date (Original)	Date
59	Produce ODM V3 Test Plan/Report Draft	Dan	Open	15-Mar-2019	TBD
64	Produce CDM P1.0.1	Brian / Dan	Open	30-Sep-2019	TBD
73	Produce ADM P1.11	Alain / Julie	Open	TBD	TBD
83	Distribute ODM V.3 Test Plan draft	Dan	Open	TBD	TBD
84	PRM Corrigendum Special Telecon	David	Open	TBD	TBD
98	Produce Navigation Events Message initial draft	Alain	Open	31-Jan-2018	TBD
67	Review ODM P2.40	All, as assigned	Open	19-Oct-2020	20-Nov-2020
87	Prepare NDM/XML combined instantiation with OPM, OMM, OEM, OCM in same message	David	Open	23-Nov-2020	23-Nov-2020
27	Prepare PRM Corrigendum	Jose Miguel / Frank	Open	20-Nov-2019	09-Dec-2020
29	Request addition of "GMST", "MET", "MRT" to Time Systems Registry	David	Open	03-Nov-2019	09-Dec-2020
33	Request OID move to separate column in "CCSDS Navigation Normative Annexes" registry	David	Open	20-Nov-2019	09-Dec-2020
39	Inquire regarding implementing a way to print a SANA registry out to PDF.	David	Open	20-Nov-2019	09-Dec-2020
40	Inquire regarding restricting the usage of some registry entries in certain standards (e.g., restricting CDM users to choosing ITRF, EME2000, or GCRF for the reference frame).	David	Open	20-Nov-2019	09-Dec-2020
42	Inquire of SANA regarding provision of some kind of "What's New?" indication for users.	David	Open	20-Nov-2019	09-Dec-2020
48	Prepare CDM Corrigendum regarding RESIDUALS_ACCEPTED	David	Open	30-Nov-2019	09-Dec-2020
53	Determine organization for Italian RDM Provider role	Elena	Open	26-Feb-2020	09-Dec-2020
75	Prepare analysis of annex order	David	Open	09-Dec-2020	09-Dec-2020
79	Re-write floating point number rules	Dan	Open	09-Dec-2020	09-Dec-2020
82	Resolve question: should ADM B4, B6 be moved to SANA Registries	TBD	Open	09-Dec-2020	09-Dec-2020
17	Update Navigation Terms in CCSDS Glossary (original + RDM terms)	Secretariat	Open	31-Aug-2019	13-Jan-2021
86	Add the PRM, NDM/XML, and CDM COLLISION_PROBABILITY_METHOD registries under the "CCSDS Navigation Standards Normative	David	Open	13-Jan-2021	13-Jan-2021

##	Action Item	Actionee	Status	Due Date (Original)	Date
	Annexes" registry upper-level hierarchy				
92	Submit Revised Orbit Centers Registry data for SANA Registry	David	Open	17-Dec-2018	13-Jan-2021
93	Submit Corrigenda to SANA Registry Data	David	Open	07-Jan-2019	13-Jan-2021
88	Add vector data type to Section 7 ODM	Dan	Open	31-Jan-2021	31-Jan-2021
89	Add data type to Section 7 ODM & ADM	Alain	Open	31-Jan-2021	31-Jan-2021
90	Change entry "EIGVAL3EIGVEC3" to "SIGVAL3EIGVEC3" in SANA Registry	David	Open	31-Jan-2021	31-Jan-2021
91	Change entry "TEIGVAL3EIGVEC3" to "TSIGVAL3EIGVEC3" in SANA Registry	David	Open	31-Jan-2021	31-Jan-2021
74	Prepare Navigation references for SANA Registry	David	Open	31-Oct-2018	10-Feb-2021
76	Prepare WG document in CWE with "typical sentences" (e.g., "agreed mutually between exchange partners", links to SANA, etc.)	David	Open	10-Feb-2021	10-Feb-2021
77	Add guideline regarding acronyms (i.e., in annex if appearing in text, but not examples)	David	Open	10-Feb-2021	10-Feb-2021
81	Add guideline related to normative language ("must", "shall", "should", "may") and substitutes for use in non-normative sections ("it is required that", "it is recommended that", "can").	David	Open	10-Feb-2021	10-Feb-2021
85	Resolve inconsistencies in keywords used to identify a space object (OCM, ACM, and CDM).	Brian, Dan, Alain, Julie	Open	10-Feb-2021	10-Feb-2021
96	SANA implementation of Nav References	SANA	Open	31-Jan-2019	31-Mar-2021
94	Library of referenced papers on CWE	David	Open	10-May-2021	10-May-2021
80	Create structural diagram of ACM similar to that of the OCM	Dan	Complete	N/A	26-Oct-2020
78	Combine events lists and distribute to WG	Alain	Cancelled	15-Dec-2018	16-Nov-2020

WORKSHOP PROCEEDINGS

CCSDS Opening Plenary / Schedule Details

Given the virtual meeting environment necessitated by COVID19, there was no CCSDS-wide Opening Plenary (though the Secretariat did distribute an informational presentation via email, available at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/CESG%20Fall%202020%20CCSDS%20Plenary%20Presentation.pdf). All CCSDS Areas and Working Groups were empowered to set their own meeting schedules subject to a CESG ending deadline. Reports to the Secretariat were due no later than 13-Nov-2020 in order to support the CESG Meeting. The CCSDS Navigation WG elected to meet on five dates between 26-Oct-2020 and 10-Nov-2020. The MOIMS Closing Plenary was conducted 11-Nov-2020.

Future Meetings (as Reported in the Fall 2020 Meetings CCSDS Opening Plenary Presentation)

The CCSDS is planning the following upcoming meetings:

a) Spring 2021 hosted by NASA at Huntsville, Alabama, USA, 10-14 May 2021
b) Fall 2021 hosted by CNES at Toulouse, dates TBD
c) Spring 2022 hosted by NASA at TBD, dates TBD
d) Fall 2022 hosted by ESA at ESTEC, dates TBD
e) Spring 2023 hosted by NASA at TBD, dates TBD
f) Fall 2023 hosted by UKSA at TBD, dates TBD
g) Spring 2024 hosted by NASA at TBD, dates TBD

MOIMS Opening Plenary

Given the virtual meeting environment necessitated by COVID19, there was no MOIMS Opening Plenary.

DAY 1, MONDAY 26-Oct-2020 (All Times UTC)

1400   1415   Introduction
1415   1600   Attitude Data Messages V.2

Attendance this day included: David Berry, Vitali Braun, Frank Dreger, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Ralph Kahle, Alain Lamy, Jose Miguel Lozano, Dan Oltrogge, Vincent Schaeffer, Brian Swinburne, Elena Vellutini, Patrick Zimmerman.

1400   1415   Introduction

David welcomed the group and presented an abbreviated version of the "Introduction to Navigation WG" material focusing on progress since Spring 2020 and goals for the Fall 2020 Meetings.

1415   1600   Attitude Data Messages V.2

The Attitude Data Messages (ADM) document was the topic of the day. Alain indicated that the review of ADM P1.10 yielded 188 comments. The discussion of observations, questions, open items, etc. from the ADM Comment Resolution Matrix (CRM) constituted the bulk of the meeting.

During the discussion of the CRM resolutions, there were a number of "harmonization" Action Items suggested: create a group document in the CWE that contains "typical sentences" to which the group has agreed (e.g., "agreed mutually between exchange partners", conventions for links to SANA, etc.), add a guideline regarding conventions for the acronyms annex (e.g., if acronyms appear in the text, list in the annex; if they appear only in example messages, do not list in annex), modify/clarify a potential ambiguity in the description of floating point number representation rules. David took action items to update or create the suggested guidelines documents.

Dan suggested addition of annex material on attitude interpolation; Julie felt there was no requirement for this in the ADM. There was also a suggestion regarding addition of a Perturbations section in the ACM, analogous to the same section in the OCM. The need for this was seen as unclear; options discussed included not adding such a section at all, or deferring until a future release of the ADM/ACM. Alain suggested deferring to the future in order to not further delay production of the ADM; Julie and Dan were both OK with this as a plan.

There was a discussion of the ACM structural diagram that appears at the beginning of Section 5 of the ADM. Dan suggested that the existing structure be modified to have the same style as that of the OCM at the beginning of Section 6 of the ODM. Julie had some questions about this; after some discussion regarding the terms "segment" and "metadata", and why they exist in these standards, there was agreement to consider the proposal. Dan took an action item to create the diagram he envisions.

We did not quite finish with the ADM material in this first session, so there was no time to discuss the plans for the ADM schedule. With Dan Oltrogge's agreement, the agenda for Meeting #2 was modified to start with completing the ADM discussion, and then changing to the ODM discussion. David indicated that he would follow up with Alain and Julie regarding the ADM schedule and potential changes thereto.

DAY 2, WEDNESDAY 28-Oct-2020 (All Times UTC)

| 1400 | 1445 | Attitude Data Messages V.2 |
| 1445 | 1600 | Orbit Data Messages V.3 (P2.40 draft, Prototyping Plan) |

Attendance this day included: Brigitte Behal, David Berry, Vitali Braun, Frank Dreger, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Ralph Kahle, Alain Lamy, Jose Miguel Lozano, Dan Oltrogge, Vincent Schaeffer, Brian Swinburne, Elena Vellutini, Patrick Zimmerman.

1400   1445   Attitude Data Messages V.2

Alain led the continued discussion of the Attitude Data Messages (ADM) updates.

Due to the ACM using the OCM as a principal "template", there were a number of ACM/OCM topics in this discussion. Sometimes these topics resulted in changes back into the OCM also.

There was discussion as to whether the keyword ordering in the ACM and OCM should be harmonized. There is no hard and fast rule on this, but in general there is customarily an attempt to keep related

keywords in a logical cluster of keywords (as opposed to alphabetizing, for example, which would reflect no technical relationships between the keywords).

We discussed the "FUEL_MASS" keyword in the ADM, and harmonization between the messages. The RDM has WET_MASS and DRY_MASS. The OCM has INITIAL_MASS, MASS (wet mass), and DRY_MASS keywords. It was agreed that the OCM and ACM would be modified to match the convention used in the RDM (though "INITIAL_MASS" will be preserved in the OCM). Note that the OPM and OMM only have the keyword "MASS". There was discussion of changing them as well, but it was ultimately agreed that we did not plan to modify these older messages given that changes to them would complicate the prototype testing phase and break backwards compatibility.

There was discussion of the need for ATT_UNITS and COV_UNITS in the ACM, analogous to the OCM. Persuasive arguments were made that these were not necessary. David had suggested that such "units lines" be mandatory in the OCM, and Dan obliged; these units lines would free the implementer from having to code all the options shown in the SANA registry. However, on further discussion, ultimately David agreed that these "units lines" (including the MAN_UNITS in the OCM) were not strictly necessary. Accordingly, ATT_UNITS and COV_UNITS will not be added to the ACM, and the various *_UNITS will be removed from the OCM as well. This increases the burden on programmers of the messages, but the solution is relatively straightforward by using look-up tables.

There was discussion as to whether material in ADM annexes B4 and B6 should be converted to SANA Registries; after some discussion, David suggested an Action Item to resolve the matter as we needed to turn attention to the ODM topic.

Another guideline was suggested in the ADM material related to normative language ("must", "shall", "should", "may") and substitutes for use in non-normative sections of the documents (e.g., "it is required that", "it is recommended that", "can"). David took an action item add these to the WG guidelines.

Alain and Julie's presentation is available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/presentation-ADM-2020-10-26.pdf .

1445   1600   Orbit Data Messages V.3

The primary topic for the ODM was the initiation of a prototyping test plan for the ODM. Dan indicated that there had been a kickoff meeting with COMSPOC and Orekit regarding this plan. Note that since the OPM, OMM, and OEM are minimally changed compared to ODM V.2, the test plan focuses entirely, and appropriately, on the OCM. The only substantive changes to the OPM, OMM, and OEM have been the addition of the optional "MESSAGE_ID" keyword, which in an astrodynamics sense is functionally equivalent to a comment; and the use of SANA registries for certain values, which will be fully exercised in OCM testing). Dan walked us through an initial draft of the test plan, which contains a very compact but informative representation of the overall test plan structure. Dan will provide the draft to the WG.

Dan introduced a couple of other topics as well, e.g., use of regular expressions that could be included to guide programmers and also check the syntax of KVN messages in a manner similar to that provided by an XML schema. Furthermore, Dan pointed out that there is support for regular expression validation in many languages, which could assist exchange partners in coding their message processors. David suggested that these regular expressions could be suited for being placed in a SANA registry, but would not be very useable if included in a standard PDF due to issues with copying from PDFs and pasting into other file types (especially if the PDF has been scanned). One potential objection is the amount of time it

takes to code them. Dan stated he was not advocating that the entire document be coded as regular expressions. Also, there are a few regular expressions that model a large number of KVN statements.

We did not quite finish with the ODM material, so there was no time to discuss the plans for the ODM schedule. We decided to start the next meeting by completing the ODM discussion before moving to the CDM.

DAY 3, MONDAY 02-Nov-2020 (All Times UTC)

1400   1445   Orbit Data Messages V.3
1445   1600   Conjunction Data Message V.2

Attendance this day included: David Berry, Vitali Braun, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Ralph Kahle, Alain Lamy, Jose Miguel Lozano, Mario Merri, Dan Oltrogge, Vincent Schaeffer, Brian Swinburne, Elena Vellutini, Patrick Zimmerman.

1400   1445   Orbit Data Messages V.3

Dan completed close out of ODM CRM topics. There were discussions on several different detailed topics that led to the addition of action items.

There was a suggestion that the ODM have an XML combined instantiation composed of an OPM, OMM, OEM, and OCM; this was suggested because the current example consists of only OMMs. David took and action item to provide such a sample and send it to Dan.

There was a discussion of the use of brackets on vector quantities (e.g., "[x, y, z]"). In some cases they have been used, and in others not. David noted that this was a possible oversight in the "Values" section of Section 7 in the ADM and ODM. This is a discussion item for a future meeting. Action items for Dan and Alain were opened to add this data type to Section 7 in the ODM and ADM if the results of the WG discussion indicate it is a worthwhile addition.

Finally, Dan reported some necessary changes in a couple of the SANA Registry entries, specifically, the current EIGVAL3EIGVEC3 and TEIGVAL3EIGVEC3 entries (orbital elements and covariance matrix registries, respectively). The new entries will be called SIGVAL3EIGVEC3 and TSIGVAL3EIGVEC3. In these new entries, the eigenvalues are replaced by 1 sigma position dispersions. David has the action item to address these changes to the SANA Team.

Dan's presentation is available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/presentation-ODM-2020-10-28.pdf .

1445   1600   Conjunction Data Message V.2

Brian stated that the first Pink Book would be going out soon. We didn't review the Pink Book itself in this meeting; Brian presented a Powerpoint that explained the features would be in the Pink Book revision.

The new material in the CDM re-creates a fair amount of material that is in the OCM (keywords, data

structures, etc.). David expressed a preference to not re-create the OCM in the CDM because of the (often realized) potential for inconsistencies between the documents; he did not recall that the presentation from Fall 2019 clearly indicated inclusion of OCM content in the CDM. After some discussion during the meeting, and several post-meeting email discussions, this matter was resolved when Brian proposed parking the OCM content discussion temporarily in order that the initial Pink Book draft can be completed with the modifications agreed at the Fall 2019 meetings in Darmstadt. This will allow Brian and Dan to reach a milestone of having a first draft document and be able to close out the current CRM document that was used to collect new requirements. Brian stated that the pink book is pretty much complete with the current proposals so could be distributed to the working group very soon for review.

We discussed the MS Word *.doc vs. *.docx issue again, and the issue with mangled equations. Mario Merri, MOIMS Area Director, happened to be present. David took an action item to send a description of the problem to Mario, and to add the issue to the Navigation WG report.

In the course of the CDM discussion, Dan suggested that the group have a SANA Library of referenced papers. David explained why this cannot be on SANA, but we can host papers on CWE with pointer in SANA.

As it happened, the time allocated to the CDM discussion was insufficient to discuss all the material. The group decided to continue the CDM discussion in the next meeting session, and to revise the remaining items on the agenda for the Meetings in order to complete the review of new CDM material.

Brian's presentation is available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/presentation-CDM-20201102.pdf .

DAY 4, MONDAY 09-Nov-2020 (All Times UTC)

1400   1500   Conjunction Data Message V2 + project schedule
1500   1600   Annex Migration=>SANA Status (with SANA Operator)

Attendance this day included: Brigitte Behal, Julien Bernard, David Berry, Marc Blanchet, Guillaume Blanchet, Vitali Braun, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Ralph Kahle, Alain Lamy, Jose Miguel Lozano, Dan Oltrogge, Vincent Schaeffer, Brian Swinburne.

1400   1500   Conjunction Data Message V.2

Brian continued previewing the changes that will appear in the first CDM Pink Book 1.0.1. Some of these changes include:
- A wider variety of reference frames
- A number of keywords to address realism of covariance and covariance confidence (scale factors, covariance confidence, etc.)
- Percentile breakdown of collision probability instead of a single Pc value, to provide a feel for the variability in collision probability.
- User defined keywords (which appear in several other Navigation WG messages).

One action item arose from the CDM discussion related to the many keywords associated with identifying a space object. Brian suggested that he, Dan, Alain, and Julie try to resolve this. Brian cited a fair amount of inconsistency in this area of the ODM, ADM, and CDM (also the RDM).

At the top of the hour we were joined by the SANA Team (Marc Blanchet, Julien Bernard, Guillaume Blanchet). Brian had a few slides remaining in his presentation that were presented at the conclusion of the SANA discussion.

1500 1600 Annex Migration=>SANA Status (with SANA Operator)

We were joined by Marc Blanchet, Julien Bernard, and Guillaume Blanchet of the SANA Team to continue discussion of SANA related topics of importance or relevance to the Navigation WG.

Marc led the SANA presentation. He indicated that the SANA Team was making numerous changes, but moving slowly so as to ensure a quality implementation. They are working on the beta registry, which reflects the changes. They have introduced a hierarchical relationship in the registries, so related registries are now grouped together. This a very welcome change (note that the attendees of the SANA Steering Group Meeting later in the week also greatly liked this feature). Dan suggested adding the PRM, NDM/XML, and CDM COLLISION_PROBABILITY_METHOD registries under the "CCSDS Navigation Standards Normative Annexes" registry upper level hierarchy; David took an action item to request this of the SANA Team. There is also a new way to import csv files as registries (Nav WG may want to find out about that feature).

Another big change is the addition of an "authorization framework" that will allow selected personnel (most likely CESG Members and WG Chairs) to log in to the SANA and modify the contents of registries for which their group has expert background. Testing of this feature is scheduled to begin in the near future; the SANA Team will be approaching Peter Shames to recruit some beta testers.

When there was some slow response time at one point during the demonstration, it was stated that the SANA Team has started moving registries to a Google Cloud implementation, and some of the databases need to be indexed properly to improve performance; ultimately they expect that the cloud implementation won't negatively impact performance. The team is also working on a "continuous integration/continuous deployment" paradigm, and streamlining some things to help with scaling, of which the cloud implementation is a part.

A specific date for when the changes in the beta registries would be moved into the Production instance is not yet announced.

DAY 5, TUESDAY 10-Nov-2020 (All Times UTC)

1400   1430   Future: Fragmentation Data Message
1430   1500   Future: "Modular/Super/Frankenstein Msg". Why Are We Not Discussing It?
1500   1600   Final report prep, Action Items, Telecon schedule

Attendance this day included: David Berry, Vitali Braun, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Alain Lamy, Jose Miguel Lozano, Vincent Schaeffer, Brian Swinburne, Elena Vellutini, Patrick Zimmerman.

1400   1430   Future: Fragmentation Data Message

After providing a brief introduction of himself to the WG, Vitali Braun led off with a presentation on the current state of the Fragmentation Data Message (FDM) proposal first introduced by Alexandru Mancas. A lot of work and thought has gone into this proposal. The material provided a brief history of the FDM concept (first proposed at Darmstadt in 2015), provided the technical motivation for the message, and discussed how it could be implemented as either a standalone message (similar to the CDM and RDM) or as part of a hybrid message that the WG has been considering for a few years now (see next topic). One of the key factors in getting a new project approved is having agencies willing to provide prototyping support, which Vitali addressed in the presentation; in this case, CCSDS member agencies ESA, DLR, and ASI have expressed interest in prototyping, as has AGI (commercial). At the conclusion of the presentation, there was discussion as to whether or not the group would be willing to take on the project at this time. Although no firm opposition was stated, there was some reservation expressed about taking on a new project when there are still so many unfinished works in the Navigation WG queue (see next topic for related discussion).

Vitali's presentation is available on the Nav WG CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/presentation-FDM-2020-11-10.pdf (it's big, so takes a while to load... be patient!).

1430   1500   Future: "Modular/Super/Frankenstein Msg". Why Are We Not Discussing It?

Based on periodic questions from some members of the WG, David made a brief presentation on the topic of why we have not been discussing the message we have been planning at high level for several years now, the message with many names. Dan has lately been calling it the "Super Message". The presentation discussed four interrelated reasons why we have not been allocating meeting time to this topic for a while: Time Constraints, Workload (Things to Finish), CCSDS Management Oversight, and Delayed Work Projects. The essential conclusion of this presentation was that the sooner we can finish the ODM and ADM, the sooner we can credibly embark upon proposing the "Super Message". Simply put, some of the documents-in-progress need to be somewhat closer to completion before we can make a credible case for starting a major new project and get it approved. Alain commented that the Super Message might be super difficult, but would also be super useful. The presentation is available on the Nav WG CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/presentation-super-message-2020-11-10.pdf .

1500   1600   Final Report Prep, Action Items, Telecon Schedule

David reviewed the draft Final Report with the WG members. We worked through the draft Final Report, making modifications as applicable. Alain reminded David that Mario had requested that the issue with the mangled equations be added to the report; it was added. On the following day, the report was presented at the MOIMS Final Plenary Meeting (see below).

Dates for telecons were announced during the meeting and are listed at the end of this report. Meeting announcements will be sent in advance of each meeting. David proposed continuation of the meeting approach we have used since we have been conducting virtual Spring/Fall Meetings, i.e., one 2-hour meeting per month, focused on one primary topic with administrative material kept to a minimum. There were no objections. (Note that the first telecon will address several miscellaneous topics that were not completed during these meetings.)

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

https://cwe.ccsds.org/moims/docs/Forms/AllItems.aspx?RootFolder=%2Fmoims%2Fdocs%2FMOIMS-NAV%2FMeeting%20Materials%2F2020%2FFall&FolderCTID=0x012000C8EEDFBFAD59894AB84FF1AF9485D0AB&View={72CC1C3E-EFA9-498B-BEA5-C88E7DEE0C54}

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

https://cwe.ccsds.org/MOIMS/DOCS/FORMS/ALLITEMS.ASPX?RootFolder=%2Fmoims%2Fdocs%2FMOIMS%2DNAV%2FDraft%20Documents&FolderCTID=0x012000C8EEDFBFAD59894AB84FF1AF9485D0AB&View=%7B72CC1C3E%2DEFA9%2D498B%2DBEA5%2DC88E7DEE0C54%7D#Inplviewhash72cc1c3e-efa9-498b-bea5-c88e7dee0c54=FolderCTID%3D0x012000C8EEDFBFAD59894AB84FF1AF9485D0AB-RootFolder%3D%252Fmoims%252Fdocs%252FMOIMS%252DNAV%252FDraft%2520Documents-SortField%3DLinkFilename-SortDir%3DAsc

DAY 6, WEDNESDAY 11-Nov-2020 (All Times UTC)

1530   1700   MOIMS Closing Plenary

Attendance this day included: Mario Merri (Area Director), Brigitte Behal (Deputy Area Director), David Berry (Nav Chair), Vitali Braun (Nav), Guillermo Buenadicha (MP&S), Marc Duhaze (MP&S), John Garrett (DAI), David Giaretta (DAI Chair), Jose Miguel Lozano (Nav), Mehran Sarkarati (MP&S Chair), Dan Smith (SM&C Chair), Roberta Svanetti (DAI), Brian Swinburne (Nav), Roger Thompson (MP&S, SM&C).

The Plenary commenced with tributes for the Deputy Area Director Brigitte Behal, who is retiring soon; this was to be her final meeting with the CCSDS. Mario and each of the WG Chairs offered thanks for Brigitte's work over the years, personal comments, and thoughts/well-wishes for her retirement. After the tribute to Brigitte, Mario offered a tribute to Dan Smith, chair of the SM&C WG, who is also retiring soon. These introductory activities were followed by delivery of the Working Group reports: Mehran Sarkarati for Mission Planning and Scheduling (MP&S), David Giaretta for Digital Archive Ingest (DAI), Dan Smith for Spacecraft Monitor & Control (SM&C), and David Berry for Navigation (Nav). The Navigation report immediately below was presented during the Plenary.

NAVIGATION WORKING GROUP CLOSING REPORT

Available at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2020/Fall/navwg-report-202010.pdf .

Achievements for this Meeting Cycle
• Continued discussion of Orbit Data Messages, Attitude Data Messages Pink Books
• Continued discussion of Prototyping Plans for the Orbit Data Messages V.3
• Continued Conjunction Data Message V.2 status update... first draft soon
• Continued discussion of structure/content of Navigation data on SANA Registry

Documents Not Discussed in this Meeting Cycle

- Navigation Events Message: first draft not ready (same Lead Editor as ADM)
- Tracking Data Message V.3: still in early stages of formulation
- Navigation Data Messages XML Specification: about to enter Agency Review

Working Group Status
- Active, "High Momentum" (some momentum loss with virtual format)

Interaction with Other WGs
- Completed joint meeting w/SANA Operator regarding continued migration of material from Nav WG document annexes to SANA. Discussed registry hierarchy, authorization framework, recent user interface improvements, etc.

Environmental Report
- Plus: Virtual meeting format worked OK, some progress on WG projects
- Minus: Often had to cut off discussion due to time constraints
- Minus: Loss of sense of WG camaraderie, difficult to get to know new members

Resolutions

- Resolutions Agreed Upon this Meeting:
  - None

- Further Resolutions Anticipated in the Next 6 Months:
  - NAV-1: Request to perform CESG Poll and CMC Poll to approve publication of the Navigation Data Messages XML Specification Version 2
  - NAV-2: Request to perform CESG Poll and CMC Poll to approve Agency Review of the Orbit Data Messages Version 3

Completed Projects Since Spring 2020:

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
MOIMS NAV	500.2	Navigation Data Message Overview (Update) V.2	Completed and published 12-May-2020	Start date 25-Apr-2018 End date 12-May-2020
MOIMS NAV	503.0	Tracking Data Message (TDM) Version 2	Completed and published Jun-2020	Start date 09-Oct-2013 End date 30-Jun-2020

Planning (Only Approved Projects):

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
MOIMS NAV	505.0	Navigation Data Messages XML Specification 5 Year Review Revision	Not discussed in these virtual meetings due to its being about to enter Agency Review (no WG action necessary at this time).	Start date 13-Jul-2016 End date 31-May-2021
MOIMS NAV	502.0	Orbit Data Message (ODM) 5 Year Review Revision	Good progress. Document stabilizing. Serious discussion of ODM testing has commenced.	Start date 16-Apr-2015 End date 31-Jan-2022
MOIMS NAV	504.0	Attitude Data Message (ADM) 5 Year Review	Good progress. Completed discussion of comments received during Pink Book P1.10	Start date 16-Apr-2015 End date 31-Mar-2022

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
		Revision	internal draft review.	
MOIMS NAV	TBD	Navigation Events Message	Not discussed in these virtual meetings due to reduced meeting time. Document has lower priority than another document with same Lead Editor.	Start date 07-Nov-2017 End date 30-Nov-2022
MOIMS NAV	508.0	Conjunction Data Message 5 Year Revision	Good progress. Completed overview discussion of plans for forthcoming Pink Book P1.0.1 internal draft.	Start date 14-Jan-2019 End date 31-Dec-2022
MOIMS NAV	503.0	Tracking Data Message (TDM) Version 3 Revision	Not discussed in these virtual meetings due to reduced meeting time. Still in early stages of development, lower priority.	Start date 07-Jan-2019 End date 30-Nov-2024

NAV WG Upcoming New Work Items

None at this time...

... but we may have a new work item proposal between now and Spring 2021; we need to do the required work force planning.

NAV WG Issues for CESG / CMC

- **Issue #1**
  - In June 2020, Working Group Chairs received a message from the Secretariat that was said to be "treated as urgent"
    - Specifically, proposed Working Group Charter changes were to be submitted to the CMC
  - In response, changes to the Navigation WG Charter were submitted to the Area Director who forwarded them to the Secretariat
  - Since June 2020, only 2 CMC Polls regarding charter modifications have been conducted:
    - Multispectral Hyperspectral Data Compression WG
    - Cross Support Services WG
  - Is there any status on the Navigation WG charter changes?
- **Issue #2**
  - Navigation WG editors have reported several issues with Draft documents containing equations that are inconsistently mangled due to issues with the equation editor (*.doc format as opposed to *.docx). This is a continuing issue.

NEXT TELECONS:

We will continue the previously set schedule inter-meeting telecons, a 2-hour telecon monthly (approximately 2 hours/month).

- 09-Dec-2020 14:00-16:00 UTC
- 13-Jan-2021 14:00-16:00 UTC
- 10-Feb-2021 14:00-16:00 UTC
- 10-Mar-2021 14:00-16:00 UTC

- 14-Apr-2021 13:00-15:00 UTC (local times remain same, except Tokyo)
- Spring 2021 Meetings 10-May-2021 to 14-May-2021 (nominal dates)

GROUP PHOTOGRAPHS:

At the end of two of the meetings, attendees were asked to turn on their cameras for a photo. Results are uneven (e.g., lighting, some couldn't get their camera to work, some had already left the meeting since it was effectively over, several members are in both photos, etc.), but here you go... Not pictured are David Berry, Cheryl Gramling, Hideaki Hinagawa, Elena Vellutini.