MINUTES OF NAVIGATION WORKING GROUP SPRING 2023 WORKSHOP 20-Jun-2023
David S. Berry / Chair

The CCSDS Spring 2023 Navigation Working Group Meetings were conducted in person in Huntsville, Alabama, USA, from 08-May-2023 through 12-May-2023. Although the meetings were held in person, the ability to attend virtually was also offered to those who could not travel. NASA hosted the meetings. 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

David Berry (NASA/JPL), Julien Bernard (SANA), Juan Crenshaw (NASA/GSFC), Madison Extine (NASA/MSFC), Jean Gilbert (SANA), Cheryl Gramling (NASA/GSFC), Alain Lamy (CNES), Jose Miguel Lozano (GMV/ESA/ESOC), Daniel Fischer (ESA, MOIMS Area Director), Dan Oltrogge (NASA (COMSPOC, ISO TC20/SC14)), Patrick Zimmerman (NASA/JSC).

TELECON PARTICIPANTS

Vitali Braun (ESA/ESOC), Frank Dreger (ESA/ESOC), Julie Halverson (NASA/GSFC), Hideaki Hinagawa (JAXA), Brian Swinburne (Airbus/UKSA).

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/2023/Spring/navwg-agenda-spring-202305-final.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 either 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/2023/Spring/navwg-action-items-202305.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 meeting series.

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), "##"
Highlighted = In Progress, Completed, or Cancelled since last telecon

##	Action Item	Category	Actionee	Status	Due Date (Original)	Date
29	Produce NDM/XML 3.0.1 Pink Book	NDM/XML	David	Open	09-Apr-2023	14-May-2023
30	Submit NDM/XML 3.0.1 Pink Book to MOIMS Area Director and Request Resolution for Agency Review	NDM/XML	David	Open	01-May-2023	14-May-2023
31	Complete NDM/XML 4.0 schema updates for ADM 2.0	NDM/XML	David	Open	30-Apr-2023	14-May-2023
32	Submit NDM/XML 4.0 schema updates for ADM 2.0 to SANA Registry	NDM/XML	David	Open	30-Apr-2023	14-May-2023
43	Perform ADM V.2 XML tests and report to Alain/Julie	ADM	David	Open	14-May-2023	14-May-2023
50	Create XML 4.0 Test Set	ADM	David	Open	14-May-2023	14-May-2023
49	Inquire of Luc if he can perform ADM/XML tests.	ADM	David	Open	15-May-2023	15-May-2023
42	Schedule meeting with CSS to discuss real time tracking data	TDM	David	Open	19-May-2023	19-May-2023
48	Send Frank Budnik document on carrier phase data to Juan	TDM	David	Open	19-May-2023	19-May-2023
11	Update CDM schemas for CDM 2.0 (P-1.0.4)	CDM	David	Open	20-Nov-2022	21-May-2023
26	Review CDM P-1.0.4 (final technical + proofreading)	CDM	All as assigned	Open	22-Mar-2023	21-May-2023
27	Finalize ADM prototypes, complete testing	ADM	Alain/Julie	Open	01-May-2023	26-May-2023
28	Finalize ADM Test Plan/Report	ADM	Alain/Julie	Open	31-May-2023	26-May-2023
17	Update Navigation Terms in CCSDS Glossary (original + RDM terms)	Glossary	Secretariat	Open	31-Aug-2019	31-May-2023
35	ODM Corrigendum (OEM Covariance) issue	ODM	Dan	Open	31-May-2023	31-May-2023
41	Review addition of new collision probability method to SANA	SANA	Dan	Open	31-May-2023	31-May-2023
47	Check with ESA Team regarding potential removal of PRM Annex B.	PRM	Jose Miguel	Open	31-May-2023	31-May-2023
12	Update CDM style sheet for CDM 2.0	CDM	David	Open	04-Dec-2022	04-Jun-2023
44	Finalize PRM Corrigendum/Pink Sheets	PRM	Jose Miguel	Open	07-Jun-2023	07-Jun-2023
53	Determine organization for Italian RDM Provider role	RDM	Elena	Open	26-Feb-2020	07-Jun-2023
36	Check all SANA Links to References	SANA	David	Open	15-Jun-2023	15-Jun-2023
37	Confirm ODM editorial changes made	ODM	Dan	Open	15-Jun-2023	15-Jun-2023
39	Propose release of ADM V.2 schemas with document publication	NDM/XML	David	Open	15-Jun-2023	15-Jun-2023
10	Create Nav WG standard Blue Book template with Nav WG approved Annex ordering	Template	David	Open	28-Jul-2021	30-Jun-2023
38	Remove NHM from Draft Projects	IOAG	David	Open	30-Jun-2023	30-Jun-2023
45	Develop Navigation Functional Message Concept Paper	NFM	David	Open	30-Jun-2023	30-Jun-2023
61	Produce TDM P-2.0.2 update	TDM	Juan / Cheryl	Open	18-Nov-2022	30-Jun-2023
74	Prepare Navigation references for	SANA	David	Open	31-Oct-2018	30-Jun-2023

##	Action Item	Category	Actionee	Status	Due Date (Original)	Date
	SANA Registry					
94	Library of referenced papers on CWE	CWE	David	Open	10-May-2021	30-Jun-2023
96	SANA implementation of Nav References	SANA	SANA	Open	31-Jan-2019	30-Jun-2023
98	Produce Navigation Events Message initial draft	NEM	Alain	Open	31-Jan-2018	30-Jun-2023
08	Distribute "Divide & Conquer" review assignments for TDM P-2.0.2 draft	TDM	David	Open	17-Aug-2022	03-Jul-2023
71	Review TDM P-2.0.2 draft	TDM	All, as assigned	Open	20-Dec-2022	31-Jul-2023
88	Refresh FDM Concept Paper	FDM	Vitali	Open	14-Dec-2022	15-Oct-2023
34	Commercial, Military(?) survey for TDM interest	TDM	Dan / Jose Miguel	Open	31-Oct-2023	31-Oct-2023
91	Prepare new project for Fragmentation Data Message	FDM	David	Open	31-Dec-2022	15-Nov-2023
16	Request deletion of "Conjunction Data Message Catalog Name" registry (post-CDM 2.0 publication)	SANA	David	Open	18-Jan-2023	31-Dec-2023
51	Arrange for floating point number and other data type changes in other documents after CDM V.2 is Blue.	"All"	David	Open	31-Jan-2024	31-Jan-2024
92	Submit Revised Orbit Centers Registry data for SANA Registry	SANA	David	In Progress	17-Dec-2018	30-Nov-2022
93	Prepare new project for Launch Data Message	LDM	David	Complete	31-Dec-2022	10-May-2023
40	Confirm SANA Registry migration plan	SANA	David	Complete	14-May-2023	14-May-2023
46	Determine whether Corrigenda or Pink Sheets is the appropriate course of action for the PRM	PRM	David	Complete	19-May-2023	14-May-2023

WORKSHOP PROCEEDINGS

MONDAY 08-May-2023

0845-1000: CCSDS Opening Plenary / Schedule Details

Vinny Ristovski, the NASA/Marshall Space Flight Center representative for the Spring Meetings, opened the meetings with a few remarks. He expressed appreciation that the attendees had visited Huntsville for these meetings (due to the recent pandemic, MSFC had been the planned sponsor for the past 3 years!). After a few brief remarks he introduced Klaus-Jürgen Schulz, the Chair of the CESG (Sami Asmar, Chair of CMC, was not present). Klaus-Jürgen provided a number of statistics on CCSDS documents that had been published since the Fall 2022 Meetings (5 new blue books since Fall 2022 [2 from Nav WG], 0 magenta, 1 orange, 5 green books [1 from Nav WG], 0 yellow); there were also 10 Agency reviews, 9 new projects, and 3 appointments to leadership positions (1 Area Director and 2 WG Chairs). He also provided information on the distribution of leadership across the CCSDS Member Agencies. He stated that there had been only one change in leadership of CESG/CMC: Daniel Fischer is the new MOIMS Area Director given the retirement of Mario Merri. Resources update: NASA and ESA dominate

standards editor/co-editor 50%/40%, and testing. CNES 10%, other agencies 0. He highlighted a number of topics that had been occupying the CESG since the Spring meetings:

1. IOAG/CCSDS Product Agreement Updates
2. Lunar Inter-Satellite Network
3. Joint IOAG/CCSDS Working Group on Security
4. Space-Comm Cross Support Architecture Requirements Document (SCCS-ARD)

Peter Shames then provided a brief presentation focusing on the CCSDS A02.1-Y-4 Yellow Book that is the basis for all CCSDS procedures. He encouraged everyone involved with CCSDS activities to read it since it describes all that we do.

The Opening Plenary covered a few of the customary topics. Here are a few keynotes:

- The Area Directors (ADs) each discussed the charter and plans for their associated working groups. This was thankfully a bit shorter than usual as the ADs didn't give as much detail as has been provided in the past. This was our first introduction to the new MOIMS Area Director Daniel Fischer of ESA, who replaced the recently retired Mario Merri.

- Much of this information is covered in a Secretariat presentation on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_Spring-2023-Open-Plenary-Final-(working).pdf , including the site of the next meetings to be held in Fall 2023.

- Fall 2023 Meetings will be hosted by ESA/ESTEC at The Hague, Netherlands, 06-Nov-2023 through 10-Nov-2023. The venue for the meeting will be Marriott The Hague hotel, the same location as the Fall 2017 meetings: https://www.thehaguemarriott.nl/ . According to the presentation, a special room rate is available to CCSDS attendees. Please be aware that a different cancellation policy applies for the reduced rate (cancellation has to be made 1 week in advance).

Unfortunately, information on the other future meetings that was formerly provided was not provided this time. Below is from past meeting notes, so it may not be reliable:

a) Spring 2024 hosted by NASA at TBD, dates TBD
b) Fall 2024 hosted by UKSA at TBD, dates TBD
c) Spring 2025 hosted by NASA at TBD, dates TBD
d) Fall 2025 hosted by ESA at TBD, dates TBD
e) Spring 2026 hosted by NASA at TBD, dates TBD

After the Area Director presentations, there was an informative "Rocket City" video from the Mayor of Huntsville, Tommy Battle, followed by some words from Mason Hall, the Operations Manager for the Huntsville Operations Support Center (HOSC) at NASA/MSFC. Mason stated that "Huntsville does lots besides rockets" and he encouraged attendees to partake of them. Finally, Mason indicated that the NASA Propulsion Center, ISS, and Gateway use lots of CCSDS standards.

The MOIMS Opening Plenary began immediately after the CCSDS Plenary.

1000-1100: MOIMS Opening Plenary

Daniel Fischer, Mario Merri's successor, introduced himself to the members of the 4 MOIMS Working Groups. As he had not prepared any material for this first meeting, he asked the Working Group Chairs to

introduce themselves and talk a bit about their respective Working Groups. Marc Duhaze, Deputy Area Director, queried the WG Chairs as to whether or not the Closing Plenary could be scheduled for Friday at 1400; all agreed. Note that the virtual setup for this Plenary was not well coordinated, so there was no virtual availability. After each of the WG Chairs described their groups and activities, Daniel provided a brief overview of his work at ESOC, where he provides support for ESA data systems for Galileo, robotic exploration, server security, and other tasks. Each of the MOIMS working group chairs provided a brief introduction of their work.

During his SM&C presentation, Mehran Sarkarati pointed out that they still have a spot in the SM&C for Navigation Services (which the Nav WG has consistently avoided). SM&C described their work plan, indicated issues with uptake of their standards, again mentioned the lack of service definitions for flight dynamics, and noted the loss of the WG Deputy Chair.

During John Garrett's discussion of DAI, Dan Oltrogge provided some insightful comments about the changes in the way the ISO Secretariat wants to treat the standards developed by the CCSDS, which has been disconcerting for some CCSDS WGs (especially DAI).

David described the unusually productive year the Navigation WG has been having; we are on track for 5 Blue Books being published in this one year.

Because the Mission Planning & Scheduling Chair was not present, Marc Duhaze (Deputy Chair) described progress towards their Blue Book. Daniel asked about the SM&C and MP interrelation given their similarities; in response, Mehran cited the varying nature of skills across the different disciplines.

Daniel stated that he was aware of the traditional MOIMS Dinner, and that it would be held on Thursday evening 11-May-2023, so as to avoid scheduling over the CCSDS Cocktail Party scheduled for Wednesday evening.

The Navigation Working Group meeting began immediately after the MOIMS Plenary.

1100-1230: Navigation WG Meeting (Intro, Action Items, etc.)

Attendance this day included: David Berry, Juan Crenshaw, Frank Dreger, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Alain Lamy, Jose Miguel Lozano, Dan Oltrogge, Brian Swinburne, Patrick Zimmerman. Hideaki had only been able to attend the Opening Plenary due to time zone issues. Madison Extine, a NASA/MSFC representative assigned to our WG, was also present.

During this introductory session, we had many issues with the audio/video equipment chain (HDMI, TV, Owl, Webex, Mac computer, etc.). This was a recurring theme throughout the meeting series.

David presented the "Introduction to the Navigation WG" material. Afterwards, David called for an around the room "face-to-face" introduction since Madison was a new attendee (note to David for future: this "around the room" should have been done earlier). We went through a bit more detail due to Madison's presence; however the full set of details of each document was not presented. The presentation was distributed to the WG mailing list, and also uploaded to the Nav WG CWE (https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/navwg-intro-202305.pdf).

Before ending this introductory session, we did some schedule changes to accommodate the travel plans of some participants, e.g., our discussion of "New Projects" was swapped with the discussion of the PRM

Corrigendum. Also, the MOIMS Closing Plenary was moved to 1400 on Friday per Marc Duhaze's request, which necessitated a few other changes to the Friday schedule.

1330-1730: Attitude Data Messages (ADM) (Testing Status, XML Status, etc.)

Alain indicated that all APM and AEM changes had been tested, and most ACM testing has also been conducted. Alain and Julie's presentation is on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_ADM_testing_summary_2023-05-04_v5.pdf. Jose Miguel indicated that GMV is continuing to test and will probably be done in 2 weeks. Test status so far: KVN testing by GSFC and CNES is 100% for APM (3 tests), AEM (3 tests), and ACM (7 tests). David indicated that JPL XML testing is approximately 80% complete. Alain estimated that other participants were also at approximately 80% complete with testing. There is very good progress since last Fall's meetings. Alain recounted the history of the testing, and will put it in the Test Report, including various results that needed troubleshooting.

Finally, Alain noted a few relatively inconsequential inconsistencies between the AEM and ODM; also between the APM and AEM/ACM. Towards the end of this topic, we had much discussion on the Attitude Determination (AD) section of ACM, and David's suggestions for the section dealing with sensor data that resulted from ADM/XML tests. Most of the issues related to the AD Section were resolved; we would confirm the resolution in Thursday's session.

It seems very likely that the ADM V.2 will be published in mid-2023 given the excellent progress (estimate July 2023).

TUESDAY 09-May-2023

Attendance this day included: David Berry, Vitali Braun, Juan Crenshaw, Frank Dreger, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Alain Lamy, Jose Miguel Lozano, Dan Oltrogge, Brian Swinburne, Patrick Zimmerman.

0845-1230, 1330-1745: Tracking Data Messages (TDM)

David started the meeting with a brief review of agenda changes that had been requested on Monday. Then we launched into the day's principal topic.

Tuesday was "TDM Day #1". Juan started off with a detailed discussion of the Tracking Data Principles first established back in 2003; these describe what the TDM is intended to do. He showed the results of his analysis of the principles, with a number of wording changes. It was clear that Juan had paid considerable attention to a thoughtful analysis of the principles. In addition to those originally established, he added some new principles. Once the text had been "painted green", we spent some time prioritizing them; in some cases we backtracked and revised text that had already been "painted green". This exercise yielded an end product to which we can refer back when making decisions regarding the content of the TDM V.3. As we worked slowly and with some deliberation, revising previous decisions as necessary, this exercise took us the entire morning session and part of the afternoon session. Throughout, it was emphasized that the TDM was originally conceived as a vehicle for interoperability and cross-support. The following is a prioritized list of the principles, with a "P" number indicating the Principle Number as laid out in the presentation. (Note that Principle 2 was deleted, as it was essentially a duplicate of Principle 5. Principles 9, 10, and 11 were added; Principle 10 was subsequently deleted. A total of 9 principles remained.)

1. P8 - The TDM standard provides a format to exchange tracking data (and associated parameters) between space organizations.
2. P11 - The TDM shall seek to minimize the need for development of non-standard conventions or extensive ICD arrangements.
3. P9 - The TDM standard shall progressively accommodate new tracking data types or sensor phenomenologies that may become prevalent for space object tracking or navigation. The standard must be extensible, while maximizing backwards compatibility.
4. P3 - Every tracking instrument should have a defined reference location and orientation that could be defined in the ODM and ADM format. This reference location should not depend on the observing geometry. If the reference location changes, the format should provide an avenue to convey the changes.
5. P4 - The time-tags of the tracking data should reflect the best estimate of the transmit/receive time at the instrument reference location.
6. P5 - The TDM standard should allow for corrections of observables, such as media corrections, biases, or as derived from path delay calibrations.
7. P1 - The data conveyed in a TDM should be as independent of the equipment that was used to perform the tracking as possible, while maintaining the integrity of the observations.
8. P7 - Corrections applicable to the data should be agreed by the service provider and the customer Agencies.
9. P6 - The TDM standard should minimize the keywords needed to represent equivalent observables. The observables' units should provide flexibility to most closely represent the native system implementation.

Juan's material from this first day of TDM discussion is on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_TDM-v2.02-Overview-CCSDS-Spring-2023-Discussion_day1.pdf.

Once the principles had been wordsmithed and prioritized, Juan commenced discussion of possible revisions to the TDM. This part of the session was more "brainstormy" than the discussion of principles. In particular, Juan discussed various ideas he had with respect to modularization of the TDM data. As discussion progressed it became clearer that Juan felt that the addition of new data items was somewhat dependent upon incorporating some modularization to avoid excessive overloading of metadata terms. At the end of the day, David suggested that an analysis of the problems of the TDM should be provided so that the WG can better understand what is to come. We will have a second day of TDM on Thursday.

Dan brought up the prospect of conducting a survey of commercial and military entities to gauge interest in the TDM, and also potential needs. Jose Miguel volunteered to work with Dan on this task. An action item was levied.

WEDNESDAY 10-May-2023

Attendance this day included: David Berry, Vitali Braun, Juan Crenshaw, Frank Dreger, Madison Extine, Cheryl Gramling, Julie Halverson, Hideaki Hinagawa, Alain Lamy, Jose Miguel Lozano, Dan Oltrogge, Brian Swinburne, Patrick Zimmerman.

0845-1200: Conjunction Data Message (CDM)

We continued discussion of review comments to date from the CDM P-1.0.4 (David apologized for being late and delaying the process); Brian had entered resolutions to most comments into a P-1.0.5 draft, and in this discussion all of the remaining comments were resolved. There was a suggestion to add an "Operations Status" keyword, since there is a requirement in the annex to provide such data that is only tenuously met. At 1200 we took an early lunch since we had just finished the CDM discussion, and Dan had another meeting commitment at that time. One action item proposed was to check all SANA links to reference materials in the registries; an action item was opened.

During the CDM discussion we were summoned outside by Amber for the CCSDS Group Picture (note picture has not yet been made available).

1300-1510: Future Topics - The Launch Data Message (LDM)

Since the CDM discussion completed earlier than scheduled, the discussion of future topics was moved forward from later in the week. The discussion of future topics in this session necessarily focused on the Launch Data Message (LDM) because Alain had not had time to prepare for NEM (since it is deprioritized due to ADM), Vitali has been asked by his management to delay the FDM, and David has not had time to complete the Concept Paper for the Navigation Functional (aka "Frankenstein") Message (NFM). David noted that he had uploaded Dan's revised LDM Concept Paper to the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Draft%20Documents/Concept%20Papers/LDM/Launch_Data_Message-20221216.pdf .

Dan provided a preview of the content in the LDM Concept Paper. This message will be useful in launch conjunction assessment. It is also useful in the current environment when there are so many launches and they are happening very frequently. The Launch Data Message seeks to improve all data exchange, coordination, and inter-organizational aspects of both domestic and international launches, thereby reducing operations costs, increasing overall efficiency, and minimizing operational risk. David showed the draft project form on the CWE. We filled out as much of the "New Project" form as was possible in the absence of volunteers to test the LDM; there were no volunteers within the room at the time, so the proposal was not submitted. However, on Thursday Dan confirmed with Luc Maisonobe that he was willing to take on the testing task for the LDM, and clarified that he would take responsibility for one prototype. The "two prototypes" requirement was thus satisfied. Subsequently, the LDM project proposal was formally completed and submitted for CMC review. A CMC "New Project" Poll is currently in progress; it closes 02-Jun-2023.

1510-1615: Preparations for Meeting with SANA Operator

Since the CDM discussion completed earlier than scheduled, we prepared some talking points for the meeting with SANA scheduled for Thursday morning. David shared some initial thoughts, such as:

- Given the "beta" and "nav" registry sets, is there one in particular we should be using? or both?
- What are the registry migration mechanics?
- What is the distinction between "Provisional" entries versus "Assigned" entries? Who determines the status?
- How can we tell which is "the right registry" given that some appear in both approved and candidate registries in both "beta" and "nav"? How can we be sure we are looking at the latest updates?

The SANA Registry talking points guideline is on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-

NAV/Meeting%20Materials/2023/Spring/presentation_SANA-registry-topics-20230511.pdf . It was presented during the meeting with the SANA Team on the following day.

1615-1715: Navigation Data Messages XML Spec 4.0 Status/Issues

David discussed the overall status of the NDM/XML schema development and testing. Basically all is ready except to resolve the issue with the indexer in the keyword of the sensor data keywords. Testing of the schemas has gone well; most of the test messages prepared by Julie have been converted and tested. During this discussion, Alain inquired "Why are there user defined keywords in NDM/XML?". This is because they are defined in the constituent documents (ODM, ADM, etc.), and we are charged with creating the ability for users to format their messages in XML. The ADM/KVN test set also includes user defined keywords, so they must be included in the XML rendering of the message.

There was also discussion of several issues with scheduling because the ADM should be published by approximately 30-Jun-2023 or early July, while the NDM/XML V.4 has not yet had Document Processing, CESG/CMC Polling, Agency Review, and "Approval to Publish" polling. There is thus the potential for a several month out-of-sync condition between the ADM V.2 document and the ADM V.2 schemas. David took an action item to try to get the NDM/XML 4.0 schemas released at the same time as the ADM 2.0 since that document describes the schemas; one way to accomplish this would be for someone else (perhaps Luc?) to perform ADM/XML V.2 tests in addition to David. There would then be 2 prototypes of the XML formulation of the messages, satisfying the CCSDS requirement.

1715-1730: Early Departure

Due to the CCSDS Cocktail Hour scheduled at 1830 we knocked off a little early...

THURSDAY 11-May-2023

Attendance this day included: Julien Bernard, David Berry, Juan Crenshaw, Frank Dreger, Daniel Fischer, Jean Gilbert, Hideaki Hinagawa, Julie Halverson, Jose Miguel Lozano, Dan Oltrogge, Brian Swinburne, Patrick Zimmerman.

0845-1005: Joint Meeting with SANA Registry Team

Julien Bernard and Jean Gilbert were present to discuss several issues regarding the NavWG use of the SANA Registries, including registry migration plans, version control processing, etc.

David had a question about the various beta directories. Julien responded that "beta" and "nav.sanaregistry" beta are both OK, but the one used depends upon the specific use case. When a book is ready to be published, the beta is used first for checkout, and from the beta the registries move to Production. The "nav.sanaregistry" beta is only for the Nav WG (there is one other supplementary registry for the ISO terms). The WG also had questions about the "provisional"/"assigned" designations; that is up to the WG.

With respect to the many requests we have made to the SANA Team, Julien provided a detailed SANA migration list, registry by registry, for David to check. Julien also noted that after the migration of ODM-related nav-beta and beta files to Production, the current version of the "nav.sanaregistry" beta will be "closed", and a new snapshot will be taken.

In other discussion:

- Julien provided instructions for David to test editing certain registries that are within the purview of the CCSDS Nav WG
- There was a proposal for addition of a new collision probability method (Action Item to Dan to review it)
- Discussion of versioning, history, availability
- Julien explained that there are no current metrics on hits to the registries

The material presented by the SANA Team is available on the CWE at:
- https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_SANA-NAV-Report-CCSDS-Spring-2023.pdf
- https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_SANA-files-management-brainstorming.pdf

1005-1100, 1140-1230, 1330-1700: Tracking Data Message Topics

Tuesday was "TDM Day #2". This session of TDM discussions was punctuated by a switch to finishing up some ADM topics due to Julie's limited availability on Thursday, and then lunch. Juan started by reminding us of some of his goals for the TDM V.3 update:

1. Maximize backward compatibility
2. Evolve the data structures
3. Real Time Tracking Data
4. Consistency

Juan discussed his ideas for a different design for segmenting the data. We also spent a lot of time with the discussion of TDM corrections (and other topics).

Juan's material from this second day of TDM discussion is on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_TDM-v2.02-Overview-CCSDS-Spring-2023-Discussion_day2.pdf.

1100-1140: Attitude Data Message XML Testing

To finish up the ADM/XML issues discussed earlier in the week, David showed Julie the work done for the ADM schemas in the NDM/XML 4.0. She confirmed that the arrangement for the sensor data in the ACM/XML was acceptable. David said that he would upload the V.4 schemas to SANA after a new SANA snapshot is available in the "nav.sanaregistry" beta. David will create a test set for the NDM/XML V.4, with one bad test to show that the WG is "not cheating". Results will be sent to Alain/Julie for integration into their test report.

FRIDAY 12-May-2023

Attendance this day included: David Berry, Vitali Braun, Juan Crenshaw, Frank Dreger, Hideaki Hinagawa, Alain Lamy, Jose Miguel Lozano, Brian Swinburne, Patrick Zimmerman.

0845-0900: Tracking Data Message Question

We were a bit slow getting off the mark this morning. While folks were joining we addressed a question to Hideaki regarding one of the open points remaining from Thursday's TDM discussions. Specifically, in the TDM V.1, there had been an arrangement that allowed ranging data to be timetagged with the uplink signal transmit time based on an assertion of the JAXA representative at the time. Because of time zone issues, Hideaki was not logged into the meeting when this topic was originally discussed. In response, Hideaki stated that JAXA had 2 different ranging systems, one for deep space, and one for near earth. One of the systems had not yet been converted to TDM processing, but in the other one the ranging was timetagged with the receive time (note that tagging ranging data with the receive time is the "customary" method).

0900-0945: Pointing Request Message Corrigendum

The PRM was published in Spring 2018, and is thus now at 5 years since the original publication. David refreshed the WG knowledge of the 5 Year Review process: we choose to either reconfirm, revise, or retire. Usually we proceed by eliminating options, starting with retire. If the standard is still useful, as in this case, the answer to the question "retire?" is "No". We then usually ask "reconfirm?", to which the answer is also usually "No" because most of the time people have known of improvements they would like to make. However, when we discussed the PRM review at Toulouse, we were not aware of any desire for revision. So in this case, when we examined the question "reconfirm?", we answered "Yes", although there are some Corrigenda that Jose Miguel had prepared that we would like to apply. In this case, we opt to prepare a corrigendum requested by the MP&S WG, and then reconfirm the standard.

Jose Miguel led us through the Corrigenda he had identified for the PRM. There were no objections to proceeding with the Corrigendum. The next step is for Jose Miguel to preview the changes with the ESA team, who are probably the principal users of the standard.

David described some confusion (on his part) as to whether or not our approach is the correct one. Perhaps we have been pursuing the wrong approach? Perhaps the proper approach is Pink Sheets, but that would subject us to an Agency Review. David indicated that he would be inquiring of Tom Gannett as to whether the Corrigendum+Reconfirm conforms with CCSDS procedure. David cited the CCSDS 401 document "Radio Frequency and Modulation Systems—Part 1: Earth Stations and Spacecraft", which is currently at Blue Book #32 (401.0-B-32). It is not clear whether or not the WG uses Corrigenda or Pink Sheets for these multiple issues (if there were Corrigenda, they would be cited on the cover; if there were Pink Sheets, they would be subject to an Agency Review, but there does not appear to be an online record of them at https://public.ccsds.org/review/default.aspx). Two action items for the PRM were opened: (1) Determine whether Corrigenda or Pink Sheets is the appropriate course of action for the PRM (David) and (2) Check with ESA Team regarding potential removal of PRM Annex B (Jose Miguel).

0945-1000: Book Numbering Convention

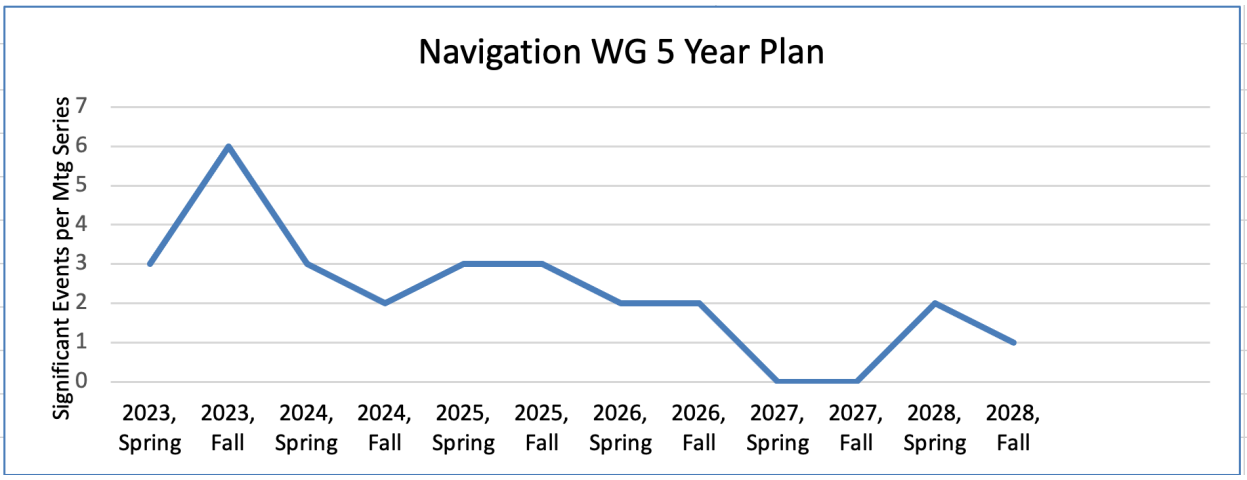
David presented an advisory about Book Numbering, particularly for Pink Book internal revisions. Generally, to avoid a duplicate document number of a Nav WG internal Pink Book Version with a Secretariat generated Pink Book version that will be subjected to the CCSDS Agency Review process, Pink Books should be numbered with a tripartite number "b.0.n", where "b" is the applicable Blue Book release number, and "n" is the internal Pink Book sequence. Duplicate Pink Book numbers generally exist in the range of "b.1" through "b.3". The presentation material is on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/presentation_navwg-book-numbering-convention.pdf .

1000-1105: Nav WG Report

The WG members went over the Navigation WG Report that was scheduled to be presented at the MOIMS Plenary later in the day. The report as presented at the MOIMS Closing Plenary is shown below. It is also available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/navwg-report-202305.pdf

1105-1130: Five Year Plan & Five Year Reviews

We went over the 5 Year Plan that had last been refreshed at Toulouse in Fall 2022. David explained the methodology: the process starts by roughly synchronizing the plan with the schedules on the CWE Framework that had been updated through the week. After that initial plan, several simplifications are utilized in order to keep the detail in the plan manageable. For example, there is a focus on the face-to-face meetings (restricted to April=Spring, October=Fall, other months are "rounded" to the closest meeting). David explained that there is probably a need for greater granularity in the dates because the half year range causes some unrealistic bunching when a document schedule is very rapid; monthly may be too much granularity for a 5 Year Plan, but quarterly might be feasible. There is a focus on 4 major events (Initial White book, Red/Pink Book/Agency Review complete, Blue Book complete, 5 Year Review), so many of the items in the full Framework schedule are ignored. A simple prioritization scheme is used for sorting (Blue Book=1, Red/Pink Book=2, White Book=3 or 4). The outcome of this process shows the number of major events that are planned to complete around the meeting series. The detailed 5 Year Plan is available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/navwg-5-year-plan-202305.pdf . Here is the plot for the Spring 2023 plan:



1130-1210: Document Schedules & End of Meeting

We confirmed in progress document schedules on the CWE. Afterwards, we bid adieu and started making plans for the Fall 2023 Meeting in The Hague.

The dates for monthly telecons are listed at the end of these minutes. Meeting announcements will be sent in advance of each meeting. The single 1-hour meeting approximately once per month will be maintained.

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

https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/

Draft documents reviewed during the meetings are in their respective directories on the CCSDS CWE: https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Draft%20Documents/ (sort by "Name" for easier searching).

1400-1510: MOIMS Closing Plenary

Attendance at the Plenary included: Marc Duhaze (MOIMS Deputy Area Director, MP&S Deputy Chair), David Berry (Nav Chair), John Garrett (DAI Deputy Chair), Mehran Sarkarati (SM&C Chair), Peter van der Plas (MP&S Chair). There were also several members of other MOIMS working groups. Daniel Fischer, MOIMS Area Director, was not able to attend.

The Working Group Chairs delivered their reports: Peter van der Plas for Mission Planning and Scheduling (MP&S), John Garrett for Digital Archive Ingest (DAI), Mehran Sarkarati for Spacecraft Monitor & Control (SM&C), and David Berry for Navigation (Nav). In the course of their presentations, every MOIMS Working Group Chair stated that the meetings are much more productive when we are onsite, face-to-face. The Navigation report immediately below was presented during the Plenary. The report is also available on the CWE at https://cwe.ccsds.org/moims/docs/MOIMS-NAV/Meeting%20Materials/2023/Spring/navwg-report-202305.pdf .

NAVIGATION WORKING GROUP CLOSING REPORT for HUNTSVILLE, ALABAMA

NAV WG EXECUTIVE SUMMARY

Achievements for this Meeting Cycle

- Completed discussion of Attitude Data Messages Pink Book prototyping and test results.
- Completed discussion of Conjunction Data Message V.2 Pink Book comments from internal review of Pink Book P1.0.4
- Continued discussion of Tracking Data Message principles and discussion of plans for content update in Tracking Data Message V.3
- Completed discussion of Pointing Request Message Corrigendum in preparation for Reconfirmation
- Continued discussion of NDM/XML V.4 Pink Book draft and issues with the document schedule
- Completed preparation of proposal for new project "Launch Data Message" and requested CMC Poll

Working Group Status

- Active, "High Momentum"
- Very good attendance

Interaction with Other WGs

- Met with SANA Operator Team to discuss various topics related to the Nav WG use of SANA Registries.

Problems and Issues

- In-Person/Virtual Hybrid meetings have both advantages and disadvantages:
  - In-Person meetings are more efficient in several ways: no time zone issues, no audio/video issues. But it can be costly.
  - Virtual meetings allow people that cannot travel for fiscal or health reasons to participate. Virtual participants had some difficulties with hearing and participating (we had lots of troubles with

connections to TV monitor, Owl, Webex, etc.). Can negatively affect people who want to be in-person but agency management won't pay.

Resolutions agreed upon this meeting:

- NAV-01: To transition the Attitude Data Messages (ADM) Pink Book 1.1 and publish ADM Blue Book 2.0
- NAV-02: To create a new project "Launch Data Message" (already a Draft Project, CMC Poll Requested)
- NAV-03: To cancel the Draft Project "Navigation Hardware Message" and remove it from the IOAG-CCSDS Product Agreements (the need for this document has been superseded).

Further Resolutions anticipated in the next 6 months:

- NAV-04: To publish a Corrigendum for the Pointing Request Message
- NAV-05: To "Reconfirm" the Pointing Request Message once the Corrigendum is applied

Planning (Only Approved Projects):

Area & WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date	
MOIMS NAV	503.0	Tracking Data Message (TDM) Version 3 Revision	Very good progress. Spent considerable time discussing tracking data message principles and plans for future requested changes.	Start date End date	06-May-2019 30-Aug-2026
MOIMS NAV	504.0	Attitude Data Message (ADM) 5 Year Review Revision	Excellent progress. Continued discussion of prototype test results to date, plan for completing testing, and the "end game".	Start date End date	16-Apr-2015 30-Jun-2023
MOIMS NAV	505.0	Navigation Data Messages XML Specification Version 4 Revision	Acceptable progress. Discussed issues with the schedule due to the gap between publishing the ADM and this companion document.	Start date End date	06-Jan-2023 16-Dec-2023
MOIMS NAV	507.0	Navigation Events Message (NEM)	No progress. This project has been deprioritized several times due to the much higher priority of the ADM, which is now nearly complete.	Start date End date	07-Nov-2017 30-Nov-2024
MOIMS NAV	508.0	Conjunction Data Message 5 Year Revision	Good progress. Completed discussion of issues raised to date during internal review of Pink Book P1.0.4	Start date End date	14-Jan-2019 31-Dec-2023
MOIMS NAV	509.0	Pointing Request Message	Completed 5 Year Revision discussion with decision to prepare a Corrigendum, then Reconfirm.	Start date End date	N/A N/A

NAVIGATION WG UPCOMING NEW WORK ITEMS

Area and WG name	CCSDS Ref Number	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)					Comments Rationale What if not started?
					TOTAL	EDITOR	PROTO1	PROTO2	
MOIMS NAV	<<To be chosen by Secretariat>>	Launch Data Message	01-Aug-2023 01-Dec-2025	2023	2	2	0	0	Current non-integrated hodge podge of launch data information will persist.
				2024	8	4	2	2	
				2025	14	2	6	6	

NAV WG ISSUES FOR CESG / CMC

Minor Issue Related to CCSDS Draft Projects and Concept Papers:

- Note that the CCSDS A02.1-Y-4 "Organization and Processes for the Consultative Committee for Space Data Systems" states in 6.1.1 "Every CCSDS document (or family of related documents) starts out as a CCSDS concept paper".
- A02.1-Y-4 contains extensive discussion about the purpose, content, etc. of concept papers, but there is no current way to associate a concept paper with a Draft Project on the CWE when a CMC Poll is requested (https://cwe.ccsds.org/fm/Lists/Projects/AllOpenChartersWithDraftProjects.aspx).
- It seems logical that a Concept Paper could be attached to the Draft Project form.

NAVIGATION WG PARTICIPATION/MEETING DEMOGRAPHICS

- 5 sessions, Monday 08-May-2023 through 12-May-2023
- This meeting was generally 69% in person, 31% virtual (various reasons: member health, budget, other work commitments). As the meeting progressed, the balance changed to 56% in person, 44% virtual as 2 participants had issues that caused a switch from in person to virtual.

Agency	NAV WG	
CNES	1	Alain Lamy
CNSA		
CSA		
DLR		
ESA	4	Frank Dreger (virtual), Daniel Fischer, Vitali Braun (virtual), Jose Miguel Lozano
JAXA	1	Hideaki Hinagawa (virtual)
NASA	7	David Berry, Juan Crenshaw, Cheryl Gramling, Julie Halverson (virtual), Dan Oltrogge, Patrick Zimmerman, Madison Extine
ROSCOSMOS		
UKSA	1	Brian Swinburne (virtual)
Others	2 (SANA)	Jean Gilbert, Julien Bernard
Total	16	
Meeting Duration	5 days	
Agency Diversity	5	

NEXT TELECONS:

We will continue the 1-hour telecons approximately monthly between Spring and Fall Meetings. If we are not making sufficient progress and the WG approves, we could go back to a 2-hour/meeting schedule.

- 07-Jun-2023 13:00-14:00 UTC
- 12-Jul-2023 13:00-14:00 UTC
- 02-Aug-2023 13:00-14:00 UTC
- 06-Sep-2023 13:00-14:00 UTC
- 11-Oct-2023 13:00-14:00 UTC
- 06-Nov-2023 through 10-Nov-2023 Fall Meetings at The Hague, Netherlands

NOTE:
Europe Daylight Savings Time ends 29-Oct-2023
US Daylight Savings Time ends 05-Nov-2023