**CCSDS Spacecraft Monitor and Control (SM&C) Working Group**

**Spring 2018 Workshop - April 9-13, 2018**

**National Institute of Standards and Technology. Gaithersburg, Maryland USA**

# Summary (from the final plenary presentation to the MOIMS Area Director):

1. Held multiple sessions to discuss the opportunity to advocate for the use of MO Services for the Lunar Orbital Platform-Gateway (LOP-G). Responses to their draft recommended standards document are due by the end of May 2018.
2. Continued our discussion of Interoperability. Our Roadmap had an entry for a potential new book on the use of MO for inter-Agency interoperability. The new thought is that a short whitepaper could serve this purpose, be part of the submittal to LOP-G, and help inform the changes to the MO Green Book. An annotated outline was developed.
3. Continued the important WG series on actual mission scenarios. This meeting featured a ½ day session on ESA mission operations and ground systems as well as the multiple sessions on the LOP-G.
4. Reviewed status of all documents, including those subject to 5yr review soon. Three XTCE books may need updating later this year and a plan was developed for them. C++ API book should be submitted for publication soon and the MO Green Book should start making more progress.
5. Discussed the next set of services to be defined: File management, automation, and ping.
6. Worked on MO advocacy and awareness. Will be updating the website entry point information.
7. Discussed possible binding from MAL to DTN/BP. WG felt our lack of knowledge was limiting factor and therefore agreed to work with internal DTN experts between this meeting and next before proposing joint DTN/SIS meeting at next workshop in Berlin
8. Discussion on existing and future OMG standards and activities. XTCE 1.2 is approved for OMG publication. OMG future activities on Ontology and Display pages has the WG support. OMG C2MS was discussed.

# Agenda (revised throughout the meeting)



# Attendance

Twenty-two people registered for all or portions of the SM&C meetings. Attendance at any single session varied from 8 people to about 20. Because NASA GSFC is nearby, several people from GSFC attended in support of specific topic areas.



# Files posted to CWE

Files from the meeting have been posted to the CWE under the MOIMS Area / SM&C / Meeting Materials / 2018 / Spring directory:

1. These minutes
2. CCSDS MO Open Source – ideas on posting MO open source software from Olivier Churlaud
3. Solar Observatory L1 L5 cooperative mission – Scenario that Ian Harrison presented
4. OMG Status April 9 2018 – OMG status that Dan Smith presented
5. Use of CCSDS Standards to promote Mission Ops Interoperability – Early start of the new whitepaper
6. D01-WG-Report-to-Area-Spring2018SMC 13 Apr18 – Presentation to Area Director summarizing the week.
7. SMandC Doc Status – Documentation status report
8. MOIMS-SC-Agenda – Original agenda (updated version is in the minutes)

# Day 1. Monday April 9, 2018

* Full CCSDS and MOIMS Plenary meetings were held in the morning.
* SM&C WG began at 11:45 am with general discussion of the week’s plans.
* Discussions began on the timely opportunity to advocate for the use of MO Services and other MOIMS standards on the Lunar Orbital Platform – Gateway (LOP-G). There is a call-for-comments out now on a draft document of recommended standards for the LOP-G. A quick look at the document shows that there seems to be a lack of focus on mission operations. SM&C or MOIMS should develop a response and submit it by the May 31 deadline.
* OMG status was discussed for two full hours after lunch. Charts are posted on CWE.
	+ XTCE. Kevin Rice from GSFC explained the technical details of the recently approved version 1.2 – dozens of fairly small technical changes and a couple new capabilities. Dan Smith explained that OMG now has a several month publication process and that CCSDS has asked that we wait for that to complete prior to submitting it for Agency up/down approval. NASA accepted the action to review the two related Green Books to see if changes are needed. New projects will be opened only if changes are required.
	+ The OMG is considering the development of a simple display format exchange standard. The WG discussed it at length and agreed to its value and recommends that the OMG, rather than SM&C, develop the standard.
	+ The OMG is considering working on a terminology/ontology of mission operations terms. Our WG agrees that it could take a considerable effort, with low chance of full success and limited benefit. Although it would be great if we all used the same terms the same way all the time, it is not seen as practical to expect it.
	+ The OMG has voted to accept the C2MS standards and is working towards an expected publication at the end of 2018. Dan explained how, C2MS really is the message format portion of NASA’s GMSEC (not the API, software, or reference architecture) and that it has been adopted by many U.S. product vendors, integrators and government space agencies. These other groups approached the OMG to ask NASA to make it a formal standard since it was already considered a common-use standard. C2MS is a set of message formats that generally align to the key interfaces of the commercial products and used CCSDS contents where practical (NAV, telemetry packets, eventually planning and scheduling, etc.). MO clearly has a broader capability set, a more powerful underlying framework, and was envisioned for use across multiple space and ground assets.
		- NASA’s view was that C2MS has a scope and purpose sufficiently different than that of MO and the MO is clearly the recommended standard for inter-Agency Interoperability. NASA does not see an overlap between MO and C2MS with regards to inter-Agency interoperability.
		- ESA, CNES and DLR collectively believes that there is a level of overlap and expressed concerns at the overlap but did not quantify a level (large, small, etc.) or the extent of perceived issues.
* The rest of the day was a continuation of the discussion of LOP-G.

# Day 2. Tuesday April 10, 2018

* **C++ API**. Dan Smith explained that the MAL C++ API book has two unresolved RIDs. The original author responded to all 40+ RIDs and the originators have agreed to the responses except for these two cases. Since the original author from NASA/JSC is no longer available, Dan presented the two remaining RIDs to the WG. One was resolved very quickly. DM03, however, required a lot of discussions and Mario Merri was able to contact Dominque at ESA and arrange an immediate telecon. After some discussion, Dominique agreed to make several changes to the text and then Dan and Sam will review the modifications. Dan has an action to then submit the full package and resolution to Mario Mario, as Area Director, by 24 April 2018.
* **Documentation Status**. The status of every document still being worked on was reviewed. The summary status sheet is included at the end of these minutes. CWE was then updated, with the summary status below:

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| 522.0 | Mission Operations - Common Services  |  - Updating after RIDs - OK | Start date 01/01/2006End date 30/10/2018 |
| 524.3 | Mission Operations - Message Abstraction Layer Binding to HTTP Transport and XML Encoding  |  - Awaiting poll to publish - OK | Start date 30/03/2015End date 30/06/2018 |
| 524.4 | Mission Operations - Message Abstraction Layer Binding to ZeroMQ Transport and CNES Binary Encoding  |  - Updating after RIDs - OK | Start date 01/06/2015End date 01/07/2018 |
| 522.2 | Mission Operations - Mission Data Product Distribution Services  |  - CESG comments being procecssed | Start date 01/01/2015End date 15/12/2018 |
| 523.2 | Mission Operations C++ API  |  - Last 2 RIDs being processed - OK | Start date 05/04/2015End date 30/09/2018 |
|   | Mission Operations Service Concept (Issue 4) |  - Update being worked on - Very slow progress - New commitment to complete before next meeting | Start date 01/12/2016End date 01/02/2019 |
| 660.0 | XML Telemetric and Command Exchange (XTCE) 1.2 |  - Per CCSDS rules, will wait for OMG publication to begin CCSDS Agency Review | Start date 01/01/2008End date 03/12/2018 |

* **More on LOP-G**. Joint meeting with DAI. DAI should be included in the list of standards areas to be commented in the response to the LOP-G draft list of recommended standards (currently with little mission of mission operations).
* **LOP-G Cover Letter.** Folllowing is some draft text developed for the potential cover letter to our submittal in response to the LOP-G standards draft document:

*The list of Standards for Deep Space is currently missing Operability standards applicable to the future programs. The CCSDS has an area of Mission Operation standards dedicated to interoperability services defining a basic set of interfaces, interactions and services, which are common in the Space and Ground domains. A general trend is the movement of intelligent applications from Ground to Space and the standards are an enabler for this movement, due to their common nature and technology abstractions. Reasons for inclusion of CCSDS Operational standards in the Deep Space Programs are:

 - Original Development of ISS had several issues where common Mission Operation standards would have helped.
 - CCSDS has well defined standards in the missions ops area, using modern service orientated approach.
 - LOP-G is considering several related CCSDS standards for comms and security, same rational is applicable for the use of Mission Operations (MO) Standards.
 - MO Services focus on the interface boundaries, with minimal invasion into the hosting systems.  So easily usable on new or legacy and space and ground systems.
 - Mission Operation standards simplify the integration of systems (legacy and new applications).
 - Mission Ops will drive the LOP-G system in ways not currently considered, MO Service standards simplify system redirection / expansion.
 - As well as the basic defined standards, the service framework allowing easy expansion of new capabilities as locally bespoke services or as new MO standards through CCSDS. Working groups are always excited to support new standards with a clear use case.*

* **Open Source Posting.** Olivier Churlaud presented two charts on how we could post our open source software. Charts are posted on CWE.

# Day 3. Wednesday April 11, 2018

* **ESA Mission Ops (all morning).** Ian Harrison presented a detailed scenario of a cooperative ESA-NOAA Solar Observatory mission. Charts are posted on CWE.
	+ Can take 18 months to reach the L5 location. Very low level of cruise phase operations, but can use some of the time for instrument checkout.
	+ About 25 standards were listed (mix of CCSDS and ECSS standards) that manufacturers and contractors are expected to follow.
	+ With a 20 minute round trip light time, traditional real-time telemetry and command activities must be modified.
	+ ESA has a warranty period on their software. But if heavy use is deferred for until after the cruise phase, then it is too late to report new problems under the warranty period. NASA often uses in-house software or has contractors on the team, so does not deal with the same warranty issues.
	+ At ESA, there is some mission customization of the telemetry and command system, but it generally starts with the latest common system.
* **LOP-G Discussion with Adam Schlesinger.** Mark Lupissela from GSFC helped on discussions of LOP-G and invited a member of the LOP-G avionics and software management team to attend. Adam Schlesinger from NASA JSC joined the WG for 90 minutes to discuss the LOP-G. Very good discussion.
	+ Emphasized the importance of standards and open system architectures and the need for broad levels of interoperability. Their working model is the opposite of what they tried on C3I several years ago when NASA wanted to develop new “standards” internally and then let all the others know about them. This time it is about transparency, working together, and using existing standards.
	+ He noted that LOP-G is under NASA’s Advanced Exploration Systems (AES) but is not a formal program and is being managed out of NASA HQ right now.
	+ Mr. Schlesinger was familiar with MO services and the work of Lindolfo Martinez at JSC prior to his death. Tom Ridge at JSC is the current contact point. Good words on MO and he encouraged us to comment on the standards recommendations now out for review.
	+ Core Flight Software (cFS) will probably be baselined for the onboard framework. We should look into a cFS-MO adapter. Will probably also use DTN and XTCE.
	+ It was agreed that most areas of CCSDS standards were well covered in the draft document, but that mission operations were barely mentioned. They would appreciate our inputs, but they need to be submitted by the end of May 2018.
	+ Mr. Schlesinger took the action to see if the ConOps document is releasable and to identify the best people for us to have further discussions with.
	+ SM&C has the action to get our comments submitted by May 30.
* **Next Services.** File management and Automation Services seem to be the most appropriate next services to develop.
	+ **File management.** Need to align with, or check on overlap with, CSTS generic file transfer services and possibly SOIS file services. Need to explain an agency-to-agency interoperability use case for using this service between Agency mission ops centers. Sam Cooper / ESA volunteered to start the effort.
	+ **Automation.** [Dan still thinks this is mis-named]. This is a service for the control functions of scripts, macros, models, etc. regardless of their language, syntax, or location. Things like start, stop, suspend, step, submit value, etc. Still need Agency commitment.
* **Roadmap**
	+ The team reviewed the roadmap developed at the Fall 2017 meeting.
	+ Deleted potential interoperability book, since the whitepaper for LOP-G may suffice.
	+ Deleted display page standard. It was low priority and the WG determined that the OMG would be a better group to develop it.
	+ Decided to pursue the file management service and the automation service soon.

#  Day 4. Thursday April 12, 2018 (1/2 day)

* **Need for MO Reference Model.** The group did a quick review of the current MO Reference Model Magenta Book and determined that it does need updates for its 5yr review. Several areas for update were identified. Stefan Gaertner agreed to begin the updates.
* **Plans for a new book on Interoperability using MO.** At the Fall 2017 meetings the WG discussed the need for a book to highlight how MO could be used for inter-Agency interoperability by using only a simplified subset of the overall MO capability set. Although the intent is still valid, the decision was made to develop a short whitepaper to address both this need and the need to respond to the LOP-G request for comments.
* **Review of Open Action Items.** Reviewed all action items from previous meeting (see Fall 2017 action table at end of email). Those actions still open were moved to the Spring 2018 list and 12 new actions were added based on the week’s meetings.
* **Mailing List.** We again discussed the mailing list. ESA and DLR reviewed the names from their org on the list and about 20 names were marked for unsubscription. The list reduction effort will continue.
* **Did not meet in the afternoon**.

# Day 5. Friday April 13, 2018 (1/2 day)

* **Only met in the morning**. MOIMS Plenary was in the afternoon.
	+ The WG broke into groups to work on the minutes, the plenary presentation, the action item lists, and the Lunar Orbital Platform – Gateway standards recommendation.

**Fall 2017 Actions with April 12, 2018 Status Updates**

**(open actions will be moved to the new Spring 2018 list)**

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| --- | --- | --- | --- | --- | --- |
| **ID** | **ACTION** | **ASSIGNED TO** | **DUE** | **NOTES** | **STATUS** |
| 20171109-1 | Submit HTTP comments/questions as RIDs | Adrian Tinio/NASA | 11/30/2017 | Submitted as comments |  CLOSED |
| 20171109-2 | Begin process to release HTTP prototype as open source | Brian Giovannoni/NASA | 12/15/15 start | Goal of April 2018 release. 12Apr18 AWAITING JPL STATUS |  OPEN |
| 20171109-3 | Send out list of MO resources useful during the HTTP prototyping effort | Adrian Tinio/NASA | 11/30/2017 | 11/13/2017 | CLOSED |
| 20171109-4 | Add to Adrian’s list of MO resource materials | All | 12/15/2017 | Reviewed at NIST, being added to website |  CLOSED |
| 20171109-5 | Comment on SOIS Yellow Book within 30 days of its release | All | TBD |  | OPEN |
| 20171109-6 | Send out revised Green Book | Sam Cooper | 12/1/2017 | 11/13/2017 | CLOSED |
| 20171109-7 | Review updated Green Book | All | 11/30/2017 | 12Apr18: Awaiting next update. | OPEN |
| 20171109-8 | Sign up to do something from our Work Plan | All | 1/31/2018 | Assignments reviewed at NIST meetings. | CLOSED |
| 20171109-9 | Review the Reference Architecture Document to determine extent of changes need for 5-year revision | All | 1/31/2018 | 12Apr18: Reviewed at NIST meetings, update needed. | CLOSED |
| 20171109-10 | Schedule 3 full telecons prior to April 2018 meeting | Dan/Sam | 12/15/2018 | 12Apr18: Next meetinghas been schedule. | CLOSED |

**Spring 2018 Action Item List**

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| --- | --- | --- | --- | --- | --- |
| **ID** | **ACTION** | **ASSIGNED TO** | **DUE** | **NOTES** | **STATUS** |
| 20171109-2 | Begin process to release HTTP prototype as open source | Brian Giovannoni/NASA | 12/15/15 start | Goal of April 2018 release. 12Apr18 AWAITING JPL STATUS |  OPEN |
| 20171109-5 | Comment on SOIS Yellow Book within 30 days of its release | All | TBD |  | OPEN |
| 20171109-7 | Review updated Green Book | All | 11/30/2017 | 12Apr18: Awaiting next update. | OPEN |
| 20180413-1 | Complete C++ API Doc | D. Smith | 24 Apr 2018 | Requires update from Dominique and review from Sam. | OPEN |
| 20180413-2 | Review XTCE Green Books to determine whether changes are needed | K. Rice / NASA | 13 May 2018 | Will then Confirm, or open project to update documents | OPEN |
| 20180413-3 | Submit comments on draft LOP-G recommended standards document | All | 15 May 2018 | HARD DEADLINE! | OPEN |
| 20180413-4 | Describe ideas for posting of open source software from multiple agencies | O. Churlaud  | 13 May 2018 |  | OPEN |
| 20180413-5 | Update the SM&C mailing list per the updates provided at the NIST meeting | D. Smith | 24 April 2018 |  | OPEN |
| 20180413-6 | Discuss concepts and need for a mapping of MO onto DTN as a transport layer | S. Cooper | 15 July 2018 |  | OPEN |
| 20180413-7 | Determine your agency’s interest in committing to work on File Management Services. | ESA, TBD | 1 July 2018 |  | OPEN |
| 20180413-8 | Determine your agency’s interest in committing to work on Automation Services. | All | 1 July 2018 |  | OPEN |
| 20180413-9 | Update the MO Reference Model Book (5 yr update) | S. Gartner | 1 July 2018 |  |  |
| 20180413-10 | Determine your agency’s interest in committing to work on 5 yr update to the JAVA MAP API. | All | 1 June 2018 |  |  |
| 20180413-11 | Post any MAL and JAVA API on github | All | 1 July 2018 |  |  |
| 20180413-12 | Discuss cFS-MO adapter with SOIS team | D. Smith | 1 June 2018 |  |  |

**SM&C Status of Documents in Progress**

**April 12, 2018**

**520.0.G MO Services Green Book - 5y** **Revision (ESA)** **Sam Cooper**

* 10April18 Limited progress to date. Sam to provide new dates.

**520.1-M-1 Mission Operations Reference Model               Stefan Gaertner**

* 12April18: Reviewed by WG. Updates are needed. Not a major change, but there are sections and references that are out of date. Need to open a project for the update. Plan for draft of all updates in June 2018.

**522.0.B Common Services (ESA, CNES) Sam Cooper**

* 12Feb18: Agency Review Closed. RIDs from INPE (8), CNES (38), ESA (29); No JAXA RIDs
* 10April18: All RIDs addressed. CNES to confirm resolutions by 12Apr18.
* 10Apr18: Resolution to be requested following ESA and CNES prototype. CNES prototype implemented but not yet tested. Goal of mid-July 2018 to conduct test, write Yellow Book.

**522.2.B Mission Data Product Distribution Services** **(ESA, CNES) Mehran Sarkarti / TBD**

* 14Jul17: CESG poll for AR closes with conditions by Barkley, Shames, Burleigh.
	+ Concerned that it too abstract for a Red Book, may overlap other product distribution standards. Sam also to email Scott Burleigh.
* 10Apr18: Sam to finalize responses to Peter and Scott by April 20, 2018

**523.2.M C++ API (NASA) Dan Smith**

* 10Apr18:Dan/Sam to review final RID resolution. Should provide package to Mario by 24Apr18.

**524.3.B HTTP/XML** **(ESA, NASA/JPL) Sam Cooper**

* 8Feb18: Approval to Publish, But there were issues with some RIDs
* 12Feb18: Sam quickly resolved issue, Mario submitted request to publish
* 10Apr18: Awaiting poll for publication

**524.4.B ZMTP Binding: (CNES, ESA) Olivier Churland**

* 12Feb18: Agency review closed. No comments from JAXA, INPE, CNES. 5 from ESA
* 10Apr18: ESA RIDs and Peter Shames comments provided to CNES

**660.0 XTCE 1.2 Blue Book (NASA) Dan Smith**

* 19Feb18: Submitted to OMG for formal approval
* 10Apr18: OMG has approved technical content. Per CCSDS rules, will wait for OMG publication to begin CCSDS Agency Review. Possibly September 2018. Will be an up/down vote.

**660.1; 660.2 XTCE 1.2 Green Books Dan Smith**

* This books will need minor updates once the XTCE Blue Book is updated.  No action should be taken until the OMG releases their XTCE 1.2 Specification later this year.
* 10Apr18: NASA agrees to evaluate current document for needed changes. Will then recommend that it be CONFIRMED for 5 more years or a project will be open to update the documents.

**SM&C Roadmap**

**Updated at the NIST Meetings in Gaithersburg, Maryland USA**

**April 9-13, 2018**

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