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**Comments on document:**

**“Overlap Assessment between OMG C2MS and CCSDS MO”**

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# General Comment

This assessment was prepared “on behalf of CCSDS SM&C Working Group members of CNES, DLR and ESA”. This is a carefully worded statement. I am the SM&C Working Group Chair and this is not a product of that working group and NASA was not asked to participate in the preparation of the document. As the SM&C WG Chair, I would object to any implication that this is an SM&C product or supported by the WG. And unless fully reviewed by the SM&C WG, CESG, and CMC, I do not feel that it should go to the OMG as an official CCSDS paper.

# Document Purpose

1. The document discusses perceived overlaps between C2MS and MO. What is not clear is what the end-goal is or what how the document should be used.
	1. There does not appear to be a reason to share this with the OMG.
	2. Note that the CCSDS MOIMS Area Director has been aware of the C2MS initiative from the start. He chose not to attend the 2+ hour discussion on this topic at the last CCSDS meeting, but was later briefed. We always report OMG status at the CCSDS meetings and CCSDS status at the OMG meetings – although the CCSDS liaison typically does not participate in any of the discussions.
	3. There is no strong recommendation for follow-up actions
	4. There is a statement that MO can benefit from some of the OMG work and also a statement that the two standards may not both be needed.
2. Not clear how this submittal aligns with the OMG processes
	1. In the case of C2MS, comments were to be submitted by May 2018. No comments were received from CCSDS.
	2. Mario Merri submitted a vague comment after the due date and not through the OMG comment web site that referred to non-specified overlaps with the CCSDS MO standards and indicated that details would be provided in late June.
	3. In late June, the OMG met for its vote on accepting C2MS as a standard. The report expected from Mario Merri was not received in time for the meeting (and still has not been received) and it was not clear whether the contents would merit any reconsideration.
	4. At the OMG meeting it was noted that the OMG is not a consensus organization – they use a “majority rules” approach on their approval votes. The potential for getting more details from Mario Merri at some TBD future date did not change the vote outcome.
	5. It was also noted by the OMG that C2MS is not an OMG “built from scratch” proposed standard. Instead, it went through their “Request for Comment” process. With RFCs, it must be shown that what is proposed for a formal standard is already in use by multiple parties and is effectively already a standard (but not formal). C2MS is in use by multiple U.S. government agencies, major U.S. contractors, and most U.S. telemetry and command system product vendors. These groups voiced their support for C2MS. Common use is the key criteria that C2MS was submitted under. The OMG Board understood that the C2MS broad use claims were not being challenged by Mario’s email.

# OMG-CCSDS Working Relationship

Should emphasize how OMG and CCSDS work together and how C2MS utilizes CCSDS standards.

1. The OMG Space Domain Task Force (SDTF) holds CCSDS in very high regard and defers to CCSDS where it feels standards already exist or are planned. Navigation messages and telemetry frame/packet messages in C2MS consist of a routing header and a data block which is defined to match the corresponding CCSDS format. References to CCSDS are provided.
2. C2MS has held off on defining schedule messages, assuming that this is a current CCSDS area for which formats will be developed.
3. A recent effort by the OMG to develop a ground station schedule format was halted when it became clear that the CCSDS simple schedule format could meet their needs. NASA and CCSDS supported the assessment activities of the OMG and their member organization.
4. The OMG has suggested that a standard is needed for shareable data displays. The ideas were discussed at the CCSDS meetings at NIST and the CCSDS SM&C WG decided that the interest level was high but also that it was more appropriate for the OMG to develop the standard.
5. There is a liaison position between CCSDS and the OMG. Mario Merri serves this position for CCSDS and Steve MacLaird from the OMG interfaces with CCSDS. Dan Smith is NASA’s technical point-of-contact to the OMG and James Afarin is the NASA OMG Lead and voting member.

# Style and Formatting.

1. Cover page. Please spell out the acronyms that are used, starting with the title of the paper.
2. Add page numbers.

# Technical Points – Section 3

1. Differences in Objectives. It is true that both MO and C2MS deal with space data systems. MO is defined very broadly and supports interoperability, software reuse within agencies, common interfaces to spacecraft, on-board use, new ops concepts, and more. C2MS normalizes key existing interfaces common to available commercial products as a way to simplify the integration of the mixed vendor systems. C2MS grew out of the NASA GMSEC system which grew out of a collaboration with many commercial product vendors.
2. Differences in Approach. MO is a full Service Specification. It includes service specifications, message abstraction, transport choices and more and has been in development for over 15 years. C2MS follows the newer OMG-directed approach to standards and consists only of the message formats modeled in UML to create a Platform Independent Model (PIM) and from one to many Platform Specific Models (PSMs). The NASA reference architecture, API layer, transport options, and functional tools are not part of the OMG standard. MO assumes new underlying operations concepts and the C2MS is geared towards current common practices and does not preclude local or future changes.
3. Section 3 says that because the OMG only standardizes the messages and not the API and transport and that C2MS can not be considered to be an interoperable standard. The dozens of missions and vendors that have used the C2MS messages are proof otherwise. Technically, one could say that a common C2MS-compliant reference architecture [in conjunction with the C2MS] is what provides the interoperability. The OMG philosophy is that a single C2MS standard could be implemented within multiple architectures and systems.
4. It is true that C2MS is designed with ground-ground communications in mind and some of the messages would need work if the intent changed to space-ground. [Is this really an overlap discussion?] Similarly, MO was designed with ground-space efficiencies in mind and many aspects will have to be changed to support ground-ground efficient interactions between agencies.
5. Not clear why the GMSEC API is referred to as proprietary in Section 3. It is U.S. government owned and freely available as open source. It is cleared for U.S. export release and is used on dozens of missions.
6. Saying there is no on-the-wire C2MS format is not clear. The C2MS spec uses UML diagrams, but the XML derivative is also part of the OMG specification doc set. The XML data exchanges can be used between cooperating systems with any choice of transport. It is true that, as with MO services, a middleware product will package the messages in its own way and therefore one could say that neither has an on-the-wire format when transport products are involved.

# Technical Points – Section 4

1. The table seems to show that there are significant differences in MO and C2MS and less overlap that we had thought. C2MS is more of a general purpose approach and MO is very specific. Each has advantages. The heart of C2MS implementations are the LOG and DIRECTIVE messages which are typically used by nearly all applications. DIRECTIVE supports any function an application has, just like a user input would. In MO, the individual functions must be part of the specification and therefore not very useable when trying to integrate many products from different vendors coming from a non-MO background.

# Technical Points – Section 5

1. Much of Section 5 seems to be a technical comparison of the implementation approaches taken and not a comparison of any functional overlaps.
2. In 5.1, “C2MS’s use of messages is the main interface for the user due to the lack of a standardized API”. Note that dozens of missions have used the C2MS messages since 2005 using an open government-managed API. In keeping with the OMG’s philosophy, the messages themselves form the standard. For system developers, the available compliant API provides the next level of commonality. The common API simplifies message construction, delivery, security, and more. It is much easier for developers to use than the full MO support suite.
3. In 5.2, the interaction patterns are typical for system architectures and interfaces regardless of the purpose of the system. Not an overlap topic.
4. In 5.3, Data Types. Not an overlap topic. Of course data systems will all have multiple (overlapping!?) data types.

# Technical Points - Section 6

The summary table makes it look like C2MS and MO are nearly identical. This is not the case. C2MS is derived from the successful maturation of message standards by dozens of missions over the past 13 years. It is supported by U.S. industry and multiple US space organizations and is considered, at least in the U.S., as a much more mature and proven standard than MO with a purpose of C2MS that is aligned with how systems are typically built in the U.S. When interacting with other U.S. space organizations, NASA always recommends that they also look at MO. Because of MO’s limited deployment record and lack of vendor support, none of the other organizations have chosen to go with MO. They have, however, supported the C2MS efforts and the current work to formally recognize it as an OMG standard.

MO has a much broader scope and puts a lot of emphasis on specifying each allowable function as an international standard. C2MS is more about defining simple interfaces and allowing continual innovation in the set of functional capabilities and development organization provides.

Note that several years ago, a NASA GSFC team showed that they could interface an MO capability for an external interface with a C2MS-based system internally. That should be a perfectly acceptable scenario.

Within NASA, MO should be considered for inter-Agency interoperability.

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