REVIEW ITEM DISPOSITION (RID):

 RED BOOK RID INITIATION FORM

AGENCY RID NUMBER:

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DOCUMENT NUMBER: CCSDS 732.0-P-2.1 Pink Sheets, Issue 2.1

DOCUMENT NAME: AOS Space Data Link Protocol

DATE ISSUED: December 2008

PAGE NUMBER: multiple (See below) PARAGRAPH NUMBER: multiple

RID SHORT TITLE: Add MC\_OCF Service

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DESCRIPTION OF REQUESTED CHANGE: (Use From: "..." To "..." format)

1. Page 2-6, section 2.2.3.1: change the third sentence from:

“One of them (Master Channel Frame) is provided for a Master Channel”
To:

“Two of them (Master Channel Operational Control Field and Master Channel Frame) are provided for a Master Channel”.

1. Page 2-6, Table 2.1: add an MC\_OCF row, copied from TM SDLP table 2-1.
2. Section 2.2.3: Insert a new section “Master Channel Operational Control Field (MC\_OCF) Service”, copied from TM SDLP 2.2.3.8.
3. Page 2-9, section 2.2.4: insert a new restriction on service:

“on one Master Channel, the Virtual Channel Operational Control Field Service shall not exist simultaneously with the Master Channel Operational Control Field Service;”.

1. Page 2-10, Figure 2-5: insert a Master Channel Generation layer with MC\_OCF Service between the Virtual Channel Multiplexing and Master Channel Multiplexing layers.
2. Page 2-10, Figure 2-6: insert a Master Channel Reception layer with MC\_OCF Service between the Virtual Channel Demultiplexing and Master Channel Demultiplexing layers.
[NOTE – Figure 2-7 (AOS Space Data Link Protocol Channel Tree) already has the MC\_OCF Service and does not need to be changed.]
3. Page 3-2, paragraph 3.2.5.1: Change the first sentence to “Operational Control Field Service Data Units (OCF\_SDUs) shall be transferred over a space link with the VC\_OCF or MC\_OCF Service. Data units ~~shall~~ may be carried in every Transfer Frame of a Virtual Channel (using the VC\_OCF Service), or in every frame of a Master Channel (using the MC\_OCF Service).” [Additions are underlined, deletions struck through.]
4. Page 3-2, paragraph 3.2.5.2, change the first sentence to “Although the transfer of OCF\_SDUs is synchronized with the Virtual Channel or Master Channel that shall provide the transfer service, the creation of OCF\_SDUs by the sending user may or may not be synchronized with the Virtual Channel or Master Channel.”
5. Page 3-3, section 3.2.6: insert the following specification:

“Transfer Frames transferred by the Virtual Channel Frame and Master Channel Frame Services shall be partially formatted TM Transfer Frames, and the following restrictions apply:

a) if the Insert Service exists on the Phyisical Channel, the Insert Zone of all Transfer Frames submitted to the Virtual Channel Frame Service or the Master Channel Frame Service on the same Physical Channel shall be empty;

b) if the MC\_OCF Service exists on a Master Channel, the Operational Control Field of the Transfer Frames submitted to the Virtual Channel Frame Service or Master Channel Frame Service on the same Master Channel shall be empty;

c) the Frame Error Control Field of the Transfer Frames submitted to the Master or Virtual Channel Frame Service shall be empty, if it is present on the Physical Channel.”

1. Section 3: Insert a new section “Master Channel Operational Control Field (MC\_OCF) Service” with content technically identical to that of TM SDLP 3.9, with the following exception: in the subsection titled “OCF\_SDU Loss Flag”, replace the last sentence with

“If implemented, the flag shall be derived by a signal given by the underlying Channel Coding Layer.”

[NOTE – This follows the same criteria as is used for determining the loss of a Master Channel Frame. However, if multiple MCs are present on the same physical channel, it may not be possible to unambiguously detect frame or OCF loss in one of those MCs. Any resolution of this ambiguity for MC Frames (e.g., through inclusion of a further constraint that this method works only when a single MC is present on a Physical Channel) should also be applied to MC\_OCFs.]

1. Page 4-10, paragraph 4.1.4.1.5: change NOTE 1 to

“Transfer Frames containing Idle Data in their Data Fields are sent to maintain synchronization at the receiver and also to transmit data in the Transfer Frame Insert Zone and/or the Operational Control Field on a specific Master Channel when there is no Data Field to send.”

1. Page 4-14: insert a new paragraph after 4.1.5.1: “If present, the Operational Control Field shall be associated with either a Master Channel or a Virtual Channel.”
followed by the note:

“NOTE -The association of an Operational Control Field with a Master Channel allows data to be transferred synchronized with this Master Channel. The association of an Operational Control Field with a Virtual Channel allows data to be transferred synchronized with this Virtual Channel.”

1. Page 4-14: change the paragraph currently numbered 4.1.5.2 to “The Operational Control Field is optional; its presence or absence is established by management for each Virtual Channel or Master Channel.”
2. Page 4-14: change the paragraph currently numbered 4.1.5.3 to

“If the Operational Control Field is present on a Virtual Channel, it shall occur within every Transfer Frame transmitted through the associated Master or Virtual Channel throughout a Mission Phase.”

1. Page 4-21, section 4.2.5.5, figure 4-9: change the text in the bottom box of the figure from ”Master Channel Multiplexing Function” to “Master Channel Generation Function”.
2. Page 4-20, section 4.2: insert a new section 4.2.6, “Master Channel Generation Function”:

**4.2.6.1** The Master Channel Generation Function shall be used to insert Operational Control Field service data units into Transfer Frames of a Master Channel.

NOTE - There is an instance of the Master Channel Generation Function for each Master Channel.

**4.2.6.2** If there is a user of the MC\_OCF Service for a particular Master Channel, an OCF\_SDU supplied by the user shall be placed in the Operational Control Field.

**4.2.6.3** An abstract model of the Master Channel Generation Function is illustrated in figure XXX.

1. Insert a figure XXX that is the same as figure 4-9 of the TM SDLP spec except that there is no MC\_FSH Service User input, and the text in the middle box is just “Commutation”.
2. Page 4-28, figure 4-16: change the text in the bottom box of the figure from “Master Channel Demultiplexing Function” to “Master Channel Generation Function”.
3. Page 4-28, section 4.3: insert a new section 4.3.6, “Master Channel Reception Function”:

**4.3.6.1** The Master Channel Reception Function shall be used to extract service data units contained in the Operational Control Field from Transfer Frames of a Master Channel.

NOTE - There is an instance of the Master Channel Reception Function for each Master Channel.

**4.3.6.2** If there is a user of the MC\_OCF Service for a particular Master Channel, OCF\_SDUs contained in the Operational Control Field of the Transfer Frames shall be extracted and delivered to the user.

**4.3.6.3** If frame loss is signaled by the underlying Channel Coding Sublayer, a Loss Flag may (optionally) be delivered to users.

**4.3.6.4** An abstract model of the Master Channel Reception Function is illustrated in figure 4-YYY.

[NOTE – Paragraph 4.3.6.3 is phrased comparably to that used for determining the loss of a Master Channel Frame. However, if multiple MCs are present on the same physical channel, it may not be possible to unambiguously detect frame or OCF loss in one of those MCs. Any resolution of this ambiguity for MC Frames (e.g., through inclusion of a further constraint that this method works only when a single MC is present on a Physical Channel) should also be applied to MC\_OCFs.]

1. Insert a figure YYY that is the same as figure 4-16 of the TM SDLP spec except that there is no MC\_FSH Service User output.

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CATEGORY OF REQUESTED CHANGE:

 Technical Fact \_\_\_ Recommended \_X\_\_ Editorial \_\_\_

NOTES:

TECHNICAL FACT: Major technical change of sufficient magnitude as to

 render the Recommendation inaccurate and unacceptable if not

 corrected. (Supporting analysis/rationale is essential.)

RECOMMENDED: Change of a nature that would, if incorporated, produce

 a marked improvement in document quality and acceptance.

EDITORIAL: Typographical or other factual error needing correction.

 (This type of change will be made without feedback to submitter.)

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SUPPORTING ANALYSIS:

Although AOS is intended for missions with high frame rates in which there is no need to sample the CLCW (if that is what the OCF carries) at such high rates, this operational scenario typically applies when the mission is in its routine phase. During LEOP the frame rate generally is much lower and that is when COP-1 is most helpful. Missions will not be willing to implement both AOS (for routine) and TM (for LEOP and/or safe mode).

The SLE ROCF transfer service is already defined to support MC\_OCF as well as VC\_OCF for both TM and AOS links. Explicitly providing MC\_OCF service on AOS return links aligns the AOS SDLP with the SLE ROCF service.

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DISPOSITION:

Number 2: Affecting CCSDS 732.0-B-2 AOS Standard

I refer to clause 4.2.2.5 below.



Being [3]  TM Synchronization and Channel Coding . Recommendation for Space Data System Standards, CCSDS 131.0-B-1. Blue Book.

this is a clear mistake.

In fact 131.0 does not speak at all about Idle Packets.

I am not fully sure that the fix could be limited to replacing [3] with a reference to the Space Packet Protocol.....

Regards

Gian Paolo

Number 3: Another possible correction for AOS and TM Standards (CCSDS 132.0-B & 732.0-B): First Header pointer vs. Frame Length

While the AOS and TM Standards define  the frame formats, the same standards just state, under managed parameters, "Transfer Frame Length (octets) Integer" and they require

4.1.1.2 The AOS Transfer Frame shall be of constant length throughout a specific Mission Phase for any Virtual Channel or Master Channel on a Physical Channel. Its length shall be consistent with the specifications contained in reference [3].

4.1.1.2 The TM Transfer Frame shall be of constant length throughout a specific Mission Phase for any Virtual Channel or Master Channel on a Physical Channel. Its length shall be consistent with the specifications contained in reference [3].

Being [3]  TM Synchronization and Channel Coding . Recommendation for Space Data System Standards, CCSDS 131.0-B

Then 131.0 gives a maximum frame size of about 16 kbits; i.e. around 2048 octets.

 (for AOS & TM Standards see . <http://public.ccsds.org/publications/archive/132x0b1c1.pdf> & <http://public.ccsds.org/publications/archive/732x0b2c1.pdf>)

However this is just one limitation as there is another essential limitation - given precisely by those standards - imposed by the First header Pointer.

Both AOS and TM standards use a First Header Pointer (FHP) of 11 bits and:

4.1.4.2.3.2 The First Header Pointer shall contain the position of the first octet of the first Packet that starts in the M\_PDU Packet Zone.

4.1.2.7.6.2 If the Synchronization Flag is set to 0, the First Header Pointer shall contain the position of the first octet of the first Packet that starts in the Transfer Frame Data Field.

As the location does not include header & trailer bytes, it comes out that **the maximum frame length for a frame using the FHP is a few bytes more that 2048**. The precise value is not really relevant.

Of course there is the possibility of not using the FHP and then removing such a maximum frame size.

I think it would be appropriate adding a note (or something else) in both standards to state that a Frame using the FHP the size of the "M\_PDU Packet Zone / Transfer Frame Data Field" cannot exceed the value of 2046 (as two values are reserved for no-packed and only idle data.

Comments and proposals are welcome

Regards

Gian Paolo