

Space Link Services Area Report

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25th October 2019 Version 1.0 as @ CESG Meeting



SLS Area Report - B. Meeting Demographics

Agency	5.01 - SLS - RF and Mod & 5.02 Space Link Coding and Sync & 1.06 Delta D-DOR Working Groups	5.01 - SLS - RF and Modulation Working Group	5.02 - SLS - Space Link Coding and Synchronization Working Group	5.03 - SLS - Multispectral and Hyperspectral Data Compression Working Group	5.04 - SLS - Space Link Protocols Working Group	5.09 - SLS - Space Data Link Security Working Group	5.10 - SLS - Optical Communications Working Group
CNES	1	1	1	3	1	2	2
CNSA		1	1		2		6
DLR	1	1	2		2	1	9
ESA	10	10	9	5 +2	2	4	9
JAXA	2	1	1				6
NASA	7	5	9	3	5	5	13
ROSCOSMOS	8	5	8		4		
UKSA			1		1	3	
Other (Netherlands Space Office)							1
Total	29	24	32	11 +2	17	15	46
Meeting Duration	0.5	1.0	1.0	2.5	1.0	1.5	2.5
Agency Diversity	6	7	8	3	7	5	7

Webex or telecon participants:
MHDC: +2
ESA

Space Link Services Area Executive Summary 1/2

RF & Modulation (RFM) Working Group:

- Achievements
 - WG agreed on publication of new issue of 401.0-B including
 - new Recommendation (2.1.9) on multiple uplink carriers for MSPA,
 - new Recommendation (2.6.14) on transponder turnaround ratios for the 22/26 GHz bands,
 - revised Recommendation (2.3.7) on earth station oscillator frequency stability
 - WG agreed to start agency review for revised 401.0-B Recommendation (3.1.6B) on deep space frequency channels

Coding & Synchronization (C&S) Working Group:

- Achievements
 - 431.1 (VCM protocol) Blue Book: Reports finalization expected by November to resolve for publication
 - 130.1-G (TM C&S) Green Book: Ongoing final check before requesting publication
 - 230.1-G (TC Green Book): Final update presented, WG review will be initiated in a few days.
 - 231.0-B-3 (TC C&S) Blue Book: Resolution to start Agency Review expected by end of the year
 - Resolution to update 131.0-B TM Coding Blue Book with new randomizer for high rates

Space Link Protocols (SLP) Working Group:

- Achievements
 - Consensus achieved for Publication of CCSDS 700.1-G USLP Green Book Issue 1
 - ESA, NASA, DLR RIDs resolved. WG consensus to publish CCSDS 133.0-B-2 SPP.
 - ESA RIDs resolved. WG consensus to publish CCSDS 133.1-B-3 EPP
 - CCSDS 211.0 Prox-1 SDLP: WG consensus to request pink sheets adding USLP frame.



Space Link Services Area Executive Summary 2/2

Space Data Link Security (SDLS) Working Group:

- Achievements
 - SDLS Extended Procedures (355.1-B): Review of the final draft provided to CTE for publication poll
 - SDLS Extended Procedures Green Book (350.11-G): review of contributions.
 - SDLS Core protocol (355.0-B) revision: review of preliminary pink sheets for project creation.

Multispectral & Hyperspectral Data Compression (MHDC) Working Group:

- Achievements
 - “Lossless Data Compression” (121.0-B) completed successful cross-verification of new features. Pink Sheets to undergo CMC poll to start Agency Review

Optical Communications (OPT) Working Group:

- Achievements
 - Resolution to start Agency Review for Optical Communications Physical Layer Issue 2 to add (O3K)
 - Plan to reach consensus on O3K Coding and Synchronization at Spring 2020 Meeting.
 - Magenta Book “Atmospheric Characterization and Forecasting for Optical Link Operations”: Expect to request start of Agency Review before end of the year
 - High Data Rate 1550 nm Orange Book: Expect to request publication before the end of the year
 - Resolution to start a new project for updating Optical Communications Coding and Synchronization Layer to add Generic Framing Procedure (GFP) → See Issues

RFM WG Executive Summary

Achievements for this meeting cycle:

- WG agreed on publication of new issue of 401.0-B including
 - new Recommendation (2.1.9) on multiple uplink carriers for MSPA,
 - new Recommendation (2.6.14) on transponder turnaround ratios for the 22/26 GHz bands,
 - revised Recommendation (2.3.7) on earth station oscillator frequency stability
- WG agreed to start agency review for revised 401.0-B Recommendation (3.1.6B) on deep space frequency channels
- WG agreed to revisions of 401.0-B Recommendations (2.4.18) and (2.4.23) to define the 16-APSK and 32-APSK ring radii ratios when used with codes in 131.0-B-3. Agency Review to start after VCM BB publication.

Working Group Status: **Good progress**

- Discussed revisions to draft new 401.0-B Recommendation (2.6.13) on flexible turn-around ratios to support MSPA
- Discussed draft revisions to frequency channel assignments in 211.1-B Prox-1 Physical Layer BB
- Discussed draft new 401.0-B Recommendation for PN spread DOR tones with DDOR WG

Interaction with other WGs:

- Joint meeting with C&S WG and DDOR WG: Discussed randomizer for high rate telemetry, channel modelling for DVB-S2X and SCCC-X, and PN spread DOR tones

Problems and Issues:

- None

RFM WG Executive Summary

Resolutions agreed upon this meeting:

- Resolution for publication of 401.0-B new issue including
 - NEW Recommendation (2.1.9) on multiple uplink carriers for MSPA support
 - NEW Recommendation (2.6.14) on transponder turnaround ratios for the 22/26 GHz frequency bands
 - REVISED Recommendation (2.3.7) on earth station oscillator frequency stability
- Resolution to begin agency review of revised 401.0-B Recommendation (3.1.6B) on deep space frequency channels

Further Resolutions anticipated in the next 6 months:

- None

Planning:

SLS RFM	401.0	Evolutions of CCSDS recommendations for RF & Modulation systems, part 1	Progress continues	Start date 10/15/2008 End date 04/15/2021
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SLS-RFM Summary of 401.0-B Recommendations

CCSDS Recommendation	Title	Status / Comments
401.0-B (2.1.9)	MULTIPLE UPLINK CARRIERS FOR SPACE RESEARCH EARTH STATION SUPPORT OF MULTIPLE SPACECRAFT PER APERTURE	Disposition of RIDs completed; ready for publication
401.0-B (2.3.7)	EARTH STATION OSCILLATOR REFERENCE FREQUENCY STABILITY	Disposition of RIDs completed; ready for publication
401.0-B (2.4.18)	MODULATION METHODS AT HIGH SYMBOL RATE TRANSMISSIONS, EARTH EXPLORATION SATELLITES 8 GHZ BAND, SPACE-TO-EARTH	WG agreed on proposed changes; on hold until 431.1 VCM book is published
401.0-B (2.4.23)	MODULATION METHODS AT HIGH SYMBOL RATE TRANSMISSIONS, EARTH EXPLORATION SATELLITES 25.5-27.0 GHZ BAND, SPACE-TO-EARTH	WG agreed on proposed changes; on hold until 431.1 VCM book is published
401.0-B (2.6.13)	TRANSPONDER TURNAROUND FREQUENCY RATIOS FOR MULTIPLE SPACECRAFT PER APERTURE SUPPORT IN THE 7145-7235 MHz AND 8400-8500 MHz BANDS	Under discussion in WG
401.0-B (2.6.14)	TRANSPONDER TURNAROUND FREQUENCY RATIOS FOR THE 22.55-23.15 GHz AND 25.5-27.0 GHz BANDS, SPACE RESEARCH CATEGORY A	Disposition of RIDs completed; ready for publication
401.0-B (3.1.6B)	CHANNEL FREQUENCY PLAN FOR 2, 7, 8, 32, AND 34 GHZ, CATEGORY B	WG agreed on proposed changes; ready to proceed for agency review

C&S Executive Summary

Achievements for this meeting cycle:

- 431.1 (VCM protocol) Blue Book: All RID Resolutions agreed. Latest action from Agency Review closed. Yellow book for Interoperability Reports finalization expected by November to resolve for publication
- 130.1-G (TM C&S) Green Book: Update (including parallel encoders scheme & Turbo Codes material) distributed for final check before requesting its publication
- 230.1-G (TC Green Book): Final update presented, WG review will be initiated in a few days.
- 231.0-B-3 (TC C&S) Blue Book: Confirmed agreement for the modifications to a new draft will go to WG review before being proposed for Agency Review (expected by end of the year)
- 131.6-O (DVB-S2X) Orange Book: New draft presented, final WG review expected to start in the next few days
- 131.20-O (SCCC-X) Orange Book: New draft presented, final WG review expected to start in a few weeks (following an additional update)
- Agreement on the TM Randomizer for High Data Rates (NASA & ESA contributions) for 131.0-B, with request to start new project to implement the change.
- Agreement to liaise with SLP to request a standardized definition of OID Frames generation

Working Group Status: **Good progress**

Interaction with other WGs

- Most of the topics discussed (e.g. VCM, randomizer) were topics of common C&S/RFM interest
- Liaisons expected with SLP: request work on OID, request alignment of terminology with 231.0-B for repeated tx

Problems and Issues:

- none



C&S Executive Summary

Resolutions agreed upon this meeting:

- Resolution for new CWE Project to update 131.0-B **TM Coding Blue Book** with new randomizer for high rates

Further Resolutions anticipated in the next 6 months:

- Publish 431.1 **VCM Blue Book** as per finalized Agency Review (when yellow book finalized)
- Publish 130.1-G **TM Coding Green Book** adding parallel encoders for (O)QPSK modulation and turbo codes issues in burst noise
- Publish 230.1-G **TC Coding Green Book** (material related to LDPC)
- Publish **131.16-O (DVB-S2X)** and **131.20-O (SCCC-X)**

C&S Planning (1 of 3)

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS C&S	130.11	TM Channel Coding for SCCC, Green Book	Published April 2019	Target: Nov 2019
SLS C&S	230.1-G-3	TC Channel Coding, Green Book	WG final review to start	Target: Nov 2019
SLS C&S	131.6	DVB-S2x Orange Book	WG final review to start	Target: Jan. 2020
SLS C&S	131.20	SCCCx Orange Book	Updated material to be reviewed	Target: March 2020
SLS C&S	431.1	Variable Code and Modulation (VCM) Systems for CCSDS	Agency Review concluded Yellow Book to be finalized	Target: Spring 2020
SLS C&S	211.2	Edit Dates Proximity-1 Coding & Synchronization Sublayer Modification to support USLP Frame Format	(Almost) Published CMC Poll approved Publication on 21 Oct. 2019	Target: December 2019

C&S Planning (2 of 3)

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS C&S	131.0	TM Sync and Channel Coding (Issue 4 to Define subset for uplink and add USLP)	No progress in this meeting	Target: Oct 2020
SLS C&S	131.0	TM Sync and Channel Coding (Issue 5 to Add channel interleaver for Turbo Codes)	No progress in this meeting	Target: Jan 2021
SLS C&S	231.0	TC Sync and Channel Coding (New Issue to Modify randomizer position for LDPC)	Plan to start Agency Review by end of 2019	Target: Sept 2020
SLS C&S	130.1	"TM Synchronization and Channel Coding - Summary of Concept and Rationale, Informational Report" Green Book Issue 3	Good progress. Publication to be requested before end of 2019	Target: Jan 2020

C&S Planning (3 of 3)

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS C&S	131.2	Flexible Advanced Coding and Modulation Scheme for High Rate Telemetry Applications, (Issue 2 to add USLP, uplink, etc.)	No progress in this meeting	Target: Oct 2020
SLS C&S	131.3	Space link protocols over ETSI DVB-S2 standard, (Issue 2 to add USLP, uplink, etc.)	Draft update presented in this meeting.	Target: Oct 2020

C&S Upcoming New Work Items

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS C&S	131.0-B	TM Sync and Channel Coding (Issue TBD)	Jan 2020 / End 2021	2020 9 WM (2 wm 2020, 7 WM 2021)	3 WM NASA (2 WM 2020 1 WM 2021)	3 WM NASA (2021)	3 WM ESA (2021)	Add longer randomizer for high data rates for spectral compliance

SLS-SLP Executive Summary

Achievements for this meeting cycle:

- Consensus achieved for Publication of CCSDS 700.1-G USLP Green Book Issue 1
- ESA, NASA, DLR RIDs resolved. Resolution to publish CCSDS 133.0-B-2 SPP will be issued after checking version with implemented changes and integration of more detailed SANA Annex.
- ESA RIDs resolved. WG consensus to publish CCSDS 133.1-B-3 EPP
- CCSDS 211.0 Prox-1 SDLP: WG consensus to start Agency Review on adding USLP frame.

Working Group Status: **Good progress**

Interaction with other WGs

- Coordination with CSTS WG on assessing the impact of USLP on SLE services. Only RCF & ROCF impacted. Due to USLP Frame header size changes, CSTS models require updates.
- New issues of SPP and EPP will impact Magenta Book for CFDP operations over Encapsulation (to be coordinated with SIS Area)
- Liaisons expected with C&S WG requesting work on pattern in OLD Frames and alignment of terminology with 231.0-B for TC repeated transmission [systematic retransmission in SLP]

Problems and Issues:

- None

SLS-SLP Executive Summary

Resolutions agreed upon this meeting

- CCSDS 133.1-B EPP: issue Version 3.0 Blue Book
- CCSDS 700.1-G USLP: issue Version 1.0 Green Book
- CCSDS 211.0-P Proximity-1 SDLP: start Agency Review

Further Resolutions anticipated in the next 6 months:

- CCSDS 133.0-B SPP: issue Version 2.0 Blue Book
- Publication of Issue 6 of CCSDS 211.0-P Proximity-1 SDLP

Remark: 133.1-B is changing title from *Encapsulation Service* to *Encapsulation Packet Protocol* (also alignment with SPP).

SLS-SLP Planning

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS SLP	211.0	Proximity-1 Space Link Protocol - Data Link Layer (Issue6)	Release the revised document for Agency Review	Target date: Feb 2021
SLS SLP	700.1	Unified Space Data Link Protocol Green Book	Publish the Version 1	Target date: Fall 2019
SLS SLP	130.0	Overview of Space Communications Protocols, Issue 4	Work in progress	Target Date: Jan 2021
SLS SLP	133.0	Space Packet Protocol	Publish the Version 2 in a few weeks	Target date: End 2019
SLS SLP	133.1	Encapsulation Packet Protocol	Publish the Version 3 (with new name)	Target date: End 2019
SLS SLP	707.1	SLS Glossary of Terms	Work in Progress	Target date: Summer 2021
SLS SLP	130.3	SPP and EPP Summary of Concepts, Rationale Version 1.0	Not Yet Started	Target Date: June 2021

SLS-SEA-SDLS Executive Summary

Achievements for this meeting cycle:

- SDLS Extended Procedures (355.1-B): finalization of draft blue book provided to CTE for publication poll. Interoperability testing completed. To start CESG+CMC Polls.
- SDLS Extended Procedures Green Book (350.11-G): develop and edit contributions.

Working Group Status: **Good progress**

- SDLS Extended Procedures draft BB (355.1-B) :
 - Complete detailed review of final text submitted to ADs.
- Review all contributions to SDLS Extended procedures green book (350.11-G):
 - Discussion of various mission scenarios for SDLS-EP including ISL and constellations.
 - Discussion of justifications for baseline mode parameters
- Review draft pink sheets for revision of SDLS Core Protocol (355.0-B-1): introduction of USLP as the 4th compatible Space Link Protocol, introduction of Extended Procedures,
- Presentation of key injection techniques using Public Key Infrastructure: will be added to key management green book (SEA-SEC)

Interaction with other WGs: None (in addition to permanent interaction with SEA-SEC)

Problems and Issues: None

SLS-SEA-SDLS Executive Summary

Resolutions agreed upon at this meeting:

- Creation of project for updating SDLS Core Protocol (355.0-B)

Further Resolutions anticipated in the next 6 months:

- None

Planning:

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS SDLS	355.1	SDLS Extended Procedures	Final blue book draft delivered to CTE. Interoperability testing completed with final version of the document. To start CESG+CMC Polls.	WG Resolution for publication done in October 2019. Resulting BB publication anticipated in December 2019
SLS SDLS	350.11	SDLS Extended Procedures Green Book	Drafting on-going.	Target date for publication : 30/09/2020.

SLS-SEA-SDLS Upcoming New Work Items

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS SEA-SDLS	355.0-B	SDLS Core Protocol	Jan 2020 / Mid 2021	6 WM 2020 1.5 WM 2021 4.5	2 WM ESA or CNES (1.5 WM 2020 0.5 WM 2021)	2 WM UKSA TBC (2021)	2 WM DLR TBC (2021)	Add USLP as the 4th compatible Space Link Protocol, introduction of Extended Procedures, etc.

SLS-MHDC Executive Summary

Achievements this meeting cycle:

- CCSDS-121.0-B Lossless Data Compression:
 - Completed cross-verification of new features ready to be introduced in Issue 3 revision.
 - Pink Sheets to start CMC polling. WG agreed on minor change to address comment arising from CESG poll.
- SAR Compression
 - WG agreed to request new project to develop Blue Book standard for compression of raw SAR data

Working Group Status: **Good progress**

- CCSDS-121.0-B Lossless Data Compression
 - Yellow Book documenting cross-verification of new features nearly complete. To start Agency review soon.
- CCSDS 120.0-G Lossless Data Compression
 - Reviewed and agreed on some revisions to conduct WG final review at Spring 2020 meeting.
- CCSDS-120.2-G (GB for CCSDS-123.0-B-2) Low-Complexity Lossless & Near-Lossless M & H Image Compression
 - Substantial new text reviewed and adopted. Action items assigned to complete remaining sections and conduct WG final review at Spring 2020 meeting.
- CCSDS-124.0-B telemetry housekeeping compression
 - Reviewed significant revisions to previous draft and overview of alternative approaches.
 - Agreed on next steps to be completed before next telecon (in approx. 3 months) to agree on path forward.
- SAR Compression
 - Agreed to request new project for compression of raw SAR data
 - Approach for compression of partially processed SAR data to be further assessed for onboard feasibility

Interaction with other WGs None

Problems and Issues: None

SLS-MHDC Executive Summary

Resolutions agreed upon this meeting

- Resolution to request new Blue Book project “Compression of Raw Synthetic Aperture Radar Data”

Further Resolutions anticipated in the next 6 months:

- None

Planning (only approved Projects):

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS MHDC	121.0	Lossless Data Compression (Issue 3)	CESG poll completed, to go to CMC Poll (Start Agency Review)	Start date 10/2018 End date 09/2020
SLS-MHDC	124.0	Robust Compression of Fixed-Length Housekeeping Data Packets	Revised draft White Book reviewed	Start: 4/2018 End: 12/2020
SLS MHDC	120.0	Lossless Data Compression (Issue 4)	Expect complete draft Spring 2020	Start date 10/2018 End date 7/2020
SLS-MHDC	120.2	Low-Complexity Lossless & Near-Lossless Multispectral & Hyperspectral Image Compression (Issue 2)	Supporting 123.0-B Issue 2. Expect final draft Spring 2020	Start: 4/2018 End: 7/2020

SLS-MHDC Upcoming New Work Items

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS-MHDC	TBD	Robust Compression of Fixed-Length Housekeeping Data	Fall 2020 / Fall 2021	4 WM	3 WM ESA 1 WM Others	N/A	N/A	User Guide for associated CCSDS-124.0-B CMC approval to be requested in 2020 (precise date TBD).
SLS-MHDC	TBD	Compression of Raw Synthetic Aperture Radar Data	Spring 2020 / Spring 2022	6 WM	ESA 4 WM	NASA 1WM	CNES 1WM	Formalizes standard for block-adaptive compression of raw SAR data CMC approval to be requested in 2020 (precise date TBD).

Optical Communications Working Group

Executive Summary

Achievements

- Resolution to start Agency Review for Optical Communications Physical Layer Issue 2 to add **Optical On-Off Keying (O3K)**
- Held technical discussions and reviewed proposals from ESA, CNES, DLR, NASA, and JAXA. Plan to reach consensus on **O3K** Coding and Synchronization at Spring 2020 Meeting.
- Resolution to start a new project for updating Optical Communications Coding and Synchronization Layer to add **Generic Framing Procedure (GFP)** → **See Issues**
- Reviewed latest DRAFT of the Magenta Book “Atmospheric Characterization and Forecasting for Optical Link Operations”. Expect to request start of Agency Review before end of the year
- Reviewed latest DRAFT of the High Data Rate 1550 nm Orange Book. Expect to request publication before the end of the year

Working Group Status: **Good progress**

Interaction with other WGs None

Other Accomplishments:

- Reviewed recent developments in optical communications across the various space agencies and industry



Optical Communications Working Group - Issue

The following issue is recorded at SLS Area Plenary Meeting

- SLS-OPT agreed on a Resolution to start a new project for updating Optical Communications Coding and Synchronization Layer to add **Generic Framing Procedure (GFP)** for downlink of variable length frames and transmission of frames from commercial protocols.
- Other WGs consider the change proposed by SLP-OPT to go beyond the borders of the SLS-OPT itself and affect wider architectural/stack aspects affecting at least SLS-SLP and SLS-C&S.
- It is proposed (and agreed) to discuss the issue in Joint Meeting(s) involving (at least) SLS-OPT, SLS-SLP and SLS-C&S.
- SLS-OPT will provide input documents to be discussed at Joint Meeting(s)

Planned Interaction with other WGs

- Hold SLS-OPT, SLS-SLP and SLS-C&S Joint Meeting(s) before/at Spring 2020.

Optical Communications Working Group

Executive Summary

Resolutions agreed upon this meeting

- Start Agency Review for Optical Communications Physical Layer Issue 2 to add O3K (141.0-B-1)
- Start new CWE Project for updating 142.0-B Optical Communications Coding and Synchronization Layer to add Generic Framing Procedure (GFP) → **See Issues**

Planning:

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS OPT	141.1	Atmospheric Characterization and forecasting for Optical Link Operations	Latest draft reviewed. Expect to request start of Agency Review before the end of the year	Start date 01/01/2018 End date 03/30/2021
SLS OPT	142.0	Optical Communications Coding & Synchronization (Issue for O3K addition)	Adding O3K	Start date 6/1/2019 End date 9/1/2022
SLS OPT	141.0	Optical Communications Physical Layer, Issue 2	Resolution to start Agency Review for Optical Communications Physical Layer Issue 2 to add Optical On-Off Keying (O3K)	Start date 6/3/2019 End date 3/1/2021
SLS OPT	140.0	Optical Communications Concepts and Terminologies	Table of contents and some preliminary material discussed at Spring 2019 Technical Meeting. Focus on HPE Scenario.	Start date 1/12014 End date 12/30/2022
SLS OPT	141.10	Optical High Data Rate (HDR) Communication - 1550 nm	Latest draft reviewed. Expect to request start of Agency Review before the end of the year	Start date 04/30/2017 End date 07/01/2020

Optical Communications Working Group

Upcoming New Work Items

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS OPT	142.0-B-2	Optical Communications Coding and Synchronization Layer (Issue for GFP Addition)	Jan 2020 Dec 2020	2020	NASA WM TBD	TBD	TBD	Addition of an input from upper layers supporting Generic Framing Procedure (GFP)

See reported Issue on this item.

Space Link Services Approved Project Status #1

SLS RFM	401.0	Evolutions of CCSDS recommendations for RF & Modulation systems, part 1	Progress continues	Start date 10/15/2008 End date 04/15/2021
SLS C&S	130.11	TM Channel Coding for SCCC, Green Book	Published April 2019	Target: Nov 2019
SLS C&S	230.1-G-3	TC Channel Coding, Green Book	WG final review to start	Target: Nov 2019
SLS C&S	131.6	DVB-S2x Orange Book	WG final review to start	Target: Jan. 2020
SLS C&S	131.20	SCCCx Orange Book	Updated material to be reviewed	Target: March 2020
SLS C&S	431.1	Variable Code and Modulation (VCM) Systems for CCSDS	Agency Review concluded Yellow Book to be finalized	Target: Spring 2020
SLS C&S	211.2	Edit Dates Proximity-1 Coding & Synchronization Sublayer Modification to support USLP Frame Format	(Almost) Published CMC Poll approved Publication on 21 Oct. 2019	Target: December 2019

Space Link Services Approved Project Status #2

SLS C&S	131.0	TM Sync and Channel Coding (Issue 4 to Define subset for uplink and add USLP)	No progress in this meeting	Target: Oct 2020
SLS C&S	131.0	TM Sync and Channel Coding (Issue 5 to Add channel interleaver for Turbo Codes)	No progress in this meeting	Target: Jan 2021
SLS C&S	231.0	TC Sync and Channel Coding (New Issue to Modify randomizer position for LDPC)	Plan to start Agency Review by end of 2019	Target: Sept 2020
SLS C&S	130.1	"TM Synchronization and Channel Coding - Summary of Concept and Rationale, Informational Report" Green Book Issue 3	Good progress. Publication to be requested before end of 2019	Target: Jan 2020
SLS C&S	131.2	Flexible Advanced Coding and Modulation Scheme for High Rate Telemetry Applications, (Issue 2 to add USLP, uplink, etc.)	No progress in this meeting	Target: Oct 2020
SLS C&S	131.3	Space link protocols over ETSI DVB-S2 standard, (Issue 2 to add USLP, uplink, etc.)	Draft update presented in this meeting.	Target: Oct 2020

Space Link Services Approved Project Status #3

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS SLP	211.0	Proximity-1 Space Link Protocol - Data Link Layer (Issue6)	Release the revised document for Agency Review	Target date: Feb 2021
SLS SLP	700.1	Unified Space Data Link Protocol Green Book	Publish the Version 1	Target date: Fall 2019
SLS SLP	130.0	Overview of Space Communications Protocols, Issue 4	Work in progress	Target Date: Jan 2021
SLS SLP	133.0	Space Packet Protocol	Publish the Version 2 in a few weeks	Target date: End 2019
SLS SLP	133.1	Encapsulation Packet Protocol	Publish the Version 3 (with new name)	Target date: End 2019
SLS SLP	707.1	SLS Glossary of Terms	Work in Progress	Target date: Summer 2021
SLS SLP	130.3	SPP and EPP Summary of Concepts, Rationale Version 1.0	Not Yet Started	Target Date: June 2021

Space Link Services Approved Project Status #4

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS SDLS	355.1	SDLS Extended Procedures	Final blue book draft delivered to CTE. Interoperability testing completed with final version of the document. To start CESG+CMC Polls.	WG Resolution for publication done in October 2019. Resulting BB publication anticipated in December 2019
SLS SDLS	350.11	SDLS Extended Procedures Green Book	Drafting on-going.	Target date for publication : 30/09/2020.
SLS MHDC	121.0	Lossless Data Compression (Issue 3)	CESG poll completed, to go to CMC Poll (Start Agency Review)	Start date 10/2018 End date 09/2020
SLS-MHDC	124.0	Robust Compression of Fixed-Length Housekeeping Data Packets	Revised draft White Book reviewed	Start: 4/2018 End: 12/2020
SLS MHDC	120.0	Lossless Data Compression (Issue 4)	Expect complete draft Spring 2020	Start date 10/2018 End date 7/2020
SLS-MHDC	120.2	Low-Complexity Lossless & Near-Lossless Multispectral & Hyperspectral Image Compression (Issue 2)	Supporting 123.0-B Issue 2. Expect final draft Spring 2020	Start: 4/2018 End: 7/2020

Space Link Services Approved Project Status #5

Area and WG name	CCSDS Ref Nr	Document Title	Status / Comments	Start and / or Target Publication Date
SLS OPT	141.1	Atmospheric Characterization and forecasting for Optical Link Operations	Latest draft reviewed. Expect to request start of Agency Review before the end of the year	Start date 01/01/2018 End date 03/30/2021
SLS OPT	142.0	Optical Communications Coding & Synchronization (Issue for O3K addition)	Adding O3K	Start date 6/1/2019 End date 9/1/2022
SLS OPT	141.0	Optical Communications Physical Layer, Issue 2	Resolution to start Agency Review for Optical Communications Physical Layer Issue 2 to add Optical On-Off Keying (O3K)	Start date 6/3/2019 End date 3/1/2021
SLS OPT	140.0	Optical Communications Concepts and Terminologies	Table of contents and some preliminary material discussed at Spring 2019 Technical Meeting. Focus on HPE Scenario.	Start date 1/12/2014 End date 12/30/2022
SLS OPT	141.10	Optical High Data Rate (HDR) Communication - 1550 nm	Latest draft reviewed. Expect to request start of Agency Review before the end of the year	Start date 04/30/2017 End date 07/01/2020

Space Link Services Upcoming New Work Items #1

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS C&S	131.0-B	TM Sync and Channel Coding (Issue TBD)	Jan 2020 / End 2021	2020 9 WM (2 wm 2020, 7 WM 2021)	3 WM NASA (2 WM 2020 1 WM 2021)	3 WM NASA (2021)	3 WM ESA (2021)	Add longer randomizer for high data rates for spectral compliance
SLS SEA-SDLS	355.0-B	SDLS Core Protocol	Jan 2020 / Mid 2021	6 WM 2020 1.5 WM 2021 4.5	2 WM ESA or CNES (1.5 WM 2020 0.5 WM 2021)	2 WM UKSA TBC (2021)	2 WM DLR TBC (2021)	Add USLP as the 4th compatible Space Link Protocol, introduction of Extended Procedures, etc.

Space Link Services Upcoming New Work Items #2

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS-MHDC	TBD	Robust Compression of Fixed-Length Housekeeping Data	Fall 2020 / Fall 2021	4 WM	3 WM ESA 1 WM Others	N/A	N/A	User Guide for associated CCSDS-124.0-B CMC approval to be requested in 2020 (precise date TBD).
SLS-MHDC	TBD	Compression of Raw Synthetic Aperture Radar Data	Spring 2020 / Spring 2022	6 WM	ESA 4 WM	NASA 1WM	CNES 1WM	Formalizes standard for block-adaptive compression of raw SAR data CMC approval to be requested in 2020 (precise date TBD).

Space Link Services Upcoming New Work Items #3

Area and WG name	CCSDS Ref Nr	Document Title	Target Start / Publication Date	Resources Needed (total, Editor, Proto 1, Proto 2)				Comments Rationale What if not started?
SLS OPT	142.0-B-2	Optical Communications Coding and Synchronization Layer (Issue for GFP Addition)	Jan 2020 Dec 2020	2020	NASA WM TBD	TBD	TBD	Addition of an input from upper layers supporting Generic Framing Procedure (GFP)

See reported Issue on this item.

Space Link Services Planned Resolution Summary #1

Resolutions agreed during these meetings

RF & Modulation (RFM) Working Group:

- Resolution for publication of 401.0-B new issue including
 - NEW Recommendation (2.1.9) on multiple uplink carriers for MSPA support
 - NEW Recommendation (2.6.14) on transponder turnaround ratios for 22/26 GHz frequency bands
 - REVISED Recommendation (2.3.7) on earth station oscillator frequency stability
- Resolution to begin agency review of revised 401.0-B Recommendation (3.1.6B) on deep space frequency channels

Coding & Synchronization (C&S) Working Group:

- Resolution for new CWE Project to update 131.0-B TM Coding Blue Book with new randomizer for high rates

Space Link Protocols (SLP) Working Group:

- CCSDS 133.0-B SPP: issue Version 2.0 Blue Book
- CCSDS 133.1-B EPP: issue Version 3.0 Blue Book
- CCSDS 700.1-G USLP: issue Version 1.0 Green Book
- CCSDS 211.0-P Proximity-1 SDLP: start Agency Review

Space Link Services Planned Resolution Summary #2

Resolutions agreed during these meetings

Space Data Link Security (SDLS) Working Group:

- Resolution to create a project for revision of SDLS Core protocol (355.0-B-1) in the frame of the 5-year review.

Multispectral and Hyperspectral Data Compression (MHDC) Working Group:

- Resolution to begin new Blue Book project for raw compression of SAR data

Optical Communications (OPT) Working Group:

- Start Agency Review for Optical Communications Physical Layer Issue 2 to add O3K (141.0-B-1)
- Start new CWE Project for updating 142.0-B Optical Communications Coding and Synchronization Layer to add Generic Framing Procedure (GFP) → See Issues

Space Link Services Planned **Anticipated** Resolutions

Further Resolutions anticipated in the next 6 months

RF & Modulation (RFM) Working Group:

- No resolution anticipated

Coding & Synchronization (C&S) Working Group:

- Publish 431.1 VCM Blue Book as per finalized Agency Review (when yellow book finalized)
- Publish 130.1-G TM Coding Green Book adding parallel encoders for (O)QPSK modulation and turbo codes issues in burst noise
- Publish 230.1-G TC Coding Green Book (material related to LDPC)
- Publish 131.16-O (DVB-S2X) and 131.20-O (SCCC-X)

Space Link Protocols (SLP) Working Group:

- Publication of Issue 6 of CCSDS 211.0-P Proximity-1 SDLP

Space Data Link Security (SDLS) Working Group:

- No resolution anticipated

Multispectral and Hyperspectral Data Compression (MHDC) Working Group:

- No resolution anticipated

Optical Communications (OPT) Working Group:

- No resolution anticipated

The SLS part of the Strategic Plan has been evaluated by SLS WG Chairs and updated where needed before this meeting.

Document list updated as needed moving published document from *In Production* to *Existing* status and updating links to published books or CWE Projects as required.

SLS Other Items

1. CCSDS Document Status (e.g. 5 years review)
checked and reported by each WG as applicable
2. CWE Status checked: NO project Behind Schedule.
3. ICPA checked:
 - a. IOAG to revise need date for
 - i. final 401.0-B
 - ii. final 355.1-B (currently queued for publication)
 - iii. O3K update of 141.0-B and 142.0-B
 - b. Remark closure for 141.0-B and 142.0-B for HPE
4. SLS Area thanks **ESA/ESOC** for accommodation and hospitality provided for these Meetings.