

SPACE LINK SERVICES (SLS) AREA

Jean-Luc Gerner (AD)
Gilles Moury (DAD)



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A. CURRENTLY ACTIVE WGs, BOFs & SIGs WITHIN AREA

1. **RFM WG** Radio Frequency & Modulation *
2. **RNG WG** Ranging *
3. **C&S WG** Coding & Synchronisation
4. **LEC BOF** Long Erasure Codes
5. **SLP WG** Space Link Protocols
6. **NGU WG** Next Generation Uplink
7. **MHDC WG** Multi/Hyperspectral Data Compression
8. **SDLS WG** Space Data Link Security (**Joint with SEA**)
9. **PlaCom SIG** Planetary Communications

* Will meet early May



A. STATISTICS

	SLS							
	C&S	SLP	NGU	RFM	RFM+C&S+NGU	DLs	MHDC	Plenary
ASI						2		
BNSC		2	1		2	1		2
CNES	1	1	2	1	1	2	1	2
CNSA				1	1		1	
CSA							1	
DLR	1				1			1
ESA	5	2	6	3	7	4	2	3
FSA				2	3	2		
INPE				1				
JAXA		1						1
NASA	7	3	15	5	11	6	2	5
Total	14	9	24	13	26	17	7	14
Meeting Duration	1.5 days	.5 day	1 day	1.5 days	1.5 days	.5 day	1 day	2.5 days
Agency Diversity	4	5	4	5	6	7	6	5



B. SUMMARY TECHNICAL STATUS OF EACH WG, BOF & SIG



1. RFM WG

Goal

- White recommendation on 22 GHz (the band near 22 GHz), and 26 GHz modulation;
- Red recommendations on 32 GHz modulation, and on 2 GHz modulation for Moon missions or missions supported by data relay satellites;
- Revised 413.0-G ready for approval by CESG;
- Concept papers on high rate TLM and PN ranging.

status:	OK	CAUTION	PROBLEM
comment:	Meets in May 2009		

Working Group Status: Active



2. RNG WG

Goal:

- Issue Green Book on novel ranging techniques

Working Group Status: Active

Working Group Summary Situation:

status:	OK	CAUTION	PROBLEM
comment:	Meets in May 2009		



3. C&S: Coding & Synchronization WG

- Working Group Status: **Active**
- Working Group Summary Situation:

status:	OK	CAUTION	PROBLEM
comment:	X		

- Working Group Summary progress :
 - See next slides



C&S: Coding & Synchronization WG - Working Group Summary progress

Revision of CCSDS 131.0-B-1 TM Synchronization and Channel Coding (LDPC Codes addition & Five Years Review)

- On-line editing has been performed with active discussion. Actions issued.
- **Action 1** NASA to integrate all the changes into a new version of the pink sheets documents.
- **Action 2** NASA to provide pink sheets to CCSDS Editor (and possibly to WG Members) requesting revision and application of CCSDS editorial rules and clear identification of changed items with respect to the last approved blue book.
- **Action 3** NASA to circulate document for WG approval/comments after review of the CCSDS Editor.
- **Action 4** WG Member to provide comments to the pink sheets with respect to WG resolution for starting the process of Agency Review.
- **Action 5** NASA and CCSDS Editor to finalize document according to comments and WG agreements resulting from Action 4.
- **Action 6** WG Chair to request consensus to WG Members to start the submission to Agency Review.
- **Action 7** WG Chair to issue/confirm relevant resolution if document approved by WG Members.
- **Action 8** NASA to report on the possible ASM issues linked to the LDPC Code rate 7/8 presented by ESA/UniBO in Berlin



C&S: Coding & Synchronization WG - Working Group Summary progress

EDITING SESSION Revision of CCSDS 211.2 Recommendation for Proximity-1 Space Link Protocol – Coding and Synchronization Sublayer (Five Years Review in coordination with the Space Link Protocol WG)

- On-line editing has been performed with active discussion. Some items shall be edited out of the meeting. Input from NASA is also expected for clarifications.
- Actions are recorded in the edited document.

Revision of CCSDS 231.0-B-1 TC Synchronization and Channel Coding. Blue Book. (Introduction of TC Repeated Transmission in coordination with the Space Link Protocol WG)

- The proposed changes have been presented and discussed. There is general WG agreement on the technical validity of the proposed changes. Agencies position has been deferred to the SLP meeting since other two books are affected.



C&S: Coding & Synchronization WG - Working Group Summary progress

SLE Books Issues – Coordination with CSS-CSTS

- C&S WG consensus on requesting to maintain the ERT (Earth Receive Time) specification present in the approved version of the SLE RAF and RCF Blue Book(s).
- C&S WG consensus on the fact that mixing of coding options is not allowed. This is reflected in the changes introduced in the Pink Sheets to the TM Coding Blue Book.
- Joint Session with CSTS held and items agreed.
- The time stamping considerations mentioned in the ESA input paper 'Note to SLE Time Stamp Requirement' have been provided to CSTS.



C&S: Coding & Synchronization WG - Working Group Summary progress

Issues with the Turbo Codes Sync Marker rates $\frac{1}{4}$ and $\frac{1}{6}$

- The WG acknowledges the false synchronization lock problems occurring with TC rates $\frac{1}{4}$ and $\frac{1}{6}$ reported by ESA
- NASA/JPL reports that their experience is limited to rate $\frac{1}{4}$ over BPSK where the issue is less visible
- **Action 9** All Agencies to report on their experience and opinion for follow up activity.
- These follow-up alternatives are identified:
 - Replace the two ASM's for turbo codes $r=\frac{1}{4}$ & $\frac{1}{6}$ in TM Coding & Sync Blue Book with better ones.
 - Complement the two ASM's for turbo codes $r=\frac{1}{4}$ & $\frac{1}{6}$ in TM Coding & Sync Book with better ones applicable to e.g. higher order modulations.
 - Report issues in Green Book.



C&S: Coding & Synchronization WG - Working Group Summary progress

Summary of High Data Rate Randomizer investigations

- These follow up alternatives are identified:
 - Study and introduce new randomization & synchronization options.
 - Report issues in Green Book.
- **Action 10** All Agencies to report on their experience and opinion for follow up activity.

Channel Coding Green Book update

- The following subjects will be included in a new revision of the Green Book
 - CRC clarifications (input available from ESA/UniBO)
 - LDPC addition (input to be provided by NASA)
 - Turbo Codes ASM
 - High Data Rate Randomization
 - Time Stamping



C&S: Coding & Synchronization WG - Working Group Summary progress

LDPC Codes

- Ongoing implementation activities have been presented by NASA, CNES and ESA and discussed.

Long Erasure Codes

- DLR proposal for a chartering has been discussed. The proposal addresses both RF and optical links. There may be possibilities for instance to use LEC at application level (e.g. together with CFDP or SPP).
- The subject is not mature to set-up a WG.
- There is a need to focus on specific case and it is decided to work on Optical transmissions and file transfer.
- The objective will be to identify whether a single solution could be found for the cases of optical transmissions and file transfer and possibly for more cases in the future.
- **Action 12** DLR and JPL to produce mission scenarios for optical links with erasure model. Due: end of September 2009.



C&S: Coding & Synchronization WG - Working Group Summary progress

SCCC Standardization (Joint Meeting with RFM and SLP)

- The matter about patents is not clarified yet. It appears as the US Patent owned by Caltech has been already licensed exclusively to a third party. SLS Area Director is continuing the investigation on this topic.
- Some of the requested technical results are not available yet and they will be made available in future.
- Further decisions will be taken according to accomplishment of pending actions within RFM WG and patents investigations.
- **Action 13:** NASA/JPL requests the SLS Area Director to verify within CESG the need of free royalties for publication of Standards.

RES-1 SLS

Request the CESG/CMC to action NASA to resolve the SCCC patent issue with Caltech.

DVB-S2 Standardization (Joint Meeting with RFM and SLP)

- Patents issues: decoding is subject to royalties, encoding is royalty-free. Impact: see Action 13
- Further decisions will be taken according to accomplishment of pending actions within RFM WG and patents investigations.



C&S: Coding & Synchronization WG - Working Group Summary progress **Optical Communications (Joint Meeting with RFM & SLP)**

- **Action 14 to DLR and NASA/JPL to produce a combined charter for a SIG.**
- **Action 15 : SLS Area director will verify within CESG interested Agencies.**



C&S: Coding & Synchronization WG - Summary on Ongoing New Standard :

- The Working Group has discussed the 3 proposals for passing/starting the Standard Track activities for the 3 proposed Coding Options.
- The Working Group expressed consensus about passing the 3 proposals to the Standard Track considering that
 1. the application profiles envisaged by the 3 proposals are complementing each other with very limited overlap; i.e.
 - LDPC will be applicable to Science Missions;
 - SCCC will be applicable to Earth Exploration Satellites (EES) Missions for data rates above 100 Mbaud;
 - DVB-S2 will be applicable to EES Missions for data rates up to 150 Mbaud.
 2. The conditions stated in the next page shall be accomplished by all the three proposals.
- Consensus wrt to DVB+SCCC proposals are to be understood as “declaration of intent” pending fulfilling of mentioned conditions.



C&S: Coding & Synchronization WG - Summary on Ongoing New Standard :

- The conditions to be accomplished by the three proposals are as follows:

1. Agency to provide the envisaged Mission Profiles for applicability of the proposed Codes.
2. Agency to provide a Position Paper supporting the request including cross support aspects/requirements, Patents and Royalties issues.
3. Agency to provide a revised version of the proposed book splitting "Green and Blue" material.

For SCCC and DVB-S2 also:

4. CESC to decide whether the proposal should be split into 2 parts (Coding & Modulation) for separate standardization and split contents accordingly. (SLS AD/DAD comment: SLS to decide and seek CESC endorsement).
5. Standardization of the modulation items subject to study and approval in the RFM Working Group.



5. SLS-SLP WG

Goal:

- Progress TM & AOS Pink Sheets regarding OLD Frame usage.
- Progress Encapsulation Service Pink Sheets
- Progress Space Packet Protocol APID definition Pink Sheets to Blue book
- Progress the TC, AOS, TM, and SPP CRC pink sheets to Blue book
- Progress Space Link Identifiers Pink Sheet (adding IPE for IP header compression via Annex A [normative] to Blue Book
- Discuss the merit of ESA's proposal on TC "Systematic Retransmission"

WG Status: Active X Idle _____

WG Summary Situation:

status:	OK	CAUTION	PROBLEM
comment:	Good progress		



SLS-SLP WG

WG Summary progress:

- **OID frames to be defined consistently in AOS and TM as “Only Idle Data in the data field”. Progress as new AOS and TM Blue Book versions.**
- **The Encapsulation Service Pink Sheets are progressed to next version Blue Book.**
- **The CRC pink sheets containing the normed CRC encoding/decoding diagrams are also ready to go to the Secretariat for publishing in the TM, TC, AOS, and SPP.**
- **Space Link Identifiers Annex A CCSDS IPE to progress to new Blue Book version.**
- **Space Packet Protocol pink sheets on APID definition progressed to next version Blue book.**



SLS-SLP WG (cnt'd)

Problems and Issues:

- ESA Proposal on TC 'Systematic Retransmission'
 - ESA to make 'number of repeated retransmissions' parameter optional.
 - ESA to strike the word "preferred" from note in the proposal.
 - Greg Kazz to ask CSS-CSTS chair for that WG to provide a formal impact of TC systematic retransmission proposal on SLE-FSP and SLE-CLTU.
 - SLS-SLP WG to reassess the ESA proposal once the CSS-CSTS WG has given its response
- Takahiro Yamada has done the final edits based upon ESA's inputs to the SPP GB. It was ready to go to the CCSDS Secretariat for publishing on the web site after the Berlin Meeting. Apparently this book was never published i.e., it is NOT on the CCSDS Web site.

Action SLS AD: Raise the issue at CESG



SLS-SLP WG (cnt'd)

Planning :

- Matt Cosby to update 'OID' term in both TM and AOS Space Data Link Protocols. Within 2 weeks.
- Greg Kazz to contact CSS-CSTS chair to request formal assessment of ESA Systematic TC retransmission on SLE-FSP and potentially SLE-FCLTU. Within 2 weeks.
- Reassessment of ESA Systematic Retransmission Proposal after CSS-CSTS position is known. Before Fall 2009 meeting.
- Complete the action items assigned by SLS-NGU to SLS-SLP concerning the data link layer for File Uplink, Emergency Comm (unmanned), and Human Support application profiles before Fall 2009 meeting.
- New Work Item from SIS-IPO: investigate deprecating IPv4 and SCPS-NP in all applicable link layer documents from being recognized CCSDS packet types.

Action (M. Cosby) Examine whether or not IPv4 direct insertion in CCSDS frames is used within BNSC/ UK projects



SLS-SLP WG (cnt'd)

Resolutions :

1. **'OID Frame naming issue'. Request the CESC/CMC accept the updated TM Space Data Link Protocol and AOS Space Data Link Protocol pink sheets (after editing by Matt Cosby) to new version Blue Books.**
2. **Request the CESC/CMC accept the Encapsulation Service Pink Sheets for publication as a new version of the Blue Book.**
3. **'APID Definition Issue'. Request the CESC/CMC accept the edits to the current version of the Space Packet Protocol and advance it as a new Blue Book version.**
4. **Request the CESC/CMC to accept the TC, AOS, TM, and SPP CRC pink sheets to Blue book**
5. **Request the CESC/CMC to accept the Space Link Identifiers Pink Sheet (adding IPE for IP header compression via Annex A [normative] to Blue Book**



6. Next Generation Uplink WG

Goal:

- Develop a Green Book for Next Generation Uplink (NGU) application profiles.
- Whenever possible incorporate new requirements into existing Blue books supported by the RF & Modulation, Channel Coding & Synchronization, and Link Layer protocol WGs.
- If incorporation into existing Blue books is not possible, determine if a new Magenta or Blue book needs to be written.
- WG Status: Active X Idle _____

WG Summary Situation: Good progress.

status:	OK	CAUTION	PROBLEM
comment:	Good progress		



NGU WG (cnt'd)

- **NGU has described, generated requirements, and assigned action items to existing CCSDS WGs to formulate communication solutions for the following NGU application Profiles:**
 1. **File Uplink (data rates from 4 Kbps up to 1000 Kbps)**
 2. **Emergency Communications Unmanned (100-1000 bps)**
 3. **Human Support (up to 25 Mbps)**
- **Significant new communication approaches that NGU is investigating with the support of existing WGs for the profiles above are:**
 - **Synchronous uplink using more coding gain**
 - **New uplink acquisition sequence and technique**
 - **Use of Security techniques on the uplink**
 - **Use of Ranging techniques on same frequency bands as Telecommand**



NGU WG (cnt'd)

Action Items:

Action Items generated at this meeting are to be relayed and coordinated with the following WGs:

SLS-RF&MOD, SLS-C&S, SLS-SLP, SLS-Ranging, SLS-SDLS, SEA-SWG, CSS-CSTS, SOIS-Wireless

Problems and Issues:

Determination of exactly what kind of book (Magenta vs Blue) NGU WG effort will generate is in flux depending upon the results of the action items assigned at these meetings.



NGU WG (cnt'd)

Planning :

- Complete the action items assigned to NGU and coordinate and incorporate results of action items requested from other WGs by the Fall 2009 meeting.
- Complete the following application profile descriptions, requirements, and develop list of action items for the following profiles by the Fall 2009 meeting:
 - Command/ARQ (rates from 1 to 4 Kbps)
 - Emergency Communication Manned (rates up to 10 Kbps)

Resolutions :

None at this time.



7. Multispectral & Hyperspectral Data Compression (MHDC) WG

Goals:

1. Present compression performance results demonstrating compression performance under varying error containment segment sizes
2. Select lossless compression approach for standardization.

Working Group Status: Active ☒ Idle ☐

Working Group Summary Situation:

Disagreements on assessments and relative importance of algorithm selection criteria; goal #2 not met.

Agreed on action items to provide a more thorough assessment of hardware implementation complexity and provide a performance comparison of the prediction stages.

status:	OK	CAUTION	PROBLEM
comment:	OK progress		

Oct08

28



8. Space Data Link Security WG (cross-area SEA/SLS)

Goals:

- Develop standard protocol for security at the data link layer. This includes authentication and/or encryption both uplink and downlink. This protocol will be independent from crypto algorithm and compatible with CCSDS TM/TC/AOS data link protocols.

WG Status: Active X (7 agencies, 21 participants) Idle _____

WG Summary Situation:

- User requirements finalized (URD)
- Issues linked to the design of the protocol identified & discussed
- Review of the NASA proposal which will be updated according to RID dispositions to become White Book v1

status:	OK	CAUTION	PROBLEM
comment:	good progress (URD finalized)		



Space Data Link Security WG

Planning :

- White book v1 for core protocol : July 2009
- Red-1 for core protocol : november 2009
- Interoperability testing of core protocol : nov2009 – feb2010
- Red-2 for core protocol : april 2010
- Blue book for core protocol : July 2010
- Green book for core protocol : Oct 2010

Resolutions :

- **None**

Action:

- See WG action items list



9. Planetary Communications BOF (cross-area SEA/SIS/SLSSOIS)

Goals:

- Develop Requirements for planetary communications
- Issue a charter for a PlaCom WG

BOF Status: Active **X** (27 participants) Idle _____

BOF Summary Situation:

status:	OK	CAUTION	PROBLEM
comment:	good progress		

Participants of the meeting considering,

- That the topic is far from mature to develop a WG charter
- That the topic concerns several areas (SLS, SIS, SEA, SOIS)

Resolved

- To **convert the BOF into a SIG**

Action on agencies to provide mission profiles



9. Planetary Communications BOF (cross-area SEA/SIS/SLSSOIS)

Actions:

- SIG membership to be consolidated
- Agencies to report on mission requirements



C. INTRA & CROSS-AREA TECHNICAL ISSUES

New Cross-area work in the frame of PlaCom SIG



D. OTHER ISSUES AND CONCERNS



E. PROPOSED AREA RESOLUTIONS / ACTION ITEMS

C&S WG CODING & SYNCHRONIZATION

RES-1

Request the CESG/CMC to action NASA to resolve the SCCC patent issue with Caltech.



E. PROPOSED AREA RESOLUTIONS / ACTION ITEMS

SLP WG SPACE LINK PROTOCOLS

RES-2

‘OLD Frame naming issue’. Request the CESC/CMC accept the updated TM Space Data Link Protocol and AOS Space Data Link Protocol pink sheets (after editing by Matt Cosby) to new version Blue Books.

RES-3

Request the CESC/CMC accept the Encapsulation Service Pink Sheets for publication as a new version of the Blue Book.

RES-4

‘APID Definition Issue’. Request the CESC/CMC accept the edits to the current version of the Space Packet Protocol and advance it as a new Blue Book version.



E. PROPOSED AREA RESOLUTIONS / ACTION ITEMS

SLP WG SPACE LINK PROTOCOLS

RES-5

Request the CESG/CMC to accept the TC, AOS, TM, and SPP CRC pink sheets to Blue book

RES-6

Request the CESG/CMC to accept the Space Link Identifiers Pink Sheet (adding IPE for IP header compression via Annex A [normative] to Blue Book