Consultative Committee

CCSDS

for Space Data Systems

**Advancing Technology
With International Agreements
To Use That Technology**

MYTH

Standards stifle innovation

FACT

CCSDS stimulates advanced technology by adopting, adapting, developing, and solidifying innovations with exposure to a wider community.

MYTH

Standards delay implementation

FACT

Not if the innovation is brought into the standards process early. Delays result from reluctance to standardize, not from standardization.

STANDARDS....

LOWER COST
LOWER RISK
INCREASE CAPABILITY

When an innovative technology is rapidly brought to the standards community, it is vetted with a larger user base, hence facilitating the widespread adoption of innovative technology.

CCSDS Track Record
as of May 2012:

CCSDS currently has 69 active standards and practices

571 spaceflight missions have used various CCSDS standards

CCSDS was formed in 1982 by the major space agencies of the world to provide a forum for solving common problems in the development and operations of space data systems. It has developed Recommended Standards and Recommended Practices for data and communications systems to:

a) Promote interoperability and cross support among cooperating space agencies to reduce operations costs by sharing facilities

b) Reduce the cost to the various agencies of performing common data functions, by eliminating unjustified project-unique design and development

Currently membership includes:
    11 Member Agencies
    28 Observer Agencies
    145 Commercial Associates

CCSDS also functions as an ISO Standards Committee, Technical Committee 20 Subcommittee 13 (TC20-SC13), *Space Data and Information Transfer Systems.* In this capacity, CCSDS/ISO-TC20-SC13 represents 20 nations.

AGENCIES

⭐ MEMBER AGENCIES	⭐ OBSERVER AGENCIES
ASI/Italy	ASA/Austria
CNES/France	BFSPO/Belgium
CNSA/China	CAS/China
CSA/Canada	CAST/China
DLR/Germany	CLTC/China
ESA/Europe	CSIR/South Africa
FSA/Russia	CSIRO/Australia
INPE/Brazil	DCTA/Brazil
JAXA/Japan	DNSC/Denmark
NASA/USA	EUMETSAT/Europe
UKSA/UK	EUTELSAT/Europe
	GISTDA/Thailand
	HNSC/Greece
	IKI/Russia
	ISRO/India
	KARI/Korea
	KFKI/Hungary
	MOC/Israel
	NCST/USA
	NICT/Japan
	NOAA/USA
	NSARK/Kazakhstan
	NSPO/Taipei
	SSC/Sweden
	SUPARCO/Pakistan
	TsNIIMash/Russia
	TUBITAK/Turkey
	USGS/USA

www.ccsds.org
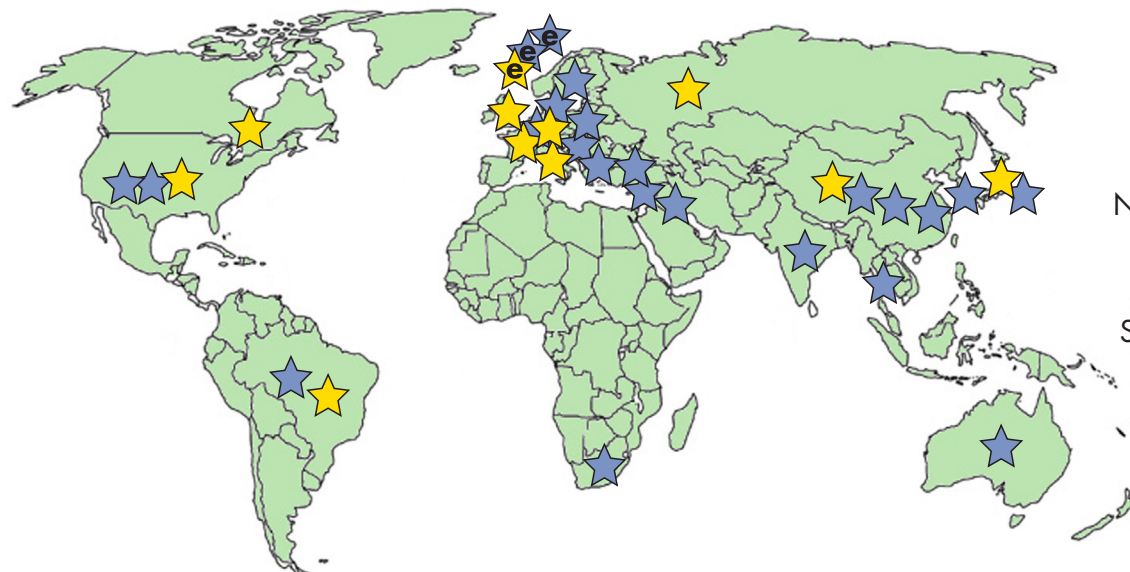
On the CCSDS website our published standards are downloadable **for free.**

PUBLICATIONS *AS OF MAY 2012*

- 50 Recommended Standards
  Blue Books – normative and directly implementable for interoperability

- 19 Recommended Practices
  Magenta Books – normative, but not directly implementable, such as architectures, practices, etc.

- 44 Informational Reports
  Green Books – overviews, ops concepts, foundations for standards

- And other documents
  Experimental, procedural, etc.

REVIEW DOCUMENTS

CCSDS conducts open, cross-organizational reviews, coordinated through space agency representatives for each nation. From the CCSDS website, anyone (agency, industry, academia, etc.) with a solid technical background can represent their organization's needs and contribute to CCSDS document reviews.

OTHER FEATURES ON WWW.CCSDS.ORG

NEW WORK ITEMS ANNOUNCEMENTS

This is where CCSDS announces new initiatives, so technical experts can see what exciting new technology work is being developed for standardization in CCSDS, and join the CCSDS team to help forge the future. These include new working groups, new document projects, new "Birds of a Feather" groups, etc.

THE CCSDS BLOG

This is for general announcements of CCSDS activity, such as new document reviews and meeting announcements.

THE COLLABORATIVE WORK ENVIRONMENT

This is the SharePoint work area where the real work gets done. Public visitors can view the working group structures, contact info, and material that is made public by the working groups. If you're interested in joining a CCSDS working group, this is the place to start.

Advance.

CCSDS.org
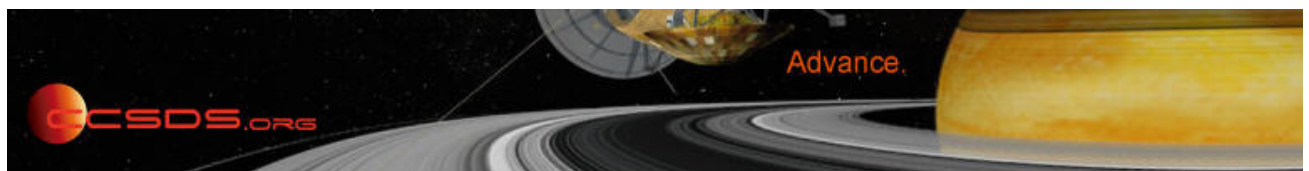
CCSDS ARCHITECTURAL OVERVIEW

This Architectural Overview shows the Areas and Working Groups (topics) that are currently, as of May 2012, developing new standards in CCSDS.
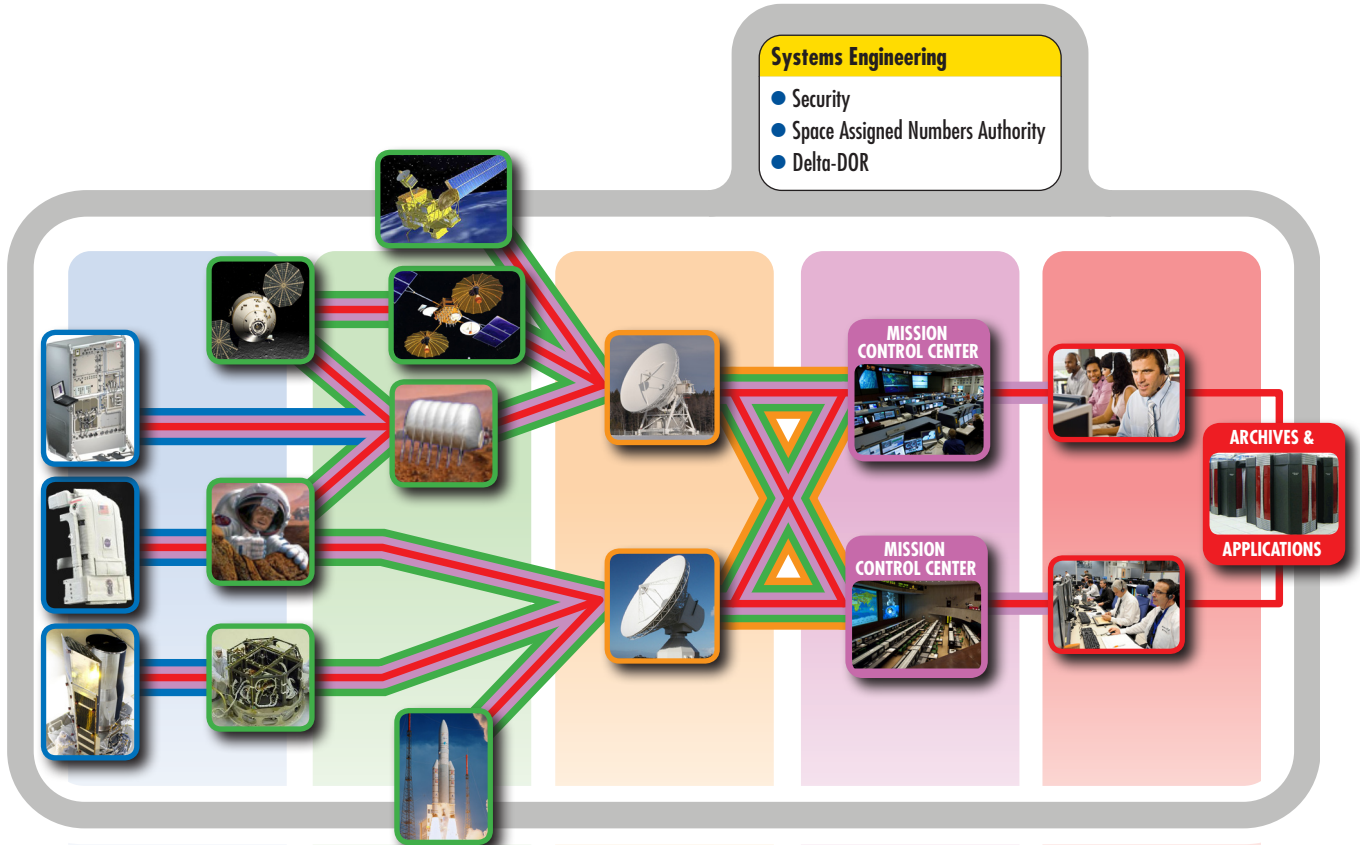
Systems Engineering
- Security
- Space Assigned Numbers Authority
- Delta-DOR

Spacecraft Onboard Interface Services
- Onboard Wireless WG
- Application Support Services (including Plug-and-Play)

Space Link Services
- RF & Modulation
- Space Link Coding and Syncrinization
- Multi/Hyper Data Compression
- Space Link Protocols
- Next Generation Uplink
- Space Data Link Security
- Planetary Communications
- Optical Coding and Modification

Cross Support Services
- Cross Support Service Management
- Cross Support Transfer Services
- Cross Support Architecture

Space Internetworking Services
- Asynch Messaging
- IP-over-CCSDS Links
- Motion Imagery and Applications
- Delay Tolerant Networking
- Voice
- CFDP over Encap

Mission Operations and Information Management Services
- Navigation
- Spacecraft Monitor and Control
- Data Archive Ingestion
- Digital Repository Audit/Certification
- Telerobotics

Six Technical Areas
Twenty-seven working bodies:
- Working Group *(producing standards)*
- Birds of a Feather stage *(pre-approval)*
- Special Interest Group *(integration forum)*

THE SIX TECHNICAL AREAS DEVELOPING NEW STANDARDS IN CCSDS

SYSTEMS ENGINEERING (SE)

The SE area supports the work of CCSDS by providing overall architecture for space mission communications, operations, and cross-support; coordination and collaboration with the other areas about architectural choices and options; and evaluation of consistency of all area programs of work with the defined architecture.

SPACECRAFT ONBOARD INTERFACE SERVICES (SOIS)

The primary objective of the CCSDS SOIS area is to improve the spacecraft flight segment data systems design and development process by defining generic services that will simplify the way flight software interacts with flight hardware and permit interoperability and reusability for the benefit of agencies as well as industrial contractors.

SPACE LINK SERVICES (SLS)

The SLS area develops efficient space link communications systems common to all participating agencies. A space link interconnects a spacecraft with its ground support system or with another spacecraft. New generations of space missions require telecommand and telemetry capabilities beyond current technologies. These new needs are for higher data rates, better link performances, and higher performing ranging systems. SLS area concentrates on radio frequency (RF) and modulation, channel coding, and data link layer – for both long-haul (e.g., spacecraft to ground) and proximity links (e.g., orbiter to lander). Two additional SLS functions are data compression for end-to-end data transfer optimization and ranging for accurate orbit determination.

CROSS SUPPORT SERVICES (CSS)

The CSS area addresses how space network resources are made available by one organization to another for the purpose of "Cross Support." The objective of the CSS area is therefore to define what services are required at various cross-support interface points, and how those services are exposed, scheduled, and used by organizations that want to confederate their infrastructure in order to execute a mission.

SPACE INTERNETWORKING SERVICES (SIS)

The SIS area provides services and protocols to address networked interactions of many forms: between spacecraft and earth-based resources, among spacecraft, between spacecraft and landed elements, and within heterogeneous spacecraft. The SIS area deals with communication services and protocols that are independent of specific link technology (as a lower layer bound) and independent of application-specific semantics (as an upper bound). This covers essentially the network through application layers of the OSI reference model. The SIS area accommodates all ranges of delay, interactivity, and directionality, although not all protocols are appropriate for all environments.

MISSION OPERATIONS AND INFORMATION MANAGEMENT SERVICES (MOIMS)

The objective of the MOIMS area is to address all of the flight execution phase applications that are required to operate the spacecraft and its ground system in response to mission objectives and their associated detailed information management standards and processes. The focus of this area is primarily on the "mission operations" functions that occur on a timescale driven by the flight path of the space vehicle. The MOIMS area ensures that application standards exist that facilitate the smooth transition of space mission information between the "mission operations" systems and the "mission utilization" systems.

CCSDS BLUE BOOKS

As of May 2012, CCSDS has 50 active CCSDS Blue Book publications. These are Recommended Standards that can be implemented and immediately demonstrate interoperability.

CCSDS Blue Books are required to be proven prior to publication by at least two independently developed prototypes that demonstrate interoperability.

CCSDS 121.0-B-1   Issue 1 | May 1997
Lossless Data Compression

CCSDS 122.0-B-1   Issue 1 | November 2005
Image Data Compression

CCSDS 131.0-B-2   Issue 2 | August 2011
TM Synchronization and Channel Coding

CCSDS 131.2-B-1   Issue 1 | March 2012
Flexible Advanced Coding and Modulation Scheme for High Rate Telemetry Applications

CCSDS 132.0-B-1   Issue 1 | September 2003
TM Space Data Link Protocol

CCSDS 133.0-B-1   Issue 1 | September 2003
Space Packet Protocol

CCSDS 133.1-B-2   Issue 2 | October 2009
Encapsulation Service

CCSDS 135.0-B-4   Issue 4 | October 2009
Space Link Identifiers

CCSDS 211.0-B-4   Issue 4 | July 2006
Proximity-1 Space Link Protocol — Data Link Layer

CCSDS 211.1-B-3   Issue 3 | March 2006
Proximity-1 Space Link Protocol — Physical Layer

CCSDS 211.2-B-1   Issue 1 | April 2003
Proximity-1 Space Link Protocol — Coding and Synchronization Sublayer

CCSDS 231.0-B-2   Issue 2 | September 2010
TC Synchronization and Channel Coding

CCSDS 232.0-B-2   Issue 2 | September 2010
TC Space Data Link Protocol

CCSDS 232.1-B-2   Issue 2 | September 2010
Communications Operation Procedure-1

CCSDS 301.0-B-4   Issue 4 | November 2010
Time Code Formats

CCSDS 320.0-B-5   Issue 5 | September 2007
CCSDS Global Spacecraft Identification Field Code Assignment Control Procedures

CCSDS 401.0-B-21   Issue 21 | July 2011
Radio Frequency and Modulation Systems — Part 1: Earth Stations and Spacecraft

CCSDS 414.1-B-1   Issue 1 | March 2009
Pseudo-Noise (PN) Ranging Systems

CCSDS 415.1-B-1   Issue 1 | September 2011
Data Transmission and PN Ranging for 2 GHz CDMA Link via Data Relay Satellite

CCSDS 502.0-B-2   Issue 2 | November 2009
Orbit Data Messages

CCSDS 503.0-B-1   Issue 1 | November 2007
Tracking Data Message

CCSDS 504.0-B-1   Issue 1 | May 2008
Attitude Data Messages

CCSDS 505.0-B-1   Issue 1 | December 2010
XML Specification for Navigation Data Messages

CCSDS 521.0-B-1   Issue 1 | October 2010
Mission Operations Message Abstraction Layer

CCSDS 620.0-B-2   Issue 2 | May 1992
Standard Formatted Data Units — Structure and Construction Rules

CCSDS 622.0-B-1   Issue 1 | May 1997
Standard Formatted Data Units — Referencing Environment

CCSDS 630.0-B-1   Issue 1 | June 1993
Standard Formatted Data Units — Control Authority Procedures

CCSDS 632.0-B-1   Issue 1 | November 1994
Standard Formatted Data Units — Control Authority Data Structures

CCSDS 641.0-B-2   Issue 2 | June 2000
Parameter Value Language Specification (CCSD0006 and CCSD0008)

CCSDS 643.0-B-1   Issue 1 | November 1992
ASCII Encoded English (CCSD0002)

CCSDS 644.0-B-3   Issue 3 | June 2010
The Data Description Language EAST Specification (CCSD0010)

CCSDS 647.1-B-1   Issue 1 | June 2001
Data Entity Dictionary Specification Language (DEDSL) — Abstract Syntax (CCSD0011)

CCSDS 647.2-B-1   Issue 1 | June 2001
Data Entity Dictionary Specification Language (DEDSL) — PVL Syntax (CCSD0012)

CCSDS 647.3-B-1   Issue 1 | January 2002
Data Entity Dictionary Specification Language (DEDSL) — XML/DTD Syntax (CCSD0013)

CCSDS 650.0-B-1   Issue 1 | January 2002
Reference Model for an Open Archival Information System (OAIS)

CCSDS 660.0-B-1   Issue 1 | October 2007
XML Telemetric and Command Exchange (XTCE)

CCSDS 661.0-B-1   Issue 1 | September 2008
XML Formatted Data Unit (XFDU) Structure and Construction Rules

CCSDS 714.0-B-2   Issue 2 | October 2006
Space Communications Protocol Specification (SCPS) — Transport Protocol

CCSDS 727.0-B-4   Issue 4 | January 2007
CCSDS File Delivery Protocol (CFDP)

CCSDS 732.0-B-2   Issue 2 | July 2006
AOS Space Data Link Protocol

CCSDS 735.1-B-1   Issue 1 | September 2011
Asynchronous Message Service

CCSDS 910.11-B-1   Issue 1 | August 2009
Space Communication Cross Support — Service Management — Service Specification

CCSDS 910.4-B-2   Issue 2 | October 2005
Cross Support Reference Model — Part 1: Space Link Extension Services

CCSDS 911.1-B-3   Issue 3 | January 2010
Space Link Extension — Return All Frames Service Specification

CCSDS 911.2-B-2   Issue 2 | January 2010
Space Link Extension — Return Channel Frames Service Specification

CCSDS 911.5-B-2   Issue 2 | January 2010
Space Link Extension — Return Operational Control Fields Service Specification

CCSDS 912.1-B-3   Issue 3 | July 2010
Space Link Extension — Forward CLTU Service Specification

CCSDS 912.3-B-2   Issue 2 | July 2010
Space Link Extension — Forward Space Packet Service Specification

CCSDS 913.1-B-1   Issue 1 | September 2008
Space Link Extension — Internet Protocol for Transfer Services

CCSDS MAGENTA BOOKS

As of May 2012, CCSDS has 19 active CCSDS Magenta Book publications. These set forth Recommended Practices.

CCSDS 131.4-M-1	Issue 1 | July 2011
TM Channel Coding Profiles	
CCSDS 311.0-M-1	Issue 1 | September 2008
Reference Architecture for Space Data Systems	
CCSDS 506.0-M-1	Issue 1 | April 2011
Delta-Differential One Way Ranging (Delta-DOR) Operations	
CCSDS 520.1-M-1	Issue | July 2010
Mission Operations Reference Model	
CCSDS 651.0-M-1	Issue | May 2004
Producer-Archive Interface Methodology Abstract Standard	
CCSDS 652.0-M-1	Issue 1 | September 2011
Audit and Certification of Trustworthy Digital Repositories	
CCSDS 652.1-M-1	Issue 1 | November 2011
Requirements for Bodies Providing Audit and Certification of Candidate Trustworthy Digital Repositories	
CCSDS 851.0-M-1	Issue 1 | December 2009
Spacecraft Onboard Interface Services—Subnetwork Packet Service	
CCSDS 852.0-M-1	Issue 1 | December 2009
Spacecraft Onboard Interface Services—Subnetwork Memory Access Service	
CCSDS 853.0-M-1	Issue 1 | December 2009
Spacecraft Onboard Interface Services—Subnetwork Synchronisation Service	
CCSDS 854.0-M-1	Issue 1 | December 2009
Spacecraft Onboard Interface Services—Subnetwork Device Discovery Service	
CCSDS 855.0-M-1	Issue 1 | December 2009
Spacecraft Onboard Interface Services—Subnetwork Test Service	
CCSDS 872.0-M-1	Issue 1 | January 2011
Spacecraft Onboard Interface Services—Time Access Service	
CCSDS 914.0-M-1	Issue 1 | October 2008
Space Link Extension—Application Program Interface for Transfer Services—Core Specification	
CCSDS 915.1-M-1	Issue 1 | October 2008
Space Link Extension—Application Program Interface for Return All Frames Service	
CCSDS 915.2-M-1	Issue 1 | October 2008
Space Link Extension—Application Program Interface for Return Channel Frames Service	
CCSDS 915.5-M-1	Issue 1 | October 2008
Space Link Extension—Application Program Interface for Return Operational Control Fields	
CCSDS 916.1-M-1	Issue 1 | October 2008
Space Link Extension—Application Program Interface for the Forward CLTU Service	
CCSDS 916.3-M-1	Issue 1 | October 2008
Space Link Extension—Application Program Interface for the Forward Space Packet Service	

FIELD GUIDE
TO CCSDS PUBLICATIONS

BLUE BOOKS
RECOMMENDED STANDARDS

Normative, and sufficiently detailed (and pre-tested) that they can be used to implement interoperable systems.

MAGENTA BOOKS
RECOMMENDED PRACTICES

Normative, but at a level that is not implementable for interoperability. Reference architectures, APIs, operational practices, etc.

GREEN BOOKS
INFORMATIVE DOCUMENTS

Not normative. These may be foundational for Blue Books and Magenta Books, describing their applicability, overall architecture, ops concept, etc.

ORANGE BOOKS
EXPERIMENTAL

Normative, but may be very new technology that does not yet have consensus of enough agencies to standardize.

RED BOOKS
DRAFT STANDARDS/PRACTICES

Drafts of future Blue Books or Magenta Books that are in agency review.

YELLOW BOOKS
ADMINISTRATIVE

Procedures, test reports, etc.

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