

CCSDS LINK

A QUARTERLY NEWSLETTER

VOLUME 2 ISSUE 2 — JUNE 2007

Brussels CMC Workshop

The CMC will meet in Brussels to discuss a number of important topics.

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SM&C WG Update



Read the latest status of the work within the Spacecraft Monitoring & Control Working Group.

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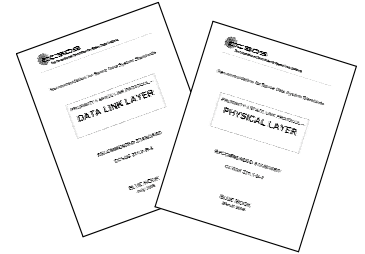
Calls for Nominations

Find out how to nominate deserving colleagues for various honors and awards.

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New and noteworthy

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Welcome to the CCSDS Link

The *Link* is intended to serve as a communication forum for the CCSDS community. Through content developed by CCSDS technical experts, members of the CMC and CESG, and by secretariat staff we hope to provide readers with a wealth of information about the organization and its work. Information in the *Link* is aimed at CCSDS participants as well as users of CCSDS specifications and technical information.

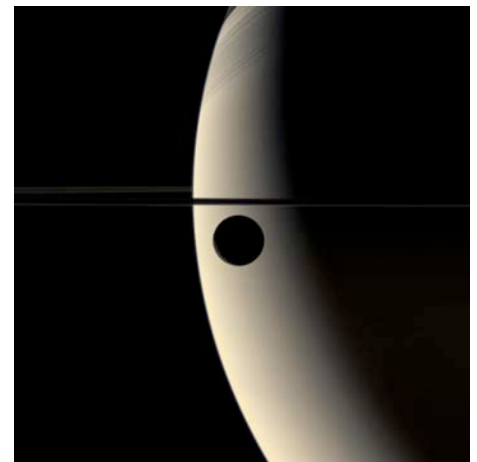
This issue of the *Link* contains information on a number of items of interest to the CCSDS community. As the issue is written the CMC is preparing for a workshop in Brussels in June. Secretariat staff is hard at work on a number of CCSDS business process improvement proposals and tools aimed at improving the efficiency and visibility into our work program. ISO TC20/SC14 on Space Systems and Operations is meeting in Beijing and discussing, among other things, increased cooperation with CCSDS. Planning for the Fall CCSDS/SC13 meetings in Darmstadt is in full swing. And, as always, a number of CCSDS projects are moving through our process toward publication.

We need your help to make this publication a success and a useful communication tool. Your input and content submissions will be critical. The intent is to issue the *Link* approximately once per quarter. We will solicit your content ideas with formal "Calls For Content", but are also very open to suggestions and topics of interest at any time. At times when we are approaching a CCSDS meeting we will shift the publication schedule to ensure you have all of the critical information you need for a meeting cycle in one place.

All that being said, please do not hesitate to submit any feedback on this publication to secretariat@mailman.ccsds.org at any time.

A View From "Out There"

Soft hues, partially lit orbs, a thin trace of the ring and slight shadows highlight this understated view of the majestic surroundings of the giant planet Saturn. Looking nearly back toward the sun, the Cassini spacecraft captured the crescent phases of Saturn and its moon Rhea in color a few months ago.



As striking as the above image is, it is but a single frame from a recently released 60-frame silent movie where Rhea can be seen gliding in front of its parent world. Since Cassini was nearly in the plane of Saturn's rings, the normally impressive rings are visible here only as a thin line across the image center. Cassini has now passed the official half-way mark of its mission around Saturn, but is well situated to complete another two years investigating this complex and surprising system.

Image credit: NASA/ESA/JPL/SSI

Brussels CMC Workshop

The CMC will hold a special workshop on 25-27 June 2007. The meeting will be held in Brussels, Belgium and is being coordinated in conjunction with the OMG Technical Meeting taking place the 25th through the 29th of June. The OMG is providing the meeting space for this special working session. The current agenda can be downloaded [here](#).



The main topics of discussion will be a report from the IOAG-11 meeting, various CCSDS WG progress, business practice revisions and tools, and future coordination with the OMG.

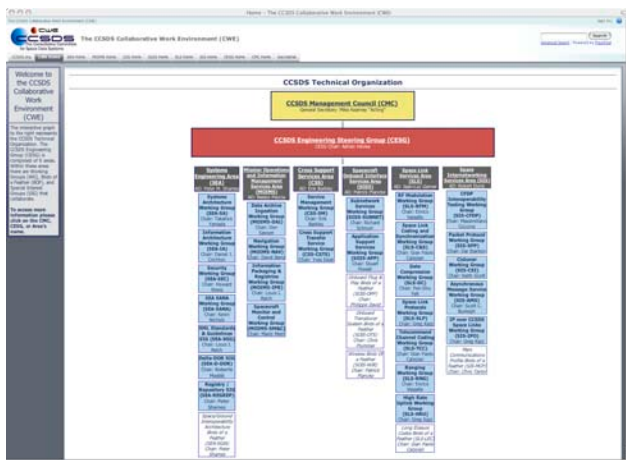
The meeting will take place at the Crowne Plaza Brussels City Centre Hotel. The OMG has negotiated a block room rate with the hotel that will end on 1 June (subject to continued availability). For more information on the hotel and on the OMG Technical Meeting please refer to the meeting website <http://www.omg.org/registration/registration-info-brussels.htm>.

CMC members that plan to attend this workshop and have not already done so, please RSVP to the Secretariat at secretariat@mailman.ccsds.org.

Secretariat Update

The CCSDS Secretariat staff has been busy since our last meetings in Colorado Springs. Perhaps the largest and most visible project has been the introduction of a new CCSDS Collaborative Work Environment (CWE). Much work and preparation went into this extensive redesign of the system. Brain Oliver and Laura Stafford worked hard to launch the new system on time with minimal disruption to CWE users and both deserve many thanks for their commitment.

The new CWE is a brand new implementation built from the ground up using the latest version of Microsoft Sharepoint™. A number of improvements were made to introduce a simpler architecture (9 sites as opposed to 40 sites), a cleaner user interface, and to make the tools easier to support.



Besides the snappy pictures of most of our area directors and working group leads, some of the specific changes you may have noticed include:

- ✓ **updated look and feel** - the user interface has been updated to remove some of the clutter and to allow users to quickly move between area sites
- ✓ **streamlined Area and WG navigation and pages** - instead of having a separate page for every area, every WG, every BoF, and every SIG there is now a single access point to all of the WGs, BoFs, and SIGs in a particular Area. Additionally, all of the groups within an Area now share a common calendar, announcement list, action item list, and discussion board.
- ✓ **user managed account info** - two of the requests we heard frequently with the old CWE were for users to have the ability to update their own passwords and for there to be a way to logout of the system. On the new site, both of these actions can be accomplished by clicking on your name in the top right of every page.
- ✓ **improved file recovery system** - If you ever accidentally deleted a file from one of your folders on the old system, recovering it could be a chore. With the new CWE each group has access to its own recycle bin that will allow users to recover deleted files for up to 30 days.
- ✓ **improved site-wide search** - We've implemented a new search engine on the new CWE which can be accessed from any page on the site.

These are only a few of the changes made to the site, if you have not visited the CWE recently, please [take a look](#) and let us know what you think.

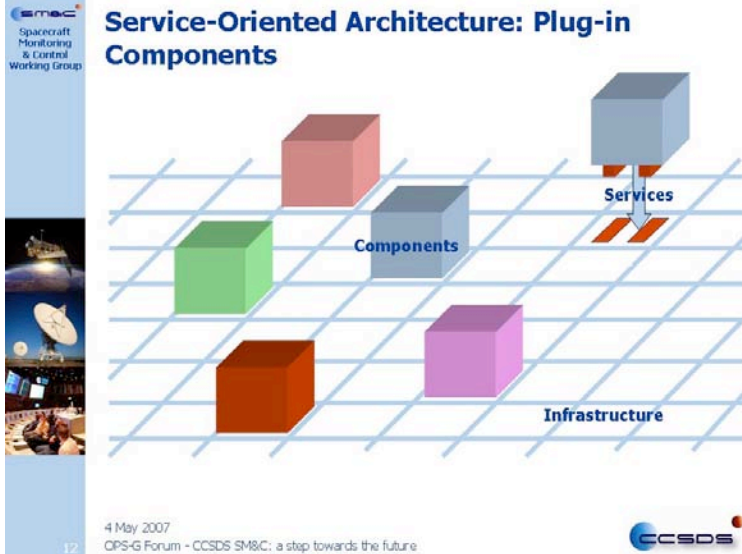
To get involved in the work of the CCSDS technical groups, please [review the participation information](#) and then [request a CWE login](#). Interested parties can always view any of the public information on any of the CWE sites without a login. If you have any questions on how to get involved, please do not hesitate to contact the [secretariat](#).

Progress on Spacecraft Monitoring and Control Standards

There is a general trend and increasing pressure to increase mission complexity and reduce the cost of mission operations, both in terms of initial deployment and recurring expenditures. Closed, or 'monolithic' mission operations system architectures do not allow the re-distribution of functionality between space and ground, or between nodes of the ground system. This lack of architectural openness leads to:

- lack of interoperability between agencies;
- lack of re-use between missions and ground systems;
- increased cost of mission specific development and deployment;
- unavailability of commercial generic tools;
- inability to replace implementation technology without major system redesign;
- lack of operational commonality between mission systems, and
- increased training costs.

In the CCSDS Spacecraft Spacecraft Monitoring & Control (SM&C) Working Group, 10 space agencies are working hard to define a set of standard services, which constitutes a framework that enables many similar systems to be assembled from compliant 'plug-in' components. These components may be located anywhere, provided they are connected via a common infrastructure. This allows components to be re-used in different mission-specific deployments: between agencies, between missions, and between systems.



The working group has produced a [Green Book \(Informational Report\)](#) and is working on the specifications. The first three standard books, the SM&C Message Abstraction Layer, the SM&C Common Service and the SM&C Core Service, are currently being finalized in preparation for Agency Review after several internal reviews and two incremental validations by prototype. It is also important to note that the approach does not prescribe the components themselves or their implementation. Only the service interfaces between components are standardized. This allows for innovation, specialization and differentiation in components, while ensuring they can be rapidly integrated into a system. At the last CCSDS workshop (Jan 07), NASA agreed to increase support to the SM&C effort while continuing to identify the candidate enabling technologies for the future Constellation Program.

On the XML Telemetry and Telecommand Exchange (XTCE) front, the original Object Management Group (OMG) specifications amended by two CCSDS Agency Reviews have been finally approved by OMG and are currently being adopted by CCSDS. Additionally, the SM&C WG has complemented them with a [Green Book](#) and is currently working on a Magenta Book (Recommended Practice) that will provide guidance for tailoring XTCE for CCSDS-enabled missions.

SOIS Update

The Spacecraft onboard interface services (SOIS) area has recently completed a set of draft documents for Agency review. With this release a framework has been established for the further development of onboard protocols, some by external expert groups, to meet the SOIS defined communication services. Much work remains and SOIS is now focusing its attention on

the topic of 'Plug & Play' initially to determine it's meaning and application in the context of spacecraft data handling systems.

Interoperability in Space

The following blog post is reprinted from the [Space Pragmatism Blog](#) with permission from the author. We felt that it dramatically illustrates the human side of the CCSDS goals. It is reproduced here to illustrate the concern that other communities have for interoperability, and that there is support for our work in arenas that many may not realize exist.

I was down to my last 30 minutes of air. Why did I come out on this damn solo hike? I was 25 km from Goddard Colony but because of the damn crater ridge, my radio signal can't get through. Admittedly, this entire hike wasn't planned well. I have been sitting on this damn spot for almost an hour trying to get somebody on comms.

To bad we only have two satellites in orbit. Of course neither one is in range for another two hours. We don't have the launch capability yet, and Earth doesn't think a small localized colony needs satellites for intra-moon communications, the bastards.

Oh crap, my leg just went numb. That can't be good. Maybe if I twist around this, wait! Is that a rover? I think it is one of the Chinese rovers. Thank God! Come on guys, pick up the phone. Wait, they are turning around. Damn, they can't hear me, there's no air. Why don't they pick up?

"In today's top story, A young man was found dead 25 km from Goddard Colony at the foot of the largest crater. Apparently he had broken his leg and the crater broke "line-of-site" communications with the colony. According to officials he ran out of air this morning about 11:00 am GMT.

According to rescue workers, a Chinese mining crew passed near his position but due to non-standard comms formats, were unable to hear the distress call.

This latest tragedy has caused heated debate on both lunar communications satellites and standard radio formats across all lunar areas.

This is Debra Jones reporting."

Interoperability on Earth is a problem. I know, it is why I have a job. The military needs divisions to be able to communicate at all times. Problem is, they don't tend to think of it until after it's needed (like during a war). Then it costs a fortune to retrofit and design comms equipment to translate for each group.



I believe the problem will be worse on the Moon if we don't plan ahead. At least on the Earth we have air so we can shout at each other over short distances. The Moon has no such luxury. If you can't talk over radio (or laser or whatever) you can't talk.

The history of deep space communications is a tale of mission specific message formats. Voyager 1 used X-band and S-band radio with a mission specific message format. Hubble uses the TDR Satellites to beam data down at Ka, Ku, or S-Band satellites, again with a mission specific format.

Most NASA spacecraft use X, Ka, Ku, or S-band radio and Reed-Solomon convolution encoding. The problem is, as I have seen in the past, they are developing the communications for the mission.

That may sound stupid, but think about it. If each mission has its own message format (even if it does use the same frequency and encoding) nobody can talk to each other.

You have to design an expandable message format that most everyone (tactically important comms aside) can use. We need to design a space TCP/IP that we can all develop spacecraft to fit. Not for a mission with a specific infrastructure, but with an expandable non-defined infrastructure.

There have been positive steps. The CCSDS has worked to create international communications standards. In fact, over 300 space missions have launched with CCSDS comm standards.

If new space is going to take off, we really need a way for a stranded SS3 [Space Ship 3] to call a Bigelow [Aerospace] station for help. Safety, reliability, trade, and development cost all beg for it.

AIAA Publishes Adaptations of CCSDS SLE Standards

AIAA is finalizing two new specifications: ANSI/AIAA S-123-2007 and ANSI/AIAA S-124-2007. They are titled *Adaptations and Conversions of CCSDS Space Link Extension Forward Communications Link Transmission Unit Transfer Service* and *Adaptations and Conversions of CCSDS Space Link Extension Return All Frames Transfer Service*. These specifications are intended to provide an open standard for telemetry and command ground interfaces among military and non-military US government (USG) satellite control networks.

The USG maintains a suite of satellite control networks. The largest of these is the Air Force Satellite Control Network (AFSCN), with some 15 remote tracking stations at 8 remote sites worldwide. NASA maintains 3 separate satellite control networks: the Deep Space Network (DSN), the Ground Network (GN), and the Tracking and Data Relay Satellite System (TDRSS)-based Space Network (SN). NOAA maintains two separate sites in Wallops, VA and Fairbanks, AK. The AFSCN, NOAA, and NASA GN are all ground-based S-band networks employing similar hardware systems used for generic operations including state-of-health, control of the bus, launch and early orbit, and disposal operations. Besides these S-band networks, there are many other USG networks operating in different frequency regimes used for specific satellite missions to manage high data rates associated with the various civil, scientific, and national security payloads.

In 2000, NASA, NOAA, and the Department of Defense (DoD) signed the Satellite Operations Architecture Transition Plan, which set out to bring the various networks toward interoperability. A vision was enunciated of an Interoperable Satellite Control

Network. Certainly, there are special-purpose or mission-specific networks which may never need to interoperate. However, there is a compelling rationale for bringing the general-purpose S-band ground networks, which share commonalities in hardware and operational mandate, toward greater interoperability.

Interoperability is not without its technical hurdles. The DoD missions and associated networks employ ternary uplinks at frequencies around 1800 MHz, whereas the NASA and NOAA (civil) network employ binary uplinks around 2000 MHz. Similarly, DoD missions require more stringent performance requirements on transfer of data between remote tracking station (RTS) and space operations center (SOC) than do the civil networks. These requirements result ultimately from the widespread use of link layer encryption for DoD missions.

In response to the SatOps Transition Plan, the Air Force Space Command levied an interoperability requirement on the AFSCN. The acquisition agency for the AFSCN, the Air Force Space & Missile Systems Center, established a project to address the new interoperability requirement and called this project the SMC Interoperability Project. This project soon determined that the key to interoperability among military and non-military ground networks lay with open, standard interfaces operating over IP networks connecting remote tracking stations and mission control centers.

Meanwhile, CCSDS had established a successful civil inter-agency standard for the space link between remote tracking stations and space vehicles. In the 1990s, they sought to extend that standard from RTSs to SOCs, thereby creating the Space Link Extension (SLE) standards. The SLE transfer services include the Return All Frames (RAF) service for telemetry and the SLE Forward Communication Link Transmission Unit (FCLTU) service for commanding. All SLE transfer services use TCP/IP to provide reliable network connectivity. The SLE transfer service specifications, in particular those for RAF and FCLTU, are available on the [CCSDS web site](#).

When the SMC Interoperability Project began to identify a viable IP-based telemetry and command standard, SLE was an attractive prospect. The USG representative to CCSDS, NASA, had already begun to move toward SLE adoption. The SLE interfaces were available in multiple vendor systems. Yet there was a hitch in that SLE did not support some of the DoD-specific operations such as ternary uplinks and unframed telemetry. When approached with the DoD-based service needs, the international organization was understandably reluctant to include new services for a single network and which are somewhat retrograde technologically. Recognizing that the SatOps Transition Plan did amount to a US national requirement for interoperability, and that some sort of US interagency specification was needed, the project team approached AIAA (an ANSI-accredited Standards Developing Organization) with proposed adaptations and conversions of SLE for USG interoperations.

After several years of prototyping and much collaborative work with NASA, NOAA, and vendors, the result is the two new specifications being released as [ANSI/AIAA S-123-2007](#) and [ANSI/AIAA S-124-2007](#). The plan is for DoD and civil systems to implement these standards in future ground system procurements. The AIAA adaptations and conversions of SLE will support DoD operations, while the unmodified SLE services will support conventional civil operations. A unified open standard is

thus available for future procurements guaranteed to meet the operational requirements of all DoD and civil missions.

As a postscript, CCSDS is retooling its SLE approach in a modular manner to more readily allow future data flows unanticipated in either the AIAA specifications or some future operations.

Report From ISO TC20/SC14

ISO TC20/SC14 (space systems and operations standardization) recently concluded its annual Spring Working Group and Plenary Meetings in Beijing, China, which ran from 21-25 May 2007. The meeting was hosted by the Chinese delegation and CASC whose outstanding hospitality, facilities and supporting staff enabled SC14 to have a very successful series of meetings.

Key resolutions passed in the meeting included the approval of Mr. Bill Raynor and Dr. David Finkleman as the new convenors for WG 2 (interfaces, intergration, and test) and 3 (operations and ground support) respectively, the provision of an updated and prioritized work plan and schedule from the Orbital Debris Coordination Group, and the unanimous support of the member body delegations for the proposal submitted by the Chairman of SC13 for greater collaboration with CCSDS/SC13 with an action for the Secretary and Chairman to move towards formalizing this collaboration. Other key areas of discussion included the reorganization of ECSS and further collaboration with this group, the formation of a Space Systems Technical Committee and the progress of a shared Orbit Data Message and Exchange document with SC 13.

TC20/SC14 Working Groups will be meeting this fall in Brazil and England, and the next Spring Working Group and Plenary Meeting will take place in Turino, Italy from 11-16 May 2008.

For Your Information

Save the Date for Darmstadt Meetings

Hosted by ESA, the CCSDS Fall 2007 meeting series will be held at the Bruchsee Hotel in Heppenheim, Germany, from 1st October - 5th October 2007.

The following week, the CESC - CMC Meetings will be held at ESA / ESOC in Darmstadt, Germany

CESG Meeting	8 October 2007
CESG - CMC Meeting	9 October 2007
CMC Meeting	10-11 (am) October 2007

For the most up-to-date meeting information, including hotel reservations and agendas, please visit the [website](#).

New Chinese Observer Agency

The CCSDS Management Council (CMC) recently approved the Chinese Academy of Sciences (CAS) as a new CCSDS Observer Agency. The [Center for Space Science and Applied Research](#) (CSSAR) within CAS will serve as the focal point for increased Chinese participation in CCSDS.

Please join us in welcoming the participation from this new body within the working groups.

Help Recognize Your Colleagues for Outstanding Work

The SpaceOps Organization is currently accepting nominations for two awards.

The *International SpaceOps Award for Outstanding Achievement* is presented for outstanding efforts in overcoming space operations and/or support challenges, and recognizes those teams or individuals whose exceptional contributions were critical to the success of a space mission.

The inaugural recipient of this award (2006) was Mr. Joachim Kehr.

The *International SpaceOps Distinguished Service Medal* is presented to give unique recognition to an individual member of the international Space Operations community who has distinguished himself or herself with service to the Space Ops organization or to the field of space operations and support. The recipient shall be an individual who has shown particular dedication to the interests of the organization or space ops field by making significant and continuing contributions over an extended period of time.

The inaugural recipient of this award (2006) was the U.S. Geologic Survey Landsat 5 Flight Ops Team.

Nominations must be submitted no later than 1 February 2008 to the [SpaceOps Secretariat](#).

The *AIAA Excellence in Aerospace Standardization Award* is presented on odd years to recognize contributions by individuals that advance the health of the aerospace community by enabling cooperation, competition, and growth through the standardization process.

Past winners of this award include:

- Dr. William W. Vaughan (2005)
- Dr. Macgregor S. Reid (2007)

Nominations for this award are accepted through the [AIAA website](#) and must be submitted by 1 July 2008.

Help Spread the Word About CCSDS

In an effort to keep the widespread and continued use of CCSDS work in front of the greater space community, we have developed an organization communication plan. Part of this plan calls for issuing periodic press releases coinciding with significant missions, mission milestones, successes, demonstrations in which CCSDS specifications have played a role.

While we on the Secretariat staff can monitor the U.S.-based missions fairly well, we would very much appreciate your help in keeping us apprised of events worthy of further publicity occurring within your local space programs.

Of course an opportunity for publicity does not necessarily have to be directly mission-related. If you feel that ongoing standard development work may be of interest to a broader audience, let us know and we will help you to get the word out.

Please send any and all suggestions you may have at any time to secretariat@mailman.ccsds.org.

New and Noteworthy

The following documents have recently been released for formal agency review or have been published.

Documents Under Review

CCSDS 644.0-P-2.1 (Pink Sheets): *The Data Description Language EAST Specification*

This Recommendation defines the Enhanced Ada SubeT (EAST) language used to create descriptions of data, called Data Description Records (DDR). Such DDRs ensure a complete and exact understanding of the data and allow it to be interpreted in an automated fashion. This means that a software tool is able to analyze a DDR and interpret the format of the associated data. This allows the software to extract values from the data on any host machine (i.e., on a different machine from the one that produced the data).

This draft update to The Data Description Language EAST Specification adds improvements/clarifications to the specification and adds a requirement to include the EAST version number in the logical part of a DDR.

Comments due by 21 June 2007.

CCSDS 401.0-R/P-17.1 (Red Book): *Radio Frequency and Modulation Systems--Part 1: Earth Stations and Spacecraft*

Recommendations contained in this document, Radio Frequency and Modulation Systems, Part 1, focus upon the standardization of RF and modulation systems for Earth stations and spacecraft. Part 2, when completed, will comprise Recommendations relating to data relay satellite systems. Unlike the CCSDS Radio Frequency and Modulation Report, Reference [2], these Recommendations describe the capabilities, policies,

and procedures that the CCSDS agencies believe will be needed in future years. By proposing specific characteristics and attributes for subjects in these categories, the CCSDS hopes that the ensuing designs will be sufficiently similar so as to permit cross support of one agency's spacecraft by another agency's network.

The current draft adds new recommendation 2.4.20B and updates recommendations 2.4.12A, 2.4.12B, and 2.6.8B.

Comments due by 16 July 2007

Recently Published Documents (since Jan. 2007)

[CCSDS File Delivery Protocol \(CFDP\): Part 1: Introduction and Overview](#)

This Report provides an introduction to the concepts, features and characteristics of the CCSDS File Delivery Protocol (CFDP).

[CCSDS File Delivery Protocol \(CFDP\): Part 2: Implementers Guide](#)

This Report provides information to assist implementers in understanding the details of the protocol and in the selection of appropriate options, and contains suggestions and recommendations about implementation-specific subjects. This Report also contains implementation reports from various member Agencies, reports on testing of the implementations and protocol, and the requirements upon which the CFDP is based.



The current mission count stands at [342](#)! Please help us to stay on top of this important statistic by informing the Secretariat any time a new program, mission, or vehicle you are working on decides to implement one of our specifications.

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