CCSDS RESTRUCTURING SYNTHESIS GROUP

PROPOSAL FOR RESTRUCTURING THE CCSDS ORGANIZATION AND PROCESSES

CCSDS RECORD A02.1-Y-1

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3 PROPOSED NEW STANDARDIZATION PROCESS

NOTE WELL

When CCSDS was formed in 1982 there were virtually no international space standards and there was only a small amount of interoperable space support infrastructure in place. Today – largely as a result of the work of CCSDS - there is a large international installed base of both.

It is therefore important to recognize that while twenty years ago just about every specification was "standards track", CCSDS should now confine that category to recommendations that are directly intended to change and evolve the installed base of space and ground systems in response to well defined requirements for new capabilities. It is therefore proposed to slightly revise the CCSDS document progression to differentiate between those documents that are intended for almost immediate incorporation into deployed space and ground infrastructure, and those that are intended to provide longer-term guidance for how that infrastructure should or may evolve.

The proposed new flow of developing a CCSDS document (referenced to the "CCSDS classic" flow) is as follows:

1. Every CCSDS document (or family of related documents) starts out as a CCSDS Concept Paper. This is unchanged.

2. If a Working Group is successfully chartered by the CESG to develop a document further within CCSDS, the charter must specify which "Track" it will follow. (The significance of these Tracks will be defined later.) The Tracks are:

   - Standards Track
   - Non-Standards Track
   - Administrative Track

3. The Standards Track has two branches:

   - documents that are intended to be "Recommended Standards" (CCSDS 'Blue Books'), and;
   - documents that are intended to be "Recommended Practices" (CCSDS 'Magenta Books').

3a The flow of documents on the "Recommended Standard" branch corresponds to the old "CCSDS classic" document flow:

   - "CCSDS Proposed Standard" = classic White Book

- “CCSDS Draft Standard” = classic Red Book and Pink Sheets
- “CCSDS Recommended Standard” = classic Blue Book

Note that successful completion of a formal Agency review is always required for a document on the “Recommended Standard” branch of the Standards Track in order to:

i. advance through each of the various issues of a Draft Standard;
ii. transition from CCSDS Draft Standard to CCSDS Recommended Standard.

3b The flow of documents on the “Recommended Practice” branch broadly parallels the “Recommended Standard” branch, i.e.,

- “CCSDS Proposed Practice” (White Book)
- “CCSDS Draft Practice” (White Book)
- “CCSDS Recommended Practice” (Magenta Book)

However, successful completion of a formal Agency review for a Recommended Practice is only required for a document to transition from CCSDS Draft Practice to CCSDS Recommended Practice.

4. The Non-Standards Track includes two categories:

- "CCSDS Experimental" (Orange Book)
- "CCSDS Historic" (Silver Book)

It also contains the old "CCSDS classic" category:

- "CCSDS Informational" (the classic Green Book)

(As before, Green Books can also support the Standards Track documents.)

5. The Administrative Track corresponds to the old "CCSDS classic" category:

- "CCSDS Record” (Yellow Book)

The proposed new general taxonomy of CCSDS documentation is shown in Figure 2-2. The proposed new Tracks and designations are summarized as:

- **CCSDS CONCEPT PAPER**

- **CCSDS STANDARDS TRACK**
  - CCSDS Proposed Standard ("White Book")
  - CCSDS Draft Standard ("Red Book" and "Pink Sheets")
  - CCSDS Recommended Standard ("Blue Book")
  - CCSDS Proposed Practice ("White Book")
  - CCSDS Draft Practice ("White Book")
  - CCSDS Recommended Practice ("Magenta Book")

- **CCSDS NON-STANDARDS TRACK**
  - CCSDS Experimental ("Orange Book")
  - CCSDS Informational ("Green Book")
  - CCSDS Historic ("Silver Book").

- **CCSDS ADMINISTRATIVE TRACK**
  - CCSDS Record ("Yellow Book")

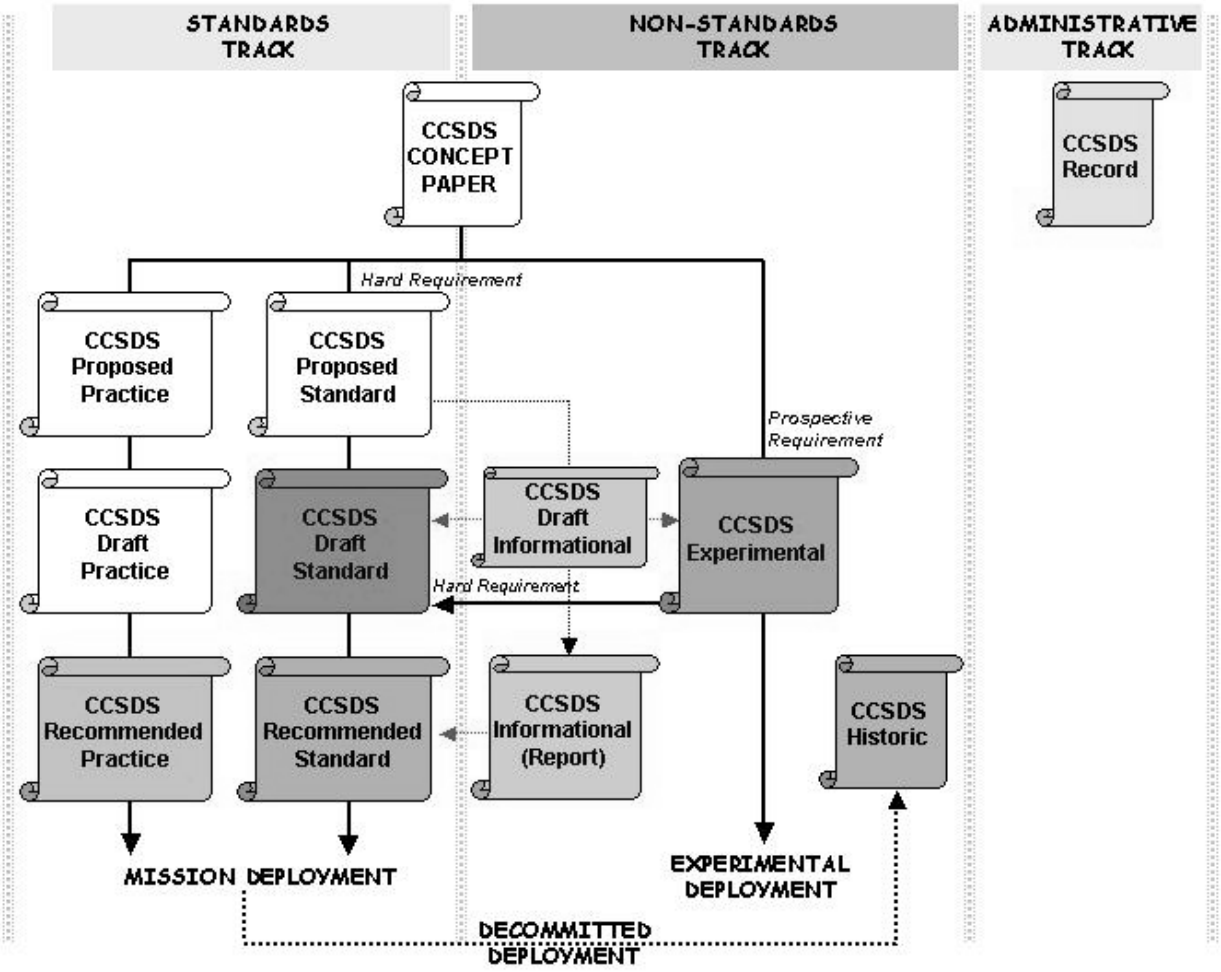

Figure 2-2: CCSDS Document Taxonomy

3.1 CCSDS CONCEPT PAPER

Every final CCSDS Recommended Practice or Recommended Standard starts out as a CCSDS Concept Paper. Not all CCSDS Concept Papers, though, end up as CCSDS Practices or Standards.

A CCSDS Concept Paper is not archived and it only has a lifetime of 9-months, after which time it has no further significance. Anyone (from any organization and not necessarily already affiliated with CCSDS) can write a CCSDS Concept Paper at any time and it is generally used as the "talking paper" in order to get work started. All that is necessary is to observe some basic formatting rules that are established by the Secretariat, and to submit it to the Secretariat for publication. The Secretariat will then assign the Concept Paper a reference number and a date of expiration, will place it in an accessible part of the CCSDS web site and will announce its availability to an interested Mailing List. The announcement

will contain a short summary of the Concept Paper's subject to solicit interest. This announcement can often be the basis for the subsequent formation of a BOF.

If a CCSDS Concept Paper has been processed by a BOF as part of its work in developing a WG charter, it must be updated as necessary (so that it has active status) and must be submitted to the CESG as part of the WG approval process. If accepted as a work item by the CESG, the Concept Paper becomes the primary initial working document of the WG and its subsequent development will be assigned by the CESG to either the Standards Track, or to the Non-Standards Track, or to the Administrative Track.

3.2 CCSDS STANDARDS TRACK

Standards Track documents are those that are intended to directly influence and enhance the international installed base of CCSDS-compatible space mission support infrastructure. Generally, they are developed in response to a direct mission or operational need (a “hard requirement”) that has been identified via the CMC Customer Interface function and approved by a customer group (such as the IOAG). In order to enter the Standards Track, the WG charter must demonstrate to an AD that the work has broad support across the CCSDS community – normally by showing that multiple Agencies or other organizations are willing to participate in the development.

Standards Track specifications normally must not depend on other Standards Track specifications that are at a lower maturity level, or on non-Standards Track specifications other than referenced specifications from other standards bodies. The CESG makes recommendations for which work items should enter the Standards Track when chartering a WG and the CMC must approve those recommendations prior to the initiation of work.

A RECOMMENDED STANDARDS

CCSDS Recommended Standards (Blue Books) define specific interfaces, technical capabilities or protocols, or provide prescriptive and/or normative definitions of interfaces, protocols, or other controlling standards such as encoding approaches. Standards must be complete, unambiguous and at a sufficient level of technical detail that they can be directly implemented and used for space mission interoperability and cross support. Standards must say very clearly, “this is how you must build something if you want it to be compliant”.

B RECOMMENDED PRACTICES

CCSDS Recommended Practices (Magenta Books) are the consensus results of CCSDS community deliberations and provide a way to capture "best" or "state of the art" approaches for applying or using standards. They may include references to sets of standards selected to perform certain applications, or guidelines for standardized processes or procedures for accomplishing tasks, or other materials (such as reference models) to assist in the design, use or selection of standards. Practices say, “here is how the community recommends that you should carry out or describe this particular kind of operation at present, or how the community recommends that it should be carried out in the future".

Historically, CCSDS Recommended Standards have often been concerned with the technical specifications for hardware and software components required for computer communication across interconnected space mission support networks. One example of a Recommended Practice would therefore be to specify some specific “Application Profiles” of multiple CCSDS Standards that are recommended for use in particular mission support configurations.

Another use could be to recognize that the world space mission infrastructure is composed of networks operated by a great variety of organizations, with diverse goals and rules, and that good user service requires that the operators and administrators of these networks follow some common guidelines for policies and operations. While these guidelines are generally different in scope and style from protocol standards, their establishment needs a similar process for consensus building. The Recommended Practice branch of the Standards Track creates a smoothly structured way for these entities to insert proposals into the consensus-building machinery of the CCSDS while gauging the community's view of that issue.

3.2.1 CCSDS Proposed Standard (White Book)

The entry-level maturity for a document on the Standards Track that is targeted towards being a Recommended Standard is "Proposed Standard". An explicit CESG and CMC approval action is required to move a Concept Paper onto the Standards Track at the "Proposed Standard" level. Prior to that approval, even though a WG has been chartered, its documents remain at the Concept Paper stage.

A Proposed Standard specification represents a convergence of concepts via a process of WG consensus, has resolved the major design choices, is believed to be pursuing a well understood sequence of development, has received limited peer review, and appears to enjoy enough community interest to be considered valuable. However, further experience might result in a change or even retraction of the specification before it advances. Since the content of a Proposed Standard may be changed as it progresses if problems are found or better solutions are identified, deploying implementations of such standards into a disruption-sensitive environment is not recommended.

A Proposed Standard should have no known technical omissions with respect to the requirements placed upon it. However, this requirement may be waived by the CESG in order to allow a specification to advance to the Proposed Standard state when it is considered to be useful and necessary (and timely) even with known technical omissions. Implementers should treat Proposed Standards as immature specifications.

Usually, neither implementation nor operational experience is required for the initial re-designation of a Concept Paper as a Proposed Standard. However, such experience is highly desirable, and will usually represent a strong argument in favor of granting it a Proposed Standard status.

Proposed Standards will generally go through several "Issues" during which they will progressively become more mature. Every Issue must clearly state the status of the

specification and must indicate the risks associated with implementing it in its current state. As they progress, it is desirable to prototype Proposed Standards in some kind of test system in order to gain experience and to validate and clarify the specification. Such a prototype should exercise critical elements of the specification in an operationally-relevant environment, either real or simulated.

Note that the CESG may require prototyping and/or operational experience prior to granting Proposed Standard status to a specification that materially affects the core CCSDS interoperability protocols or that specifies behavior that may have significant operational impact on the installed base of international mission support infrastructure.

3.2.2 CCSDS Draft Standard (Red Book)

Elevation to Draft Standard is a major advance in status, indicating a strong belief that the specification is mature and will be useful. A second explicit CESG and CMC approval action is required to move a Proposed Standard to the Draft Standard level. A Draft Standard must be well understood and known to be quite stable, both in its semantics and as a basis for developing an implementation. It will generally go through several "Issues" during which time it will progressively become more mature. Every time that an Issue of a Draft Standard is published, it automatically triggers a formal Agency review and the results of that review must be satisfactorily incorporated before a new Issue can be published. Since formal Agency reviews consume resources, a “review budget” must be agreed by the CESG and the CMC prior to publishing the first Issue of a Draft Standard; this budget identifies how many review cycles can be consumed without re-authorization by the CMC. Each separate Issue must clearly state the status of the specification and must indicate the risks associated with implementing it in its current state.

At some point in the evolution of a Draft Standard that is intended to result in a change to mission support infrastructure, at least one hardware or software prototype (or other implementation) must exist which demonstrates and exercises all of the options and features of the specification in an operationally relevant environment, either real or simulated. This point may be Issue-1, or it may be a later Issue depending on circumstances, but for most documents the implementation must exist prior to issuing a "final" Draft Standard. The WG Chair is responsible for documenting the specific implementation(s) that qualify the specification, along with reports relevant to their testing, or for justifying why such implementation is either inappropriate or should otherwise be waived. The documentation of the qualifying implementation must include clear statements about its ability to support each of the individual options and features. If patented or otherwise controlled technology is required for the implementation, it must be demonstrated that the licensing process and fees are fair and non-discriminatory

In its final stages of Issue, a Draft Standard is normally considered to be a final specification, and changes are likely to be made only to solve specific problems encountered. In most circumstances, it is fairly safe for users to deploy implementations of the final Issue of a Draft Standard into a disruption sensitive operational environment.

3.2.3 CCSDS Recommended Standard (Blue Book)

Generally, only a specification for which significant implementation experience has been obtained may be elevated to the CCSDS Recommended Standard level. (Exceptions include things like prescriptive Reference Models, which are not intended to be directly implemented in hardware or software.) A CCSDS Recommended Standard is characterized by a high degree of technical maturity and by a generally held belief that the specified protocol or service provides significant benefit to the international space mission community.

Converting a CCSDS Draft Standard to a CCSDS Recommended Standard is always preceded by a successful final formal Agency review. With a few exceptions (for which waivers must be sought), conversion of a Draft Standard to a Recommended Standard also requires that at least two independent and interoperable prototypes or implementations must have been developed and demonstrated in an operationally-relevant environment, either real or simulated. In cases in which one or more options or features have not been demonstrated in at least two interoperable prototypes or implementations, the specification may advance to the CCSDS Recommended Standard level only if those options or features are removed. The WG Chair is responsible for documenting the specific implementations that qualify the specification for CCSDS Recommended Standard status, along with reports relevant to their testing, or for justifying why such implementation is either inappropriate or should otherwise be waived. The documentation of qualifying implementations must include specific statements about its ability to support each of the individual options and features. If patented or otherwise controlled technology is required for the separate implementations, they each must also have resulted from separate exercise of the licensing process and it must be demonstrated by the WG chair that the licensing process and fees are fair and non-discriminatory.

Based on operational experience, Recommended Standards may themselves go through several "Issues" during their lifetime as new features or enhanced capabilities are added. Every Issue must clearly state the status of the specification and must indicate the risks associated with implementing it in its current state.

The procedure for changing a CCSDS Recommended Standard is that the updates must be circulated back through the CCSDS Draft Standard phase: this is the familiar CCSDS "Pink Sheet" process.

A CCSDS Recommended Standard must be reconfirmed or updated every five years, or it shall be retired to "CCSDS Historic" status.

3.2.4 CCSDS Proposed Practice, BCP (White Book)

The entry-level maturity for a document on the Standards Track that is targeted towards being a Recommended Practice is "Proposed Practice". An explicit CESG and CMC approval action is required to move a Concept Paper onto the Standards Track at the "Proposed Practice" level. Prior to that approval, even though a WG has been chartered, its documents remain at the Concept Paper stage.

A Proposed Practice represents a convergence of concepts via a process of WG consensus, has resolved the major choices, is believed to be pursuing a well understood sequence of development, has received limited peer review, and appears to enjoy enough community interest to be considered valuable. However, implementers should treat Proposed Practices as immature guidance.

A Proposed Practice will generally go through several WG-internal "Issues", during which it will progressively become more mature, until the WG chair is ready to propose its advancement to the next stage via a request transmitted to the CESG by the Area Director. Usually, neither implementation nor operational experience is required for the initial re-designation of a Proposed Practice as a Draft Practice. However, such experience is highly desirable, and will usually represent a strong argument in favor progressing it forward. The WG chair is responsible for documenting the history of the Proposed Practice and for indicating why it is thought to be ready for advancement,

3.2.5 CCSDS Draft Practice (White Book)

Even though its “color” does not change, elevation to Draft Practice is a major advance in status, indicating a strong belief that the document is mature and will be useful. A Draft Practice must be well understood and known to be quite stable, both in its semantics and as a basis for guiding an implementation. The CESG will look for evidence of this maturity before granting Draft Practice status, and may recommend that the first Issue of a Draft Practice should be subjected to formal Agency review in order to gauge its acceptability to the community.

A Draft Practice will generally go through several more Issues, during which it will progressively become more mature. Every Issue of the Draft must clearly state its status and must indicate the risks associated with using it in its current state. The WG chair determines when each Draft Issue is published. Although formal Agency review is not required to advance to the next Issue, the CESG may recommend such a review when judged to be beneficial. At such time as the WG feels that it is ready for finalization, the WG chair must demonstrate that its contents represent the true consensus of the group and must petition the CESG via the AD for permission to submit the document for formal Agency review prior to its designation as an approved Recommended Practice. To support this advancement, it is desirable to demonstrate its use in some kind of test application in order to gain experience and to validate and clarify the specification. In its final stages of Issue, a Draft Practice is normally considered to be a final specification, and changes are likely to be made only to solve specific problems encountered.

3.2.6 CCSDS Recommended Practice (Magenta Book)

Converting a CCSDS Draft Practice to a CCSDS Recommended Practice is always preceded by a successful formal Agency review. Generally, only a specification for which significant implementation experience has been obtained may be elevated to the CCSDS Recommended Practice level. The WG Chair is responsible for documenting the specific

implementations that qualify the specification for advancement. A CCSDS Recommended Practice is characterized by a high degree of maturity and by a generally held belief that the specified activity provides significant benefit to the international space mission community.

Based on operational experience, Recommended Practices may themselves go through several "Issues" during their lifetime as new features or enhanced capabilities are added. Every Issue must clearly state the status of the specification and must indicate the risks associated with implementing it in its current state. The procedure for changing a CCSDS Recommended Practice is that the updates must be circulated back through the CCSDS Draft Practice phase. A CCSDS Recommended Practice must be reconfirmed or updated every five years, or it shall be retired to "CCSDS Historic" status.

3.2.7 A Note On "Reference Implementations"

The proposed new standardization procedures defined above greatly increase the significance of producing prototypes and implementations as requirements to progress along the Standardization Track. It is recognized that implementing a major complicated standard may be a significant piece of work and that developing "reference implementations" that can be shared is highly desirable. Making reference implementations available to prospective designers of operational systems can offer them both cost and risk reduction advantages and can help in the testing of their fielded implementations.