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Space data and information transfer systems — CCSDS file delivery protocol

Systèmes de transfert des informations et données spatiales — Protocole CCSDS de livraison de fichiers

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17355 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 727.0-B-3, June 2005) and was adopted (without modifications except those stated in Clause 2 of this International Standard) by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 13, *Space data and information transfer systems*.

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This third edition cancels and replaces the second edition (ISO 17355:2004), which has been technically revised.

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Space data and information transfer systems — CCSDS file delivery protocol

1 Scope

This International Standard defines a CCSDS file delivery protocol (CFDP) and associated service for application in the space environment. It is intended for use over the current and envisaged packet delivery services used in the space environment, including

— CCSDS conventional packet telecommand;

— CCSDS conventional packet telemetry;

— CCSDS advanced orbiting systems (AOS) path service.

It may also operate over a wide variety of ground network services, including those specified by the CCSDS for cross-support purposes. The protocol operates in the space-to-ground, ground-to-space, and space-to-space directions of transfer. It may be initiated by the file sending or receiving entity. In the interests of interoperability, protocol elements are included for generalized forms of standard file manipulation operations based on assumptions of a common model for a 'filestore', or medium used to store files. It is recognized, however, that the precise nature and capabilities of filestore management systems are operating-system dependent and, for that reason, the protocol assumes a virtual filestore and associated services that an implementation must map to the capabilities of the actual filestore used.

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The scope and field of application are furthermore detailed in subclauses 1.2 and 1.3 of the enclosed CCSDS publication.

2 Requirements

Requirements are the technical recommendations made in the following publication (reproduced on the following pages), which is adopted as an International Standard:

CCSDS 727.0-B-3, June 2005, *CCSDS file delivery protocol (CFDP).*

For the purposes of international standardization, the modifications outlined below shall apply to the specific clauses and paragraphs of publication CCSDS 727.0-B-3.

Pages i to v

This part is information which is relevant to the CCSDS publication only.

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Add the following information to the reference indicated:

[1] Document CCSDS 732.0-B-1, September 2003, is equivalent to ISO 22666:2005.

[2] Document CCSDS 132.0-B-1, September 2003, is equivalent to ISO 22645:2005.

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[3] Document CCSDS 133.0-B-1, September 2003, is equivalent to ISO 22646:2005.

[4] Document CCSDS 232.0-B-1, September 2003, is equivalent to ISO 22664:2005.

3 Revision of publication CCSDS 727.0-B-3

It has been agreed with the Consultative Committee for Space Data Systems that Subcommittee ISO/TC 20/SC 13 will be consulted in the event of any revision or amendment of publication CCSDS 727.0-B-3. To this end, NASA will act as a liaison body between CCSDS and ISO.

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The Consultative Committee for Space Data Systems

Recommendation for Space Data System Standards

CCSDS FILE DELIVERY PROTOCOL (CFDP)

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RECOMMENDED STANDARD

CCSDS 727.0-B-3

BLUE BOOK

June 2005

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AUTHORITY

Issue:	Recommended Standard, Issue 3
Date:	June 2005
Location:	Not Applicable

This document has been approved for publication by the Management Council of the Consultative Committee for Space Data Systems (CCSDS) and represents the consensus technical agreement of the participating CCSDS Member Agencies. The procedure for review and authorization of CCSDS Recommendations is detailed in the reference [A1], and the record of Agency participation in the authorization of this document can be obtained from the CCSDS Secretariat at the address below.

This Recommendation is published and maintained by:

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STATEMENT OF INTENT

The Consultative Committee for Space Data Systems (CCSDS) is an organization officially established by the management of its members. The Committee meets periodically to address data systems problems that are common to all participants, and to formulate sound technical solutions to these problems. Inasmuch as participation in the CCSDS is completely voluntary, the results of Committee actions are termed **Recommended Standards** and are not considered binding on any Agency.

This **Recommended Standard** is issued by, and represents the consensus of, the CCSDS members. Endorsement of this **Recommendation** is entirely voluntary. Endorsement, however, indicates the following understandings:

- o Whenever a member establishes a CCSDS-related **standard**, this **standard** will be in accord with the relevant **Recommended Standard**. Establishing such a **standard** does not preclude other provisions which a member may develop.
- o Whenever a member establishes a CCSDS-related **standard**, that member will provide other CCSDS members with the following information:
  - -- The **standard** itself.
  - -- The anticipated date of initial operational capability.
  - -- The anticipated duration of operational service.
- o Specific service arrangements shall be made via memoranda of agreement. Neither this **Recommended Standard** nor any ensuing **standard** is a substitute for a memorandum of agreement.

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No later than five years from its date of issuance, this **Recommended Standard** will be reviewed by the CCSDS to determine whether it should: (1) remain in effect without change; (2) be changed to reflect the impact of new technologies, new requirements, or new directions; or (3) be retired or canceled.

In those instances when a new version of a **Recommended Standard** is issued, existing CCSDS-related member standards and implementations are not negated or deemed to be non-CCSDS compatible. It is the responsibility of each member to determine when such standards or implementations are to be modified. Each member is, however, strongly encouraged to direct planning for its new standards and implementations towards the later version of the Recommended Standard.

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FOREWORD

Until relatively recently the typical storage medium for spacecraft has been the tape recorder, a complex device offering limited data storage and data access. The use of this type of storage has typically been limited to the recording and subsequent dump to the ground of telemetry data. Manipulation from the ground has required significant human intervention and used ad hoc, privately developed protocols.

The introduction of solid state mass memory providing gigabytes of storage with random access opens up a whole new ethos of spacecraft operation where much of the routine traffic to and from the spacecraft will be in the form of files. Furthermore, because of the random access nature of the onboard storage medium, it becomes possible to repeat transmission of data lost on the link and thus guarantee delivery of critical information.

To exploit the potential advantages of onboard mass memory, protocol support is required to provide a standard means to move data to and from the onboard storage medium in the form of files.

While the onboard storage medium has rapidly evolved, the essential constraints of space missions remain:

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- limited systems resources in terms of computational power and memory capacities;
- environmental restrictions including noisy, bandwidth limited, asymmetrical, and interrupted communications links, some with very long propagation delay;

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- varying user needs including a requirement for early access to transferred data regardless of its quality.

In view of these constraints, it is clear that there is a need for a file delivery service capable of transferring files to and from mass memory located in the space segment. Such a capability must not only operate under the constraints associated with space data communication, but it must also be applicable to the diverse range of mission configurations ranging from single low earth orbiting spacecraft to complex networks of relays, orbiters, and landers.

Through the process of normal evolution, it is expected that expansion, deletion, or modification of this document may occur. This Recommendation is therefore subject to CCSDS document management and change control procedures which are defined in reference [A1]. Current versions of CCSDS documents are maintained at the CCSDS Web site:

http://www.ccsds.org/

Questions relating to the contents or status of this document should be addressed to the CCSDS Secretariat at the address indicated on page i.

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At time of publication, the active Member and Observer Agencies of the CCSDS were:

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- Agenzia Spaziale Italiana (ASI)/Italy.
- British National Space Centre (BNSC)/United Kingdom.
- Canadian Space Agency (CSA)/Canada.
- Centre National d'Etudes Spatiales (CNES)/France.
- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)/Germany.
- European Space Agency (ESA)/Europe.
- Federal Space Agency (Roskosmos)/Russian Federation.
- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- Japan Aerospace Exploration Agency (JAXA)/Japan.
- National Aeronautics and Space Administration (NASA)/USA.

Observer Agencies

- Austrian Space Agency (ASA)/Austria.
- Belgian Federal Science Policy Office (BFSPO)/Belgium.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
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DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 727.0-B-1	CCSDS File Delivery Protocol, Issue 1	January 2002	Original Issue (superseded)
CCSDS 727.0-B-2	CCSDS File Delivery Protocol, Issue 2	October 2002	Issue 2 (superseded)
CCSDS 727.0-B-3	CCSDS File Delivery Protocol, Issue 3	June 2005	Current Issue: adds procedures for unacknowledged-mode handling of metadata and file data received after the arrival of the EOF PDU for the same transaction.

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