
**Space data and information transfer
systems — Telecommand — Data
management service— Architectural
specification**

*Systèmes de transfert des informations et données spatiales —
Télécommande — Service gestion des données — Définition architecturale*

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Foreword

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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.

International Standard ISO 12174 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 13, *Space data and information transfer systems*.

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Space data and information transfer systems — Telecommand — Data management service— Architectural specification

1 Scope

This International Standard specifies the common requirements which define the architecture of a spacecraft telecommand data management service. This architecture is intended to provide a common framework within which space agencies may implement compatible future spacecraft telecommanding systems.

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 203.0-B-1, January 1987, *Recommendation for space data system standards — Telecommand — Part 3: Data management service — Architectural specification.*

For the purposes of international standardization, the modifications outlined below shall apply to the following pages of publication CCSDS 203.0-B-1.

ISO 12174:1998

Pages *i* to *iv*

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

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Add the following information to the references indicated:

- [3] Document CCSDS 202.0-B-1, January 1987, is replaced by document CCSDS 202.0-B-2, November 1992, which is equivalent to ISO 12172:1997.
- [4] Document CCSDS 201.0-B-1, January 1987, is replaced by CCSDS 201.0-B-2, November 1995, which is equivalent to ISO 12171:1998.
- [5] Document CCSDS 102.0-B-2, January 1987, is replaced by document CCSDS 102.0-B-3, November 1992, which is equivalent to ISO 13419:1997.
- [6] Document CCSDS 101.0-B-2, January 1987, is replaced by document CCSDS 101.0-B-3, May 1992, which is equivalent to ISO 11754:1994.

3 Revision of publication CCSDS 203.0-B-1

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 203.0-B-1. To this end, NASA will act as a liaison body between CCSDS and ISO.

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Consultative Committee for Space Data Systems

**RECOMMENDATION FOR SPACE
DATA SYSTEM STANDARDS**

TELECOMMAND

**PART 3
DATA MANAGEMENT SERVICE
ARCHITECTURAL SPECIFICATION**

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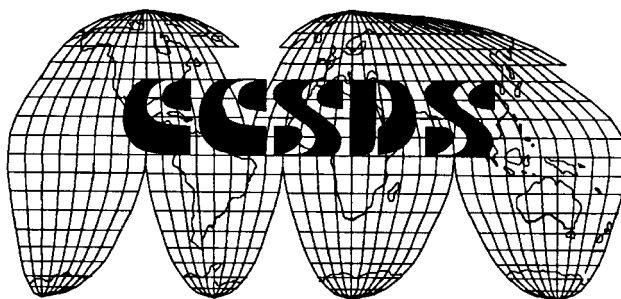
CCSDS 203.0-B-1

BLUE BOOK

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CCSDS RECOMMENDATION FOR TELECOMMAND: DATA MANAGEMENT SERVICE

AUTHORITY

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* * * * *
*      Issue:      Blue Book, Issue 1      *
*      Date:       January 1987           *
*      Location:   CCSDS Plenary Meeting   *
*                  November 1986         *
*                  Frascati, Italy        *
* * * * *
    
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This Recommendation reflects the consensus technical agreement of the following member Agencies of the Consultative Committee for Space Data Systems (CCSDS):

- o Centre National D'Etudes Spatiales (CNES)/France.
- o Deutsche Forschungs-u. Versuchsanstalt fuer Luft und Raumfahrt e.V (DFVLR)/West Germany.
- o European Space Agency (ESA)/Europe.
- o Indian Space Research Organization (ISRO)/India.
- o Instituto de Pesquisas Espaciais (INPE)/Brazil.
- o National Aeronautics and Space Administration (NASA)/USA.
- o National Space Development Agency of Japan (NASDA)/Japan.

The following observer Agencies also concur with this Recommendation: <https://standards.iso.int/catalog/standards/35700/00000-2016-04-01-a93b72c48e85/iso-12174-1998>

- o British National Space Centre (BNSC)/United Kingdom.
- o Chinese Academy of Space Technology (CAST)/People's Republic of China.
- o Department of Communications, Communications Research Centre (DOC-CRC)/Canada.

This Recommendation is published and maintained by:

CCSDS Secretariat
 Communications and Data Systems Division (Code-TS)
 National Aeronautics and Space Administration
 Washington, DC 20546, USA

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA MANAGEMENT SERVICE

STATEMENT OF INTENT

The Consultative Committee for Space Data Systems (CCSDS) is an organization officially established by the management of member space Agencies. 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 **RECOMMENDATIONS** and are not considered binding on any Agency.

This **RECOMMENDATION** is issued by, and represents the consensus of, the CCSDS Plenary body. Agency endorsement of this **RECOMMENDATION** is entirely voluntary. Endorsement, however, indicates the following understandings:

- o Whenever an Agency establishes a CCSDS-related **STANDARD**, this **STANDARD** will be in accord with the relevant **RECOMMENDATION**. Establishing such a **STANDARD** does not preclude other provisions which an Agency may develop.
- o Whenever an Agency establishes a CCSDS-related **STANDARD**, the Agency will provide other CCSDS member Agencies with the following information:
 - The **STANDARD** itself. (standards.iteh.ai)
 - The anticipated date of initial operational capability.
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 - The anticipated duration of operational service.
- o Specific service arrangements shall be made via memoranda of agreement. Neither this **RECOMMENDATION** nor any ensuing **STANDARD** is a substitute for a memorandum of agreement.

No later than five years from its date of issuance, this Recommendation 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 cancelled.

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA MANAGEMENT SERVICE

FOREWORD

This document, which is a technical Recommendation prepared by the Consultative Committee for Space Data Systems (CCSDS), is intended for use by participating space Agencies in their development of space telecommand systems.

This Recommendation allows the implementing organizations within each Agency to proceed coherently with the development of compatible Standards for the flight and ground systems that are within their cognizance. Agency Standards derived from this Recommendation may implement only a subset of the optional features allowed herein, or may incorporate features not addressed by the Recommendation.

In order to establish a common framework within which the Agencies may develop standardized telecommand services, the CCSDS advocates adoption of a layered systems architecture. Within this approach, specific layers of service (including their operational protocol and data structuring techniques) may be selected for implementation according to mission requirements.

The current layered set of CCSDS telecommand Recommendations was developed to match the conventional free-flying mission environment, as characterized by the transmission of command data at relatively low uplink data rates to spacecraft of moderate complexity. The CCSDS is currently examining the extension of these Recommendations (perhaps by defining expanded protocols and data structures within some of the layers) to a more complex mission environment, including the transmission of multiple data types at very high data rates to space vehicles which include extensive onboard data networking capability.

This Recommendation for Telecommand Data Management Service was developed within the layered architectural framework, and embraces the standard data structures and data communication procedures which may be used by conventional missions within the highest telecommand system layers.

Through the process of normal evolution, it is expected that expansion, deletion or modification to this document may occur. This Recommendation is therefore subject to CCSDS document management and change control procedures which are defined in Reference [1].

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA MANAGEMENT SERVICE

DOCUMENT CONTROL

Document	Title	Date	Status/Remarks
CCSDS 203.0-B-1	Recommendation for Space Data System Standards. Telecommand, Part 3: Data Management Service, Architectural Definition, Issue 1	January 1987	Original Issue

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REFERENCES

- [1] "Procedures Manual for the Consultative Committee for Space Data Systems", Issue 1, Consultative Committee for Space Data Systems, August 1985 or later issue.
- [2] "Telecommand, Summary of Concept and Service", CCSDS 200.0-G-6, Issue 6, Green Book, Consultative Committee for Space Data Systems, January 1987 or later issue.
- [3] "Telecommand, Part 2: Data Routing Service, Architectural Specification", Recommendation CCSDS 202.0-B-1, Issue 1, Blue Book, Consultative Committee for Space Data Systems, January 1987 or later issue.
- [4] "Telecommand, Part 1: Channel Service, Architectural Specification", Recommendation CCSDS 201.0-B-1, Issue 1, Blue Book, Consultative Committee for Space Data Systems, January 1987 or later issue.
- [5] "Packet Telemetry", Recommendation CCSDS 102.0-B-2, Issue 2, Blue Book, Consultative Committee for Space Data Systems, January 1987 or later issue.
- [6] "Telemetry Channel Coding", Recommendation CCSDS 101.0-B-2, Issue 2, Blue Book, Consultative Committee for Space Data Systems, January 1987 or later issue.

The latest issues of these documents may be obtained from the CCSDS Secretariat at the address indicated on page i.

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CCSDS RECOMMENDATION FOR TELECOMMAND: DATA MANAGEMENT SERVICE

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this document is to establish a common Recommendation which defines the systems architecture of a spacecraft telecommand "Data Management Service". The intent of this architecture is to provide a common framework within which the Agencies participating in the Consultative Committee for Space Data Systems (CCSDS) may implement compatible future spacecraft telecommanding systems. The operating principles and procedures for the CCSDS are defined in Reference [1]. The context of the Data Management Service within the overall Telecommand System is described in Reference [2].

This Recommendation primarily addresses the data unit formats and functions which are implemented within the the Application Process layer, the System Management layer and the Packetization layer of the CCSDS telecommand Data Management Service. Recognizing that much future work remains to be done relative to these top layers, their specification has been deliberately minimized by the CCSDS. **IN PARTICULAR, THE DETAILED OPERATIONAL PROTOCOLS WHICH OPERATE ACROSS THESE LAYERS, AND THE FLOW OF CONTROL INFORMATION REQUIRED TO INITIALIZE THE LAYERS AND DIRECT THE TRANSFER OF DATA BETWEEN THEM, ARE NOT PRESENTLY (ADDRESSED WITHIN) THIS DOCUMENT: THESE REMAIN ITEMS FOR POTENTIAL EXTENSION OF THIS RECOMMENDATION.**

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1.2 APPLICABILITY

This Recommendation serves as a guideline for the development of compatible internal Agency standards in field of spacecraft commanding. This Recommendation is not retroactive, nor does it commit any Agency to implement the recommended telecommand concepts at any future time. Nevertheless, all CCSDS Agencies accept the principle that all future implementations of telecommand which are used in cross-support situations will be based on this Recommendation.

The CCSDS has developed a layered concept for future spacecraft telecommanding, which is fully described in Reference [2]. Standard services are defined within each layer, and Agencies will be encouraged to develop corresponding facilities to provide these services in support of Projects. To be fully compatible with the CCSDS concept, a Project's telecommanding architecture should follow this Recommendation for Data Management Service, plus the Recommendations for telecommand "Data Routing Service" and telecommand "Channel Service" which are described in References [3] and [4]. Projects may also elect to be partially compatible with the concept by interfacing with the standard systems at intermediate layers within any of the service specifications.

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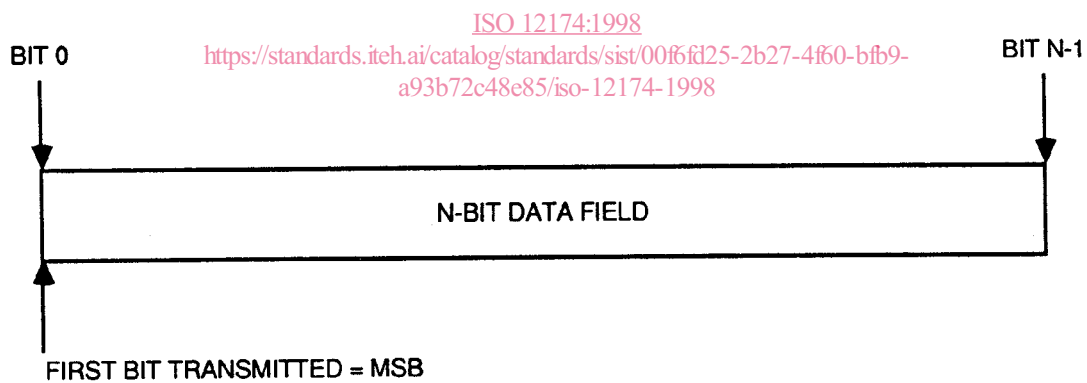
Where preferred options or mandatory capabilities are clearly indicated herein, the indicated sections of the specification must be implemented when this Recommendation is used as a basis for cross-support. Where optional subsets or capabilities are allowed or implied in this specification, implementation of these options or subsets is subject to specific bilateral cross-support agreements between the Agencies involved.

The recommendations in this document are to be invoked through the normal standards programs of each member Agency, and are applicable to those missions for which cross-support based on capabilities described in these recommendations is anticipated.

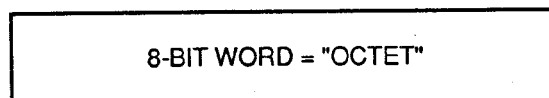
No later than five years from its date of issue, this Recommendation should be reviewed by the CCSDS Agencies to determine whether it should: 1) remain in effect without change; 2) be changed to reflect the impact of new technologies, new requirements, or new directions; or 3) be retired or canceled.

1.3 BIT NUMBERING CONVENTION AND NOMENCLATURE

In this document, the following convention is used to identify each bit in an N-bit field. The first bit in the field to be transmitted (i.e., the most left justified when drawing a figure) is defined to be "Bit 0"; the following bit is defined to be "Bit 1" and so on up to "Bit N-1". When the field is used to express a binary value (such as a counter), the Most Significant Bit (MSB) shall be the first transmitted bit of the field, i.e., "Bit 0".



In accordance with modern data communications practice, spacecraft data fields are often grouped into 8-bit "words" which conform to the above convention. Throughout this Recommendation, the following nomenclature is used to describe this grouping:



By CCSDS convention, all "spare" bits shall be permanently set to value "zero". Note that throughout this document, the word "Telecommand" may be abbreviated as "TC".

CCSDS RECOMMENDATION FOR TELECOMMAND: DATA MANAGEMENT SERVICE

2 TELECOMMAND DATA MANAGEMENT SERVICE OVERVIEW

A complete summary of the acronyms and terminology used internal to this document is presented in Annex A, and a detailed specification of the services provided by each layer is presented in Annex B. The first-time reader should digest these Annexes before proceeding further in this document.

Figure 2-1 illustrates the significance of the TC Data Management Service within the overall Telecommand System, which contains three principal elements of service: Telecommand Data Management Service; Telecommand Data Routing Service; and Telecommand Channel Service. Each of these services is documented in separate Recommendations. A more thorough discussion of the layered services, including expansion of Figure 2-1 in greater detail, is contained in Reference [2]. The Telecommand System is related to the Telemetry System as documented in Reference [5] and Reference [6].

The TC Data Management Service enables user requests for command activity to be generated, integrated, aggregated, translated and scheduled for delivery to the spacecraft by drawing upon the Data Routing and Channel Services. The Data Management Service contains three distinct layers of data handling operations:

- (1) An **APPLICATION PROCESS** layer which allows human users to control a space mission by generating commands and supervising their delivery and execution.
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- (2) A **SYSTEM MANAGEMENT** layer, which translates user command directives into detailed command application data and delivery instructions, and which manages their end-to-end delivery to the proper Application Process on the spacecraft.
- (3) A **PACKETIZATION** layer, which formats the command application data into transportable telecommand data units and moves them to the spacecraft.