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**Space data and information transfer
systems — Space data link security
protocol**

*Systèmes de transfert des données et informations spatiales —
Protocole de sécurité de liaison de données spatiales*

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Foreword

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ISO 21324 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 355.0-B-1, September 2015) 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*.

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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FOREWORD

This document describes a protocol for applying security services to the CCSDS Space Data Link Protocols used by space missions over a space link.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CCSDS has processes for identifying patent issues and for securing from the patent holder agreement that all licensing policies are reasonable and non-discriminatory. However, CCSDS does not have a patent law staff, and CCSDS shall not be held responsible for identifying any or all such patent rights.

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- Space and Upper Atmosphere Research Commission (SUPARCO)/Pakistan.
- Swedish Space Corporation (SSC)/Sweden.
- Swiss Space Office (SSO)/Switzerland.
- United States Geological Survey (USGS)/USA.

DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 355.0-B-1	Space Data Link Security Protocol, Recommended Standard, Issue 1	September 2015	Original issue

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1 INTRODUCTION

1.1 PURPOSE

The purpose of this Recommended Standard is to specify the Space Data Link Security Protocol (hereafter referred as the Security Protocol) for CCSDS data links. This protocol provides a security header and trailer along with associated procedures that may be used with the CCSDS Telemetry, Telecommand, and Advanced Orbiting Systems Space Data Link Protocols (references [1]-[3]) to provide a structured method for applying data authentication and/or data confidentiality at the Data Link Layer.

1.2 SCOPE

This Recommended Standard defines the Security Protocol in terms of:

- a) the protocol data units employed by the service provider; and
- b) the procedures performed by the service provider.

It does not specify:

- a) individual implementations or products;
- b) the implementation of service interfaces within real systems;
- c) the methods or technologies required to perform the procedures; or
- d) the management activities required to configure and control the service.

This Recommended Standard does not mandate the use of any particular cryptographic algorithm with the Security Protocol. Reference [4] provides a listing of algorithms recommended by CCSDS; any organization should conduct a risk assessment before choosing to substitute other algorithms. Annex E (non-normative) defines baseline implementations suitable for a large range of space missions.

1.3 APPLICABILITY

This Recommended Standard applies to the creation of Agency standards and for secure data communications over space links between CCSDS Agencies in cross-support situations. The Recommended Standard includes comprehensive specification of the service for inter-Agency cross support. It is neither a specification of, nor a design for, real systems that may be implemented for existing or future missions.

The Recommended Standard specified in this document is to be invoked through the normal standards programs of each CCSDS Agency, and is applicable to those missions for which interoperability and cross support based on capabilities described in this Recommended Standard is anticipated. Where mandatory capabilities are clearly indicated in sections of the

Recommended Standard, they must be implemented when this document is used as a basis for interoperability and cross support. Where options are allowed or implied, implementation of these options is subject to specific bilateral cross support agreements between the Agencies involved.

1.4 RATIONALE

The goals of this Recommended Standard are to:

- a) provide a standard method of applying security at the Data Link Layer, independent of the underlying cryptographic algorithms employed by any particular space mission;
- b) preserve compatibility with existing CCSDS Space Data Link Protocol Transfer Frame Header and Trailer formats and frame processing implementations so that, where appropriate, legacy frame processing infrastructure may continue to be used without modification;
- c) preserve compatibility with the CCSDS Space Link Extension (SLE) forward and return services; and
- d) facilitate the development of common commercial implementations to improve interoperability across agencies.

More discussion of the Security Protocol's goals and design choices, including its interaction with other CCSDS services, may be found in reference [D3].

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1.5 DOCUMENT STRUCTURE

This document is organized as follows:

Section 1 presents the purpose, scope, applicability, and rationale of this Recommended Standard and lists the conventions, definitions, and references used throughout the document.

Section 2 (informative) provides an overview of the Security Protocol.

Section 3 (normative) defines the services provided by the protocol entity.

Section 4 (normative) specifies the protocol data units provided for these services and the procedures employed by the service provider.

Section 5 (normative) specifies the constraints associated with these services for each of the supported Space Data Link Protocols.

Section 6 (normative) lists the managed parameters associated with these services.

Section 7 (normative) specifies how to verify an implementation's conformance with the Security Protocol.

Annex A (normative) provides a Protocol Implementation Conformance Statement (PICS) proforma for the Security Protocol.

Annex B (informative) provides an overview of security, SANA registry, and patent considerations related to this Recommended Standard.

Annex C (informative) provides a glossary of abbreviations and acronyms that appear in the document.

Annex D (informative) provides a list of informative references.

Annex E (informative) defines baseline implementations suitable for a large range of space missions.

1.6 DEFINITIONS

For the purposes of this document, the following definitions apply.

NOTE – Generic definitions for the security terminology applicable to this and other CCSDS documents are provided in reference [D5].

Payload: Data input to be processed by a Security Protocol function.

ApplySecurity Payload: Payload to the ApplySecurity function.

ProcessSecurity Payload: Payload to the ProcessSecurity function.

Authentication Payload: Part of the Transfer Frame to be authenticated.

1.7 CONVENTIONS

1.7.1 NOMENCLATURE

The following conventions apply for the normative specifications in this Recommended Standard:

- a) the words 'shall' and 'must' imply a binding and verifiable specification;
- b) the word 'should' implies an optional, but desirable, specification;
- c) the word 'may' implies an optional specification;
- d) the words 'is', 'are', and 'will' imply statements of fact.

NOTE – These conventions do not imply constraints on diction in text that is clearly informative in nature.

1.7.2 INFORMATIVE TEXT

In the normative sections of this document, informative text is set off from the normative specifications either in notes or under one of the following subsection headings:

- Overview;
- Background;
- Rationale;
- Discussion.

1.8 REFERENCES

The following publications contain provisions which, through reference in this text, constitute provisions of this document. At the time of publication, the editions indicated were valid. All publications are subject to revision, and users of this document are encouraged to investigate the possibility of applying the most recent editions of the publications indicated below. The CCSDS Secretariat maintains a register of currently valid CCSDS publications.

- [1] *TM Space Data Link Protocol*. Issue 2. Recommendation for Space Data System Standards (Blue Book), CCSDS 132.0-B-2. Washington, D.C.: CCSDS, September 2015.
- [2] *TC Space Data Link Protocol*. Issue 3. Recommendation for Space Data System Standards (Blue Book), CCSDS 232.0-B-3. Washington, D.C.: CCSDS, September 2015.
- [3] *AOS Space Data Link Protocol*. Issue 3. Recommendation for Space Data System Standards (Blue Book), CCSDS 732.0-B-3. Washington, D.C.: CCSDS, September 2015.
- [4] *CCSDS Cryptographic Algorithms*. Issue 1. Recommendation for Space Data System Standards (Blue Book), CCSDS 352.0-B-1. Washington, D.C.: CCSDS, November 2012.

NOTE – Informative references are listed in annex D.

2 OVERVIEW

2.1 CONCEPT OF SECURITY PROTOCOL

The Space Data Link Security Protocol is a data processing method for space missions that need to apply authentication and/or confidentiality to the contents of Transfer Frames used by Space Data Link Protocols over a space link. The Security Protocol is provided only at the Data Link Layer (Layer 2) of the OSI Basic Reference Model (reference [D1]), as illustrated in figure 2-1. It is an extra service of the Space Data Link Protocols defined in references [1]–[3], and therefore is to be used together with one of these references. (The Security Protocol is *not* applicable for use with the Proximity-1 Space Data Link Protocol.)

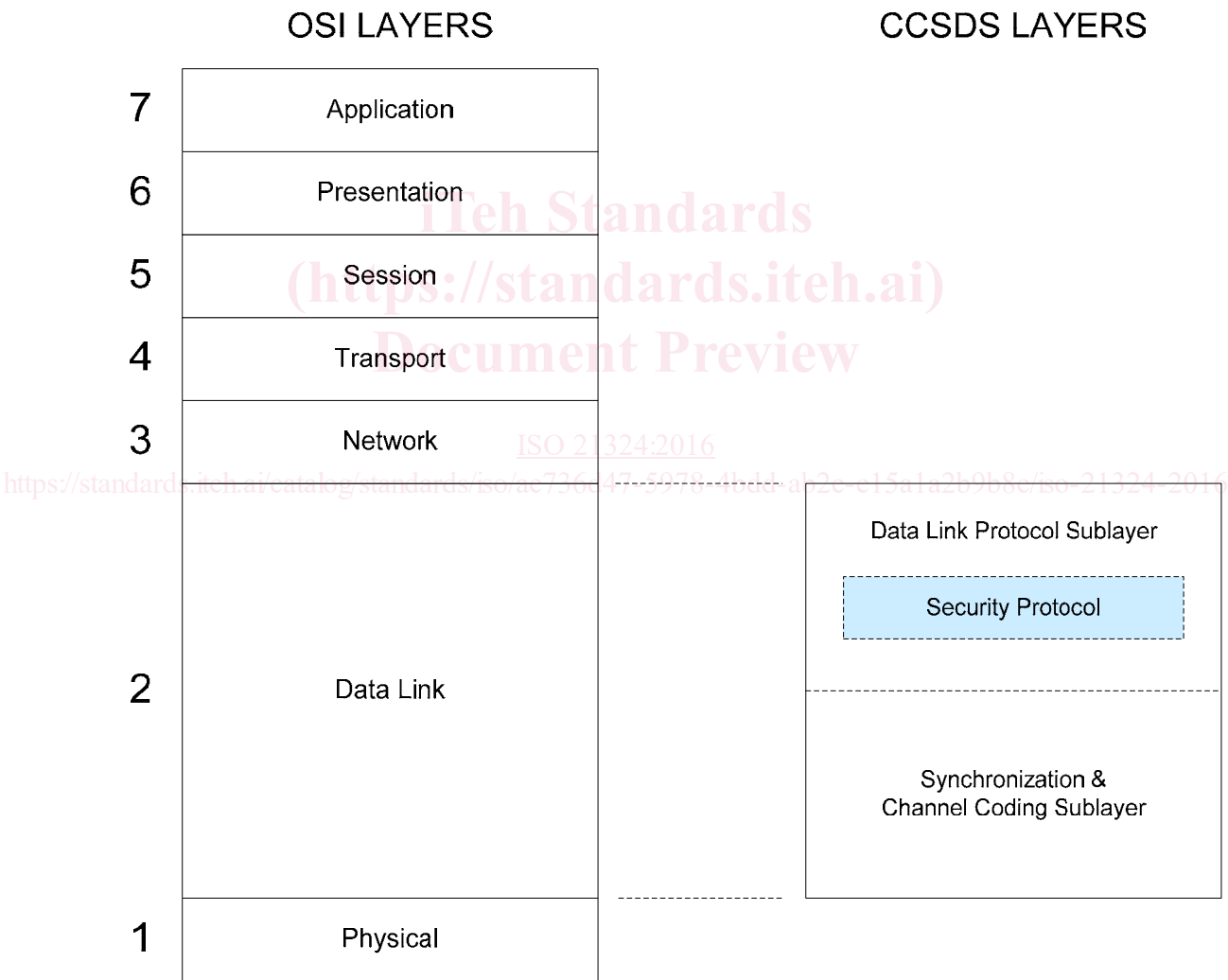


Figure 2-1: Security Protocol within OSI Model