CCSDS

The Consultative Committee for Space Data Systems

**Draft Recommendation for
Space Data System Standards**

PLANNING DATA FORMATS

PROPOSED DRAFT RECOMMENDED STANDARD

CCSDS 920.2-W-0.07

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(WHEN THIS RECOMMENDED STANDARD IS FINALIZED, IT WILL CONTAIN THE FOLLOWING STATEMENT OF AUTHORITY:)

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FOREWORD

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PROPOSED DRAFT CCSDS RECOMMENDED STANDARD FOR PLANNING DATA
FORMATS

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- Space and Upper Atmosphere Research Commission (SUPARCO)/Pakistan.
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- United States Geological Survey (USGS)/USA.

PREFACE

This document is a draft CCSDS Recommended Standard.   Its 'White Book' status indicates that its contents are not stable, and several iterations resulting in substantial technical changes are likely to occur before it is considered to be sufficiently mature to be released for review by the CCSDS Agencies.

Implementers are cautioned **not** to fabricate any final equipment in accordance with this document's technical content.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

DOCUMENT CONTROL

Document	Title and Issue	Date	Status
CCSDS 910.NN-R-0	Planning Information Specification, Draft 0.00	October 2013	Initial draft
CCSDS 910.NN-R-0.1	Planning Information Specification, Draft 0.01	October 2013	Expanded and revised
CCSDS 910.NN-R-0.2	Planning Data Formats, Draft 0.02	July 2014	Expanded and revised
CCSDS 902.2-W-0.03	Planning Data Formats, Draft 0.03	August 2014	Revisions to planning data format
CCSDS 902.2-W-0.04	Planning Data Formats, Draft 0.04	November 2014	Additions to planning data. Definition of planning request and planning request refinement added
CCSDS 902.2-W-0.05	Planning Data Formats, Draft 0.05	February 2015	Updates after working group comments.
CCSDS 920.2-W-0.06	Planning Data Formats, Draft Recommended Standard, Draft 0.06	November 2015	Revision to bring in line with the planning request being moved to the Planning and Scheduling Request Book
CCSDS 920.2-W-0.07	Planning Data Formats, Draft Recommended Standard, Draft 0.07	November 2015	Updated to consolidate event parameter definitions.

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

1.1.1 PURPOSE

This Planning Information Format Recommended Standard specifies a standard format for use in transferring planning information related to groundstations and/or relay satellites between space agencies and commercial or governmental spacecraft operators. Such exchanges are used in;

a) Mission design, i.e. in investigating the feasibility of a mission with respect to its uplink/downlink requirements and the availability of suitable groundstation/relay satellite availability.

b) Operation planning, i.e. to request the allocation of sufficient groundstation/relay satellite resources in order to carry out the planned operations, this typically is an iterative process with the details becoming more refined as the execution time of the operations approach. The operations planning often fits into 3 phases;

   a. Long Term Planning – this phase is typically several months or more before the execution time of the operations

   b. Medium Term Planning – typically this is a few weeks before the execution of the operations and involves a refinement of the Long term plan based on updated orbit/trajectory/attitude predictions, possible changes to science objectives etc.

   c. Short Term Planning – typically this occurs 1 – 2 weeks before the execution of the operations and usually involves only minor refinements to the plan based on the latest orbit/trajectory/attitude predictions.

1.1.2 SCOPE

The scope of this Recommended Standard is limited to the exchange of Planning Information required in the context of CCSDS Service Management. In the following figure the Planning Data Formats Specification is put into context with the various standards that together form the Space Communication Cross Support Service Management.
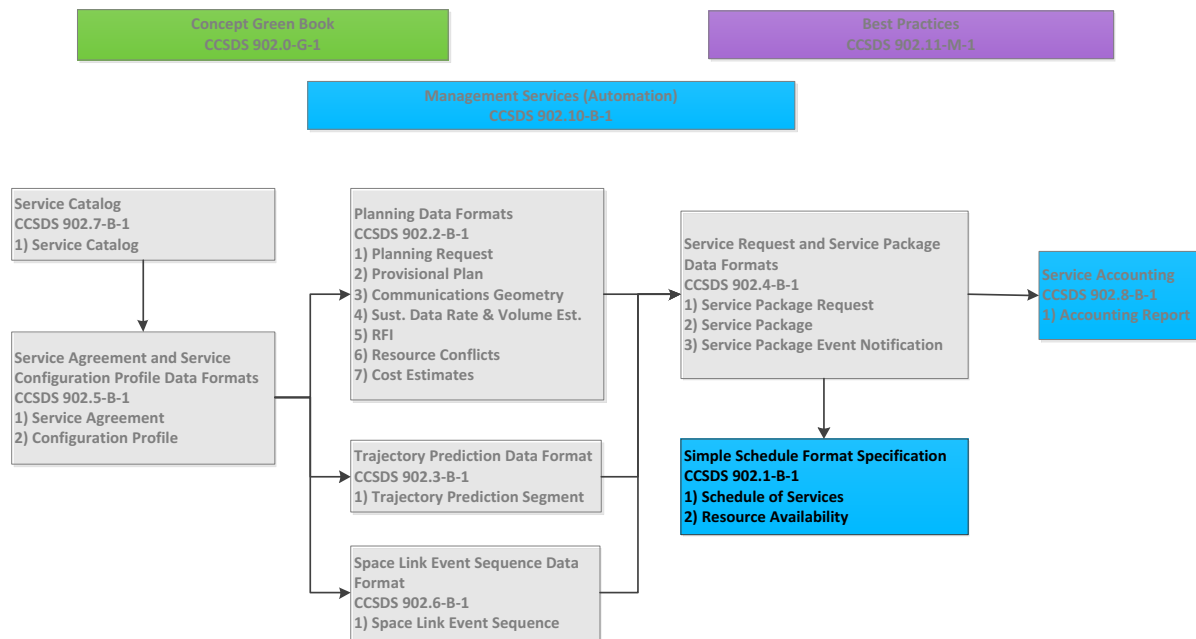
**Figure 1-1: Planning Data Formats in the Context of Space Communication Cross
Support Service Management.**

1.1.2.1   Provisional Plans

The purpose of the Provisional Plan is to supply identification and characterization of
feasible service opportunities in response to a Planning Request. The Provisional Plan
contains an uncommitted but technically feasible service plan suggested by the Provider
CSSS. The Provisional Plan Information Entity Recommended Standard conveys the
following types of planning data:

 a) predicted communications geometry events (see section 3.3.1 below);

 b) sustainable data rates and volume estimate events (NOTE: these are not addressed in
     this issue of the recommended standard and will be added in a later revision);

 c) predicted radio frequency interference events (NOTE: these are not addressed in this
     issue of the recommended standard and will be added in a later revision);

 d) predicted resource conflict events (NOTE: these are not addressed in this issue of the
     recommended standard and will be added in a later revision); and

 e) cost estimates (NOTE: these are not addressed in this issue of the recommended
     standard and will be added in a later revision).

The specific types of planning data contained in the Provisional Plans generated by a given Provider CSSS will depend on the kinds of planning data that it is capable of generating and that its client Missions deem useful.

A Provisional Plan may be used as a basis for establishing a Service Agreement. The Provisional Plan is communicated from the Provider CSSS to the Mission.

Depending on the operational procedures of the Provider CSSS, the Provisional Plan

1.2   APPLICABILITY

This Recommended Standard is applicable only to the planning data formats and contents, but not to its transmission. With respect to the transmission of the Planning Information between agencies and operators there are two scenarios:

a) The first is where the Planning Information is exchanged within the context of Service management, in this case the transmission mechanism is described in [TBD].

b) The second deals with the case where the Planning Information is exchanged outwith the scope of Service Management. Here the mechanism by which the Planning Information is transmitted is outside of the scope of this document and should be specified in an ICD agreed by the parties involved.

1.3   RATIONALE

1.3.1   GENERAL

The primary goal of CCSDS is to increase the level of interoperability among Agencies. This Recommended Standard furthers that goal by establishing the means to exchange planning information relating to where most cross support activity occurs: between the tracking stations or ground data handling systems of various Agencies and the mission specific components of a mission ground system.

The use cases described in the following sections were considered in deriving this Recommended Standard.

1.3.2   USE CASES

1.3.2.1   Mission Design

During the design phase of a mission it is often desirable to be able to obtain some idea of the availability of ground station/relay satellite availability so that the feasibility of obtaining the required uplink and downlink bandwidth can be assessed. Typically, during the mission design phase, the information required relates to periods several years in the future. Currently there is no standardized way for specifying the mission requirements and constraints between different agencies.

Whilst this recommended standard does not address the mechanism by which the required planning information can be exchanged (this possibly being covered in the negotiations involved in establishing the service agreement), it provides a standard format in which the mission requirements and constraints can be specified.

1.3.2.2 Mission Planning

In the mission planning use case the user agency provides the provider agency with a set of planning information that gives the provider agency the information it requires to allocate the appropriate resources to the user agency. It should be noted that this does not imply that the user agency will be allocated all the resources it requests. The allocation made by the provider agency will also take into account the needs of all users of its network and other constraints such as any limits on usage that may have been specified in the service agreement between the agencies.

It should also be noted that the planning process will typically go through a number of cycles, starting months before the actual activities are expected to take place and being finalized a few days before execution. During these planning cycles the operations will be refined as better orbit/trajectory/attitude predictions become available and/or science objectives are modified. This leads to the necessity to supply refinements to the initial planning. The format of these planning refinements is also covered in this Recommended Standard.

1.4 DOCUMENT STRUCTURE

This document is organized as follows:

a) Section 1 provides the purpose, scope, applicability, and rationale of this Recommended Standard and identifies the conventions and references used throughout the document. This section also describes how this document is organized. A brief description is provided for each section and annex so that the reader will have an idea of where information can be found in the document. It also identifies terminology that is used in this document but is defined elsewhere.

b) Section 2 provides a brief overview of the CCSDS-recommended Planning Data Formats.

c) Section 3 provides details about the structure and content of the Provisional Plan Format.

d) ANNEX A provides the definition of the Event and Event Parameters abstract classes.

e) ANNEX B provides the normative Implementation Conformance Statement (ICS) proforma.

f) ANNEX C provides an informative description of the normative XML schema data types that realize the classes that comprise the Simple Schedule Format as defined in section 3.

g) ANNEX D discusses security, SANA, and patent considerations.

h) ANNEX E contains a list of Acronyms applicable to the Planning Data Formats.

i) ANNEX F is a list of informative references.

1.5   DEFINITIONS

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

a) the word 'agencies' may also be construed as meaning 'satellite operators' or 'satellite service providers';

b) the notation 'n/a' signifies 'not applicable';

1.6   NOMENCLATURE

1.6.1   NORMATIVE TEXT

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.

1.6.2   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.

1.7 CONVENTIONS

1.7.1 THE UNIFIED MODELING LANGUAGE

The Unified Modelling Language (UML) diagrams used in the specification (including class diagrams, package diagrams, sequence diagrams and activity diagrams) follow the notation, semantics and conventions imposed by the Version 2.4.1 UML specification of the Object Management Group (OMG) [6].

Within the document use is made only of class diagrams. A UML class diagram describes the structure of a message; its parts; and how those parts interrelate. A UML class, represented in the diagram as a box, represents a data set. Class diagram conventions include composition, generalization, multiplicity and constraints. Enumeration notation is also used but only when it is involved in a composition constraint.

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]   *Space Communication Cross Support—Service Management—Service Specification*. Recommended Standard for Space Data System Standards, CCSDS 910.11-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, August 2009.

[2]   *Extensible Space Communication Cross Support Service Management—Concept.* Draft Informational Report, CCSDS 902.0-G-0.38, Draft Green Book. April 2014.

[3]   *Information Technology—8-Bit Single-Byte Coded Graphic Character Sets—Part 1: Latin Alphabet No. 1*. International Standard, ISO/IEC 8859-1:1998. Geneva: ISO, 1998.

[4]   "CCSDS-910.NN-B-1_XML_schemas."
http://public.ccsds.org/publications/archive/CCSDS-910.11-B-1_XML_schemas.zip.

[5]   *Time Code Formats*. Recommendation for Space Data System Standards, CCSDS 301.0-B-3. Blue Book. Issue 3. Washington, D.C.: CCSDS, January 2002.

[6]   OMG Unified Modelling Language (OMG UML), Version 2.4.1, OMG Document Number: formal/2011-08-05.

[7]   *Simple Schedule Format*. Recommendation for Space Data System Standards, CCSDS nnn.n-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, xxxx 20xx.

[8]   Planet and Satellite Names

- http://planetarynames.wr.usgs.gov/Page/Planets

[9]   Minor Planet Names

- http://www.minorplanetcenter.net/iau/lists/MPNames.html

[10]   *Standard Formatted Data Units — Control Authority Procedures*, Issue 2. Recommendation for Space Data System Standards (Blue Book), CCSDS 630.0-B-2. Washington, D.C.: CCSDS, <mark>MONTH YEAR</mark>

[11]   *CCSDS Global Spacecraft Identification Field Code Assignment Control Procedures*. Issue 6. Recommendation for Space Data System Standards (Blue Book), CCSDS 320.0-B-6. Washington, D.C.: CCSDS, October 2013.

2 OVERVIEW

2.1 GENERAL

This section provides a high-level overview of the CCSDS-recommended Planning Data Formats, which is designed to facilitate standardized exchanges of planning information between space agencies.

2.2 PLANNING DATA FORMATS

The planning data consists of files that are XML formatted. The formats of these files are suitable for automated interaction and/or (by means of a suitable XML viewer) human interaction.

Planning data is either mandatory, in which case suitable values must be present, or optional, in which case values may be present or not. In addition it is possible to extend the contents of the various planning data formats by defining additional parameters. The content of any parameters defined is outside the scope of this document and should be documented in an ICD agreed by the involved parties.

2.3 MAPPING TO W3C XML SCHEMA

This Recommended Standard includes the specification of a mapping to World Wide Web Consortium (W3C) Extensible Markup Language (XML) schema. The normative mapping of this Recommended Standard to XML W3C schemas is a virtual annex to this Recommended Standard and is contained in a stand-alone set of schema files (reference [4]).

NOTE – The XML schema has been elaborated on the basis of the mapping guidelines described in reference [E1].

3   PROVISIONAL PLAN

3.1   GENERAL

The Provisional Plan shall consist of digital data exchanged in the form of a file.

3.2 PROVISIONAL PLAN CONTENT/STRUCTURE

3.2.1 OVERVIEW

Figure 3-1 shows the UML Class diagram for the Provisional Plan. It should be noted that for clarity *abstract* classes are highlighted in green
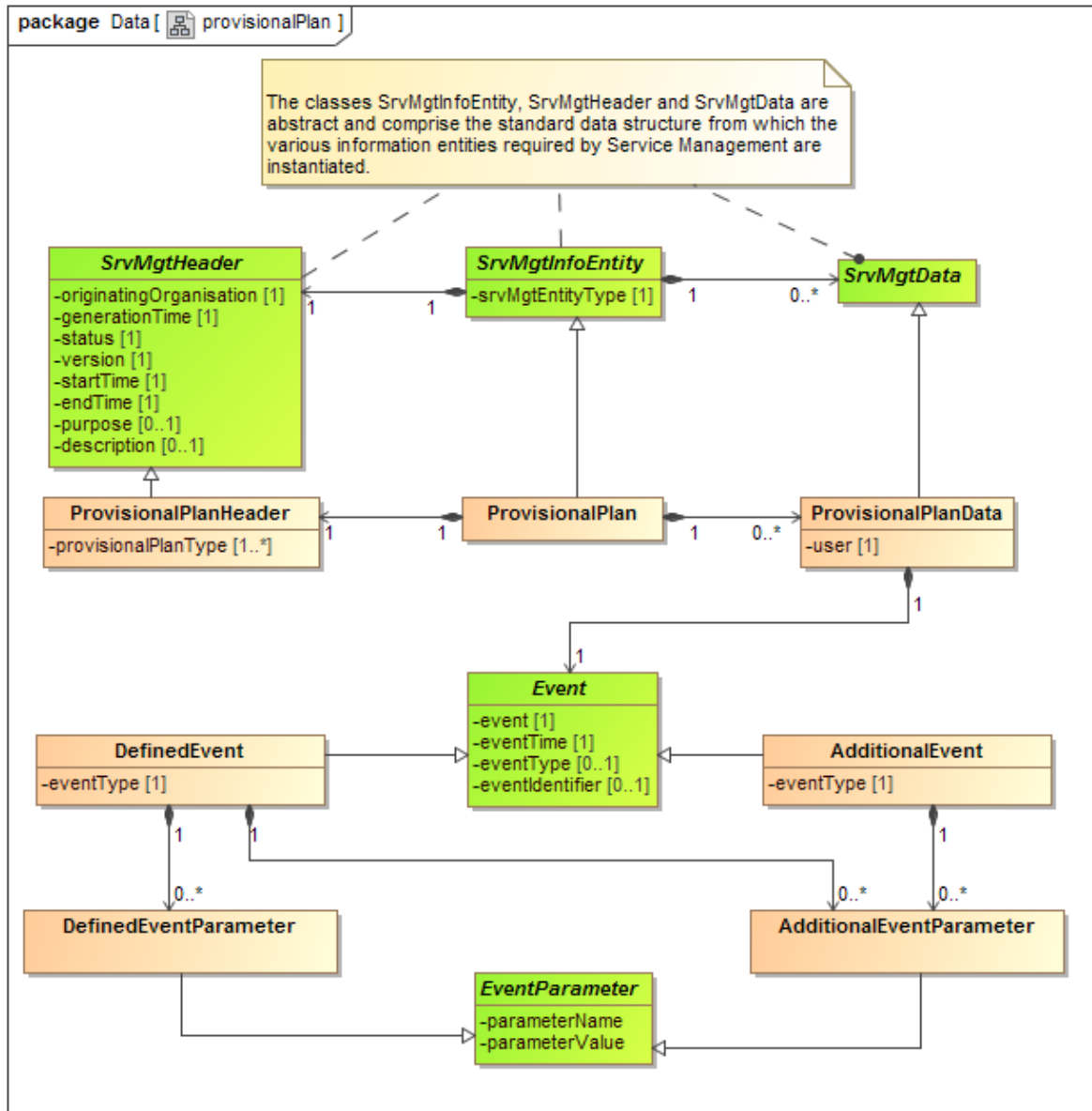
Figure 3-1: Provisional Plan Class Diagram

The attributes of each class are described further in the following subsections and tables.

3.2.2 CLASS ProvisonalPlan

3.2.2.1 The ProvisonalPlan class is mandatory and shall constitute the Provisional Plan information entity.

NOTE – The ProvisonalPlan class is a specialization of the class SrvMgtInfoEntity class described in Annex A of reference [7] and the generic description of the parameters is given there.

3.2.2.2 Table 3-1 specifies the use of the parameters in the SrvMgtInfoEntity in the scope of the Provisional Plan.

Table 3-1: Class ProvisonalPlan Parameters

Parameter	Description	Data Type	Data Units
srvMgtEntityType	See Table A-1. of reference [7].	String1024—For the planning and service request request the only permitted value for this parameter is the string – "PROVISONAL_PLAN"	See Table A-1. of ref. [7].

3.2.3 CLASS ProvisionalPlanHeader

3.2.3.1 The ProvisonalPlanHeader class is mandatory and shall constitute the 'header' of the Provisional Plan.

NOTE – The ProvisonalPlanHeader class is a specialization of the class SrvMgtHeader class described in Annex A of reference [7] and the generic description of the parameters is given there.

3.2.3.2 Table 3-2 specifies the use of the parameters in the SrvMgtInfoEntity in the scope of the Provisional Plan

Table 3-2: Class ProvisonalPlanHeader Parameters

The parameters for the ProvisonalPlanHeader class as are as per Table A-2 of reference [7] except for the following:

Parameter	Description	Data Type	Data Units

Status	The status of the provisional plan.	String32
		The following values are permitted
		− TEST
		  indicates that the provisional plan has been generated for test purposes only.
		− PROVISIONAL
		  indicates that the provisional plan contained is provisional and may still be subject to change.
		− OPERATIONAL
		  indicates that this is an operational provisional plan.	

startTime	The time at which the provisional plan starts. This corresponds to the time at which the earliest event contained in the provisional plan starts.	See Table A-2. of ref. [7].	See Table A-2. of ref. [7].
endTime	The time at which the provisional plan ends. This corresponds to the time at which the latest event contained in the provisional plan finishes.	See Table A-2. of ref. [7].	See Table A-2. of ref. [7].

3.2.3.3 Table 3-3 specifies the additional parameter defined for the ProvisonalPlanHeader class.

Table 3-3: Class ProvisonalPlanHeader Additional Parameter

Parameter	Description	Data Type	Data Units

provisonalPlanType	This specifies the type of data that is contained in the provisional plan. The various types of data that can be contained in a provisional plan are discussed in reference [2], section 5.3. A provisional plan may contain 1 or more of these different planning types.	Array of Enumerations
		– COMMS
		  Predicted communications geometry events (see reference [2], section 5.6)
		– DATARATE
		  Sustainable data rates & volume estimate events (see reference [2], section 5.7);
		– RFI
		  Predicted radio frequency interference events (see reference [2], section 5.8);
		– CONFLICTS
		  Predicted resource conflict events (see reference [2], section 5.9)
		– COSTS
		  Cost estimates (see reference [2], section 5.10)
			n/a

3.2.4 CLASS ProvisionalPlanData

3.2.4.1 The ProvisonalPlanData class is mandatory and shall constitute the 'body' of the Provisional Plan.

NOTE – The ProvisonalPlanData class is a specialization of the class SrvMgtData class described in Annex A of reference [7] and the generic description of the parameters is given there.

3.2.4.2   Each instance of the ProvisonalPlanData class shall contain 1, and only 1, instance of a class derived from the abstract Event class, i.e. either an instance of a DefinedEvent or an instance of an AddtionalEvent.

3.2.4.3   Table 3-4 specifies the additional parameters defined for the ProvisonalPlanData class.

Table 3-4: Class ProvisonalPlanData Additional Parameters

Parameter	Description	Data Type	Data Units
user	The user to which the event is relevant. These will typically be spacecraft names as specified in SANA.	String1024—Permitted values registered in SANA	n/a

3.2.5   CLASS DefinedEvent

3.2.5.1   The DefinedEvent class is optional and may be used to permit the instantiation of Events that are defined in this recommendation.

NOTE   –   The DefinedEvent class is a specialization of class Event described in ANNEX A below, and the generic description of the parameters is given in that subsection.

3.2.5.2   There shall be zero or more instances of the DefinedEvent class for each instance of the ProvisonalPlanData class.

3.2.5.3   Table 3-5 specifies the use of the parameters in the Event in the scope of the DefinedEvent.

3.2.5.4   The various events defined in this recommendations are as specified in section 3.3 below.

Table 3-5: Class DefinedEvent Parameters

The parameters for the DefinedEvent class as are as per Table A-1 in ANNEX A except for the following:

Parameter	Description	Data Type	Data Units

eventType	In the context of the DefinedEvent this parameter is mandatory and is used to specify the type of the event. The various types of event that can be contained in a provisional plan are discussed in reference [2], section 5.3.	Enumeration
		– COMMS
		  Predicted communications geometry events (see reference [2], section 5.6)
		– DATARATE
		  Sustainable data rates & volume estimate events (see reference [2], section 5.7);
		– RFI
		  Predicted radio frequency interference events (see reference [2], section 5.8);
		– CONFLICTS
		  Predicted resource conflict events (see reference [2], section 5.9)
		– COSTS
		  Cost estimates (see reference [2], section 5.10)
		– OTHER
		  Any event type not covered by the above list.
			n/a

3.2.6   CLASS AdditionalEvent

3.2.6.1   The AdditionalEvent class is optional and may be used to permit the instantiation of Events that are not defined in this recommendation. The need for this may arise if it is found that in certain cases (or missions) the Events defined in this recommendation are not sufficient and additional Events are required.

NOTE –   The AdditionalEvent class is a specialization of class Event described in 3.2.3.3 above, and the description of the parameters is given in that subsection.

3.2.6.2   There shall be zero or more instances of the AdditionalEvent class for each instance of the ProvisionalPlanData class.

3.2.6.3   Table 3-6 specifies the use of the parameters in the Event in the scope of the AdditionalEvent.

3.2.6.4   The various events defined in this recommendations are as specified in section 3.3 below.

3.2.6.5   The usage of these additional Events is not within the scope of this document and should be specified in an ICD between the relevant parties.

Table 3-6: Class AdditionalEvent Parameters

The parameters for the AdditionalEvent class as are as per Table A-1 in ANNEX A except
for the following:

Parameter	Description	Data Type	Data Units

eventType	In the context of the AdditionalEvent this parameter is mandatory and is used to specify the type of the event. The various types of event that can be contained in a provisional plan are discussed in reference [2], section 5.3.	Enumeration
		– COMMS
		  Predicted communications geometry events (see reference [2], section 5.6)
		– DATARATE
		  Sustainable data rates & volume estimate events (see reference [2], section 5.7);
		– RFI
		  Predicted radio frequency interference events (see reference [2], section 5.8);
		– CONFLICTS
		  Predicted resource conflict events (see reference [2], section 5.9)
		– COSTS
		  Cost estimates (see reference [2], section 5.10)
		– OTHER
		  Any event type not covered by the above list.
			n/a

3.2.7   CLASS DefinedEventParameter

3.2.7.1   The DefinedEventParameter class is optional and may be used to permit the instantiation of parameters for an Event that is defined in this recommendation.

NOTE –   The DefinedEventParameter class is a specialization of class EventParameter described in ANNEX A below, and the description of the parameters is given in that subsection.

3.2.7.2   There shall be zero or more instances of the DefinedEventParameter class for each instance of the DefinedEvent class.

3.2.7.3   The parameters that are expected to be associated with the various events defined in this recommendations are as specified in section 3.3 below.

3.2.8   CLASS AdditionalEventParameter

3.2.8.1   The AdditionalEventParameter class is optional and may be used to permit the instantiation of additional parameters for an Event. The need for this may arise if it is found that in certain cases (or missions) the parameters defined in this recommendation are not sufficient and additional information is required.

NOTE –   The AdditionalEventParameter class is a specialization of class Parameter described in ANNEX A below, and the description of the parameters is given in that subsection.

3.2.8.2   There shall be zero or more instances of the AdditionalEventParameter class for each instance of the DefinedEvent class.

3.2.8.3   There shall be zero or more instances of the AdditionalEventParameter class for each instance of the AdditionalEvent class.

3.2.8.4   The usage of these additional parameters is not within the scope of this document and should be specified in an ICD between the relevant parties.

3.3   EVENTS

3.3.1   EVENT TYPE - COMMS

This event type deals with predicted communications geometry events (see reference [2], section 5.6) and are as specified in Table 3-7:

Table 3-7: Predicted communications geometry events

Event	Description	Defined Parameter(s)
AOS	Acquisition of signal by aperture (ground or spacecraft)	See section 3.3.1.1 below

Event	Description	Defined Parameter(s)
LOS	Loss of signal by aperture (ground or spacecraft)	See section 3.3.1.2 below
Elevation-Ascending	Ascending angle of elevation with respect to aperture (ground or spacecraft)	See section 0 below
Elevation-Descending	Descending angle of elevation with respect to aperture (ground or spacecraft)	See section 3.3.1.4 below
Maximum-Elevation	Maximum elevation with respect to aperture (ground or spacecraft)	See section 3.3.1.5 below
Occultation-Start	Start of occultation with respect to aperture (ground or spacecraft)	See section 3.3.1.6 below
Occultation-End	End of occultation with respect to aperture (ground or spacecraft)	See section 3.3.1.7 below
SAA	Sun alignment angle	See section 3.3.1.8 below
Range	Distance with respect to aperture (ground or spacecraft)	See section 3.3.1.9 below
Range-Rate	Rate at which the rate is changing with respect to aperture (ground or spacecraft)	See section 3.3.1.10 below
OWLT	One Way Light Time with respect to aperture (ground or spacecraft)	See section 3.3.1.11 below
Coms-Start	Start of possible communication window with respect to aperture (ground or spacecraft)	See section 3.3.1.12 below
Coms-End	End of possible communication window with respect to aperture (ground or spacecraft)	See section 3.3.1.13 below
Keyhole	Keyhole occurrence at aperture	See section 3.3.1.14 below
Cable-Wrap	Cable wrap occurrence at aperture.	See section 3.3.1.15 below

3.3.1.1 AOS Event Parameters

Table 3-8: AOS Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24

3.3.1.2 LOS Event Parameters

Table 3-9: LOS Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24

3.3.1.3 Elevation-Ascending Event Parameters

Table 3-10: Elevation-Ascending Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
angle	See Table 3-25

3.3.1.4 Elevation-Descending Event Parameters

Table 3-11: Elevation-Descending Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
angle	See Table 3-25

3.3.1.5   Maximum-Elevation Event Parameters

Table 3-12: Maximum-Elevation Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
angle	See Table 3-25

3.3.1.6   Occultation-Start Event Parameters

Table 3-13: Occultation-Start Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
celestialBody	See Table 3-26

3.3.1.7   Occultation-End Event Parameters

Table 3-14: Occultation-End Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
celestialBody	See Table 3-26

3.3.1.8   SAA Event Parameters

Table 3-15: SAA Event Parameters

Parameter	Parameter Definition
angle	See Table 3-25

3.3.1.9 Range Event Parameters

Table 3-16: Range Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
distance	See Table 3-27

3.3.1.10 Range-Rate Event Parameters

Table 3-17: Range-Rate Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
rate	See Table 3-28

3.3.1.11 OWLT Event Parameters

Table 3-18: OWLT Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24
duration	See Table 3-29

3.3.1.12 Coms-Start Event Parameters

Table 3-19: Coms-Start Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24

3.3.1.13 Coms-End Event Parameters

Table 3-20: Coms-End Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24

3.3.1.14 Keyhole Event Parameters

Table 3-21: Keyhole Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24

3.3.1.15 Cable-Wrap Event Parameters

Table 3-22: Cable-Wrap Event Parameters

Parameter	Parameter Definition
siteRef	See Table 3-23
apertureRef	See Table 3-24

3.3.2   EVENT TYPE - DATARATE

This event type deals with sustainable data rates and volume estimate events (see reference [2], section 5.7) are not defined in this issue of the recommended standard and will be added in a later revision.

3.3.3   EVENT TYPE - RFI

This event type deals with predicted radio frequency interference events (see reference [2], section 5.8) are not defined in this issue of the recommended standard and will be added in a later revision.

3.3.4   EVENT TYPE - CONFLICTS

This event type deals with predicted resource conflict events (see reference [2], section 5.9) are not defined in this issue of the recommended standard and will be added in a later revision.

3.3.5   EVENT TYPE - COSTS

This event type deals with cost estimates (see reference [2], section 5.10) are not defined in this issue of the recommended standard and will be added in a later revision.

3.3.6   EVENT TYPE - OTHER

This event type consists of those events which are not covered by the above definitions. No such events are defined in this recommendation, however this category is defined as it may be useful in the definition of Additional Events.

3.4   PARAMETERS

The following sections consists of the definition of the various parameters used by the events defined in this recommended standard.

Table 3-23: Parameter siteRef Definition

Description	Data Type	Data Units
Name of the site (ground or spacecraft) to which the event refers.	String16—Permitted values registered in SANA	n/a

Table 3-24: Parameter apertureRef Definition

Description	Data Type	Data Units
Identifier of the aperture (ground or spacecraft) to which the event refers.	String16—Permitted values registered in SANA	n/a

Table 3-25: Parameter angle Definition

Description	Data Type	Data Units
Angle	Float $0 \leq$ Angle ≤ 180	Degrees

Table 3-26: Parameter celestialBody Definition

Description	Data Type	Data Units
Celestial body causing the occultation.	String1024 – Permitted values are as follows; – Planet and Satellite Names – as per ref. [8] – Minor Planet Names – as per ref. [9]	n/a

Table 3-27: Parameter distance Definition

Description	Data Type	Data Units
Distance.	Positive Number	Km

Table 3-28: Parameter rate Definition

Description	Data Type	Data Units
Rate of change of distance	Number	Km/s

Table 3-29: Parameter duration Definition

Description	Data Type	Data Units
Time taken for something to happen with respect to the event.	Any suggestions for an appropriate format, Picoseconds maybe ? (I'm not really sure any of the CCSDS time formats are suitable).	TDB

ANNEX A

ABSTRACT EVENT AND EVENT PARAMETERS CLASSES DEFINITION

(NORMATIVE)

A1   GENERAL

The Service Management Information Entity forms the basis for defining information entities required by service management.

A2   EVENT AND EVENT PARAMETERS CONTENT/STRUCTURE

A2.1   OVERVIEW

Figure A-1 shows the UML Class diagram for the Event and Event Parameters classes. It should be noted that for clarity abstract classes for highlighted in green
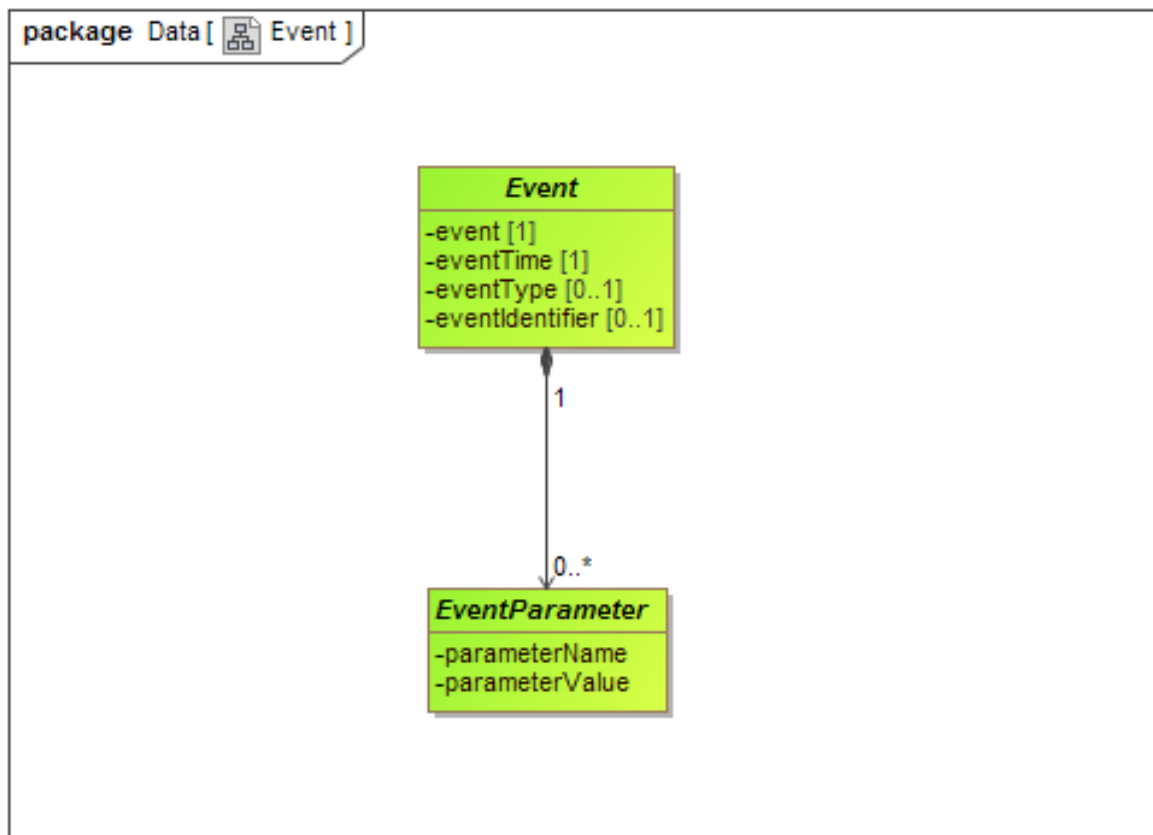
Figure A-1: Event and Event Parameters Class Diagram

The attributes of each class are described further in the following subsections and tables.

A2.2   CLASS Event (ABSTRACT)

A2.2.1   The Event class is an abstract class which is used to instantiate the various classes of events required that constitute the information about an event forming part of the provisional plan.

NOTE –   The Event class is a specialization of the class SrvMgtData class described in Annex A of reference [7] and the generic description of the parameters is given there.

A2.2.2   The Event class shall contain the parameters as specified in Table A-1.

Table A-1: Class Event Parameters

Parameter	Description	Data Type	Data Units
event	The event. The various different events of each eventType are described in section 3.3 above.	String32 — Permitted values registered in SANA (TBC)	n/a
eventTime	The time at which the event occurs.	CCSDS ASCII Time Code B (reference [5])	UTC
eventType	Optional Parameter. This can be used to specify the type of the event..	String32 — Permitted values registered in SANA (TBC)	n/a
eventIdentifier	Optional Parameter. An identifier that is unique for every occurrence of a particular event in a provisional plan. NOTE – If a provisional plan is regenerated, then the eventIdentifier for a particular event may change.	String1024	n/a

A2.3   CLASS EventParameter (ABSTRACT)

A2.3.1   The EventParameter class shall be used to permit the instantiation of parameters for an Event by allowing the specification of parameter name/value pairs using the parameters specified in Table A-2.

Table A-2: Class EventParameter Parameters

Parameter	Parameter	Data Type	Data Units
parameterName	Name of the parameter.	String1024	n/a
parameterValue	The value of the required parameter.	As required by the additional parameter	As required by the additional parameter

ANNEX B

IMPLEMENTATION CONFORMANCE STATEMENT (ICS) PROFORMA

(NORMATIVE)

B1   INTRODUCTION

B1.1   OVERVIEW

This annex provides the Implementation Conformance Statement (ICS) Requirements List (RL) for an implementation of the *Planning Data Format Specification* (CCSDS 902.2-R-1). The ICS for an implementation is generated by completing the RL in accordance with the instructions below. An implementation shall satisfy the mandatory conformance requirements referenced in the RL.

The RL in this annex is blank. An implementation's completed RL is called the ICS. The ICS states which capabilities and options have been implemented. The following can use the ICS:

  – the implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight;

  – a supplier or potential acquirer of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard ICS proforma;

  – a user or potential user of the implementation, as a basis for initially checking the possibility of interworking with another implementation (it should be noted that, while interworking can never be guaranteed, failure to interwork can often be predicted from incompatible ICSes);

  – a tester, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

B1.2   ABBREVIATIONS AND CONVENTIONS

B1.2.1   General

The RL consists of information in tabular form. The status of features is indicated using the abbreviations and conventions described below.

B1.2.2   Item Column

The item column contains sequential numbers for items in the table.

B1.2.3   Feature Column

The feature column contains a brief descriptive name for a feature. It implicitly means 'Is this feature supported by the implementation?'

NOTE – The features itemized in the RL are elements of the Planning Data Format. Therefore support for a mandatory feature indicates that a generated file will include that feature, and support for an optional feature indicates that generated files can include that feature.

B1.2.4   Class Column/Parameters

The Class/Parameters column contains, where applicable, the Planning Data Format class associated with the feature.

B1.2.5   Reference Column

The reference column indicates the relevant subsection or table in the *Planning Data Format Specification* (CCSDS 902.2-R-1) (this document).

B1.2.6   Status Column

The status column uses the following notations:

      M   mandatory.

      O   optional.

It should be noted that a parameter may be marked as M(andatory) while the class that contains it is marked O(ptional). This should be interpreted to mean that while the class is optional if it is present then the parameter must be present.

B1.2.7   Support Column Symbols

The support column is to be used by the implementer to state whether a feature is supported by entering Y, N, or N/A, indicating:

      Y   Yes, supported by the implementation.

      N   No, not supported by the implementation.

      N/A   Not applicable.

B1.3   INSTRUCTIONS FOR COMPLETING THE RL

An implementer shows the extent of compliance to the Recommended Standard by completing the RL; that is, the state of compliance with all mandatory requirements and the options supported are shown. The resulting completed RL is called an ICS. The implementer shall complete the RL by entering appropriate responses in the support or values supported column, using the notation described in B1.2. If a conditional requirement is inapplicable, N/A should be used. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference *Xi*, where *i* is a unique identifier, to an accompanying rationale for the noncompliance.

B2   ICS PROFORMA FOR SIMPLE SCHEDULE FORMAT

B2.1   GENERAL INFORMATION

B2.1.1   Identification of ICS

Date of Statement (DD/MM/YYYY)	
ICS serial number	
System Conformance statement cross-reference	

B2.1.2   Identification of Implementation Under Test (IUT)

Implementation name	
Implementation version	
Special Configuration	
Other Information	

B2.1.3   Identification of Supplier

Supplier	
Contact Point for Queries	
Implementation Name(s) and Versions	
Other Information necessary for full identification, e.g., names(s) and version(s) for machines and/or operating systems;	

B2.1.4   Document Version

CCSDS 920..2-W-0.06 draft	
Have any exceptions been required? (Note: A YES answer means that the implementation does not conform to the Recommended Standard. Non-supported mandatory capabilities are to be identified in the ICS, with an explanation of why the implementation is non-conforming	Yes _____ No _____

B2.1.5   Requirements List

B2.1.5.1   Class ProvisionalPlan

B2.1.5.1.1   General

Item	Description	Ref.	Status	Support
1.	`ProvisonalPlan`	3.2.2	M	

B2.1.5.1.2   Class ProvisonalPlan Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
1.1.	`srvMgtEntityType`	Table 3-1	M	

B2.1.5.2   Class ProvisonalPlanHeader

B2.1.5.2.1   General

Item	Description	Ref.	Status	Support
2.	`ProvisonalPlanHeader`	3.2.3	M	

B2.1.5.2.2   Class ProvisonalPlanHeader Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
2.1.	`originatingOrganization`	Table 3-2	M	
2.2.	`generationTime`	Table 3-2	M	
2.3.	`status`	Table 3-2	M	
2.4.	`version`	Table 3-2	M	
2.5.	`startTime`	Table 3-2	M	
2.6.	`endTime`	Table 3-2	M	
2.7.	`purpose`	Table 3-2	O	
2.8.	`description`	Table 3-2	O	
2.9.	`provisonalPlanType`	Table 3-3	M	

B2.1.5.3 Class ProvisonalPlanData

B2.1.5.3.1 General

Item	Description	Ref.	Status	Support
3.	`ProvisonalPlanData`	3.2.3	M	

B2.1.5.3.2 Class ProvisonalPlanHeader Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
3.1.	`user`	Table 3-2	M	

B2.1.5.4 Class DefinedEvent

B2.1.5.4.1 General

Item	Description	Ref.	Status	Support
4.	`DefinedEvent`	3.2.4	O	

B2.1.5.4.2 Class DefinedEvent Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
4.1.	`event`	Table 3-5	M	
4.2.	`eventTime`	Table 3-5	M	
4.3.	`eventType`	Table 3-5	M	
4.4.	`eventIdentifier`	Table 3-5	O	

B2.1.5.4.3 Class DefinedEvent Event Type - COMMS

Item	Event Type - COMMS	Ref.	Status	Item Support or Values Supported
4.5.	AOS	Table 3-7	O	
4.6.	LOS	Table 3-7	O	
4.7.	Elevation-Ascending	Table 3-7	O	
4.8.	Elevation-Descending	Table 3-7	O	
4.9.	Maximum-Elevation	Table 3-7	O	
4.10.	Occultation-Start	Table 3-7	O	
4.11.	Occultation-End	Table 3-7	O	
4.12.	SAA	Table 3-7	O	

Item	Event Type - COMMS	Ref.	Status	Item Support or Values Supported
4.13.	Range	Table 3-7	O	
4.14.	Range-Rate	Table 3-7	O	
4.15.	OWLT	Table 3-7	O	
4.16.	Coms-Start	Table 3-7	O	
4.17.	Coms-End	Table 3-7	O	
4.18.	Keyhole	Table 3-7	O	
4.19.	Cable-Wrap	Table 3-7	O	

B2.1.5.4.4 Class DefinedEvent Event Type – DATARATE

Not defined in the issue of the recommended standard, will be added in a later revision.

B2.1.5.4.5 Class DefinedEvent Event Type – RFI

Not defined in the issue of the recommended standard, will be added in a later revision.

B2.1.5.4.6 Class DefinedEvent Event Type – CONFLICTS

Not defined in the issue of the recommended standard, will be added in a later revision.

B2.1.5.4.7 Class DefinedEvent Event Type - COSTS

Not defined in the issue of the recommended standard, will be added in a later revision.

B2.1.5.5 Class AdditionalEvent

B2.1.5.5.1 General

Item	Description	Ref.	Status	Support
5.	AdditionalEvent	3.2.6	O	

B2.1.5.5.2 Class AdditionalEvent Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported

Item	Parameter	Ref.	Status	Item Support or Values Supported
5.1.	event	Table 3-6	M	
5.2.	eventTime	Table 3-6	M	
5.3.	eventType	Table 3-6	M	
5.4.	eventIdentifier	Table 3-6	O	

B2.1.5.5.3 Class AdditionalEvent Events

The AdditionalEvents class may be used to permit the instantiation of additional Events that are not defined in this recommendation. The additional events should be specified in table Table B-1 below.

In the following Table B-1 the columns have the following use:

  − Event   This column is used to specify the names of the additional event(s).

  − Description   This column is used to enter the description of what the additional event(s)

  − Parameters   This column is used to give a reference to where the parameters (if any) relevant to the event are specified.

Table B-1: AddtionalEvent Events

Event	Description	Parameters

B2.1.5.6 Class DefinedEventParameter

B2.1.5.6.1 General

Item	Description	Ref.	Status	Support
6.	DefinedEventParameter	3.2.7	O	

B2.1.5.6.2 Class DefinedEventParameter Parameters

Item	Parameter	Ref.	Status	Item Support or Values Supported
6.1.	`parameterName`	Table 3-5	M	
6.2.	`parameterValue`	Table 3-5	M	

B2.1.5.6.3 Class DefinedEventParameters – Defined Parameters

Item	Defined Parameters for Event Type - COMMS	Ref.	Status	Item Support or Values Supported
6.3.	`siteRef`	Table 3-23	M	
6.4.	`apertureRef`	Table 3-24	M	
6.5.	`angle`	Table 3-25	M	
6.6.	`celestialBody`	Table 3-26	M	
6.7.	`distance`	Table 3-27	M	
6.8.	`rate`	Table 3-28	M	
6.9.	`duration`	Table 3-29	M	

B2.1.5.7 Class AdditionalEventParameter

B2.1.5.7.1 General

Item	Description	Ref.	Status	Support
7.	`AdditionalEventParameter`	3.2.8	O	

B2.1.5.7.2 Class AdditionalEventParameter Parameters

If this class is used to specify additional parameters for DefinedEvent or AdditonalEvent, the additional parameters and permitted values for these should be specified in Table B-2 below.

In the following Table B-2 the columns have the following use:

- parameterName   This column is used to specify the names of the additional parameter(s).

- Description   This column is used to enter the description of what the additional parameter(s) is/are.

- parameterValueType This column is used to specify what type the parameterValue is, e.g., String1024, Integer, Unsigned Integer, Real, CCSDS ASCII Time Code B, etc.

- Permitted Values — This column is used to specify the values that are permitted for the additional parameter(s).

- Data units — This column is used to specify the Data Unit of the additional parameter(s), e.g., Seconds, Hertz, Volts, UTC, etc.

Table B-2: Class AdditionalParameter Instantiated for Classes DefinedEvent or AdditionalEvent

parameterName	Description	parameterValue Type	Permitted Values	Data units

ANNEX C

XML SCHEMA FOR THE PLANNING INFORMATION FORMATS

(INFORMATIVE)

C1   PURPOSE

This annex provides an informative description of the normative XML schema data types that realize the classes that comprise the Simple Schedule Format as defined in section 3.

C2   SCHEMA ORGANIZATION AND PACKAGING

ANNEX D

SECURITY, SANA, AND PATENT CONSIDERATIONS

(INFORMATIVE)

D1   SECURITY CONSIDERATIONS

D1.1   OVERVIEW

This section presents the results of an analysis of security considerations applied to the technologies specified in this Recommended Standard.

D1.2   CONSEQUENCES OF NOT APPLYING SECURITY TO THE TECHNOLOGY

The consequences of not applying security to the systems and networks on which this Recommended Standard is implemented could include potential loss, corruption, and theft of data. Since it is possible to utilize these messages disseminating events relating to the availability of communications and tracking resources for spacecraft and other information, the consequences of not applying security to the systems and networks on which this Recommended Standard is implemented could include compromise or loss of the mission if malicious tampering of a particularly severe nature occurs.

D1.3   POTENTIAL THREATS AND ATTACK SCENARIOS

Potential threats or attack scenarios include, but are not limited to, (a) unauthorized access to the programs/processes that generate and interpret the messages, and (b) unauthorized access to the messages during transmission between exchange partners. Protection from unauthorized access during transmission is especially important if the mission utilizes open ground networks such as the Internet to provide ground station connectivity for the exchange of data formatted in compliance with this Recommended Standard. It is strongly recommended that potential threats or attack scenarios applicable to the systems and networks on which this Recommended Standard is implemented be addressed by the management of those systems and networks and the utilization of adequate authentication, suitable protocols, and secured interfaces for the exchange of this information.

D1.4   SECURITY CONCERNS RELATED TO THIS RECOMMENDED STANDARD

D1.4.1   Data Privacy

Privacy of data formatted in compliance with the specifications of this Recommended Standard should be assured by the systems and networks on which this Recommended Standard is implemented.

D1.4.2   Data Integrity

Integrity of data formatted in compliance with the specifications of this Recommended Standard should be assured by the systems and networks on which this Recommended Standard is implemented.

D1.4.3   Authentication of Communicating Entities

Authentication of communicating entities involved in the transport of data which complies with the specifications of this Recommended Standard should be provided by the systems and networks on which this Recommended Standard is implemented.

D1.4.4   DATA TRANSFER BETWEEN COMMUNICATING ENTITIES

The transfer of data formatted in compliance with this Recommended Standard between communicating entities should be accomplished via secure mechanisms approved by the Information Technology Security functionaries of exchange participants.

D1.4.5   Control of Access to Resources

Control of access to resources should be managed by the systems upon which provider formatting and recipient processing are performed.

D1.4.6   Auditing of Resource Usage

Auditing of resource usage should be handled by the management of systems and networks on which this Recommended Standard is implemented.

D1.5   UNAUTHORIZED ACCESS

Unauthorized access to the programs/processes that generate and interpret the messages should be prohibited in order to minimize potential threats and attack scenarios.

D1.6   DATA SECURITY IMPLEMENTATION SPECIFICS

Specific information-security interoperability provisions that apply between agencies and other independent users involved in an exchange of data formatted in compliance with this Recommended Standard should be specified in an ICD.

D2   SANA CONSIDERATIONS

D2.1   GENERAL

The recommendations of this document require access to SANA the registries described below. New assignments in these registries, in conformance with the modifications identified, will be shown at the SANA registry Web site: http://sanaregistry.org. Therefore, the reader shall look at the SANA Web site for all the assignments contained in these registries.

Already registered values shall not be affected by this Recommended Standard.

D2.2   REGISTRY CONTAINING ORIGINATINGORGANISATION

The values for orginatingOrganization (see Table 3-2) shall be those listed in the "Name" field of the CCSDS Organizations registry.

The procedure to follow for adding new values to this registry shall be that defined in [10]. An approved entry shall have one additional step to this procedure: the "serviceProvider" attribute shall be set the enumerated value of "SchedulePublisher".

The CCSDS Organizations registry can be found at the following URL: http://sanaregistry.org/r/organizations/organizations.html

D2.3   REGISTRY CONTAINING USER

The values for the "user" parameter (see table **Error! Reference source not found.**) shall be as those defined in the CCSDS Spacecraft Identifiers registry, specifically with regard to the "Spacecraft Name" field of this registry.

The procedure to follow for adding new values to this registry shall be that defined in [11].

The CCSDS Spacecraft Identifiers registry can be found at the following URL: http://sanaregistry.org/r/spacecraftid/spacecraftid.html

D2.4   REGISTRY CONTAINING SITEREF AND APERTUREREF

The values for siteRef and apertureRef shall be as those defined in the CCSDS Sites and Apertures registry.

 The procedure to follow for adding new values to this registry shall be that defined in [11].

The CCSDS Sites and Apertures registry can be found at the following URL: http://sanaregistry.org/xxx

NOTE: Only values that have been registered should be used for the originatingOrganization, user, siteRef and apertureRef   parameters.   Unregistered values for the originatingOrganization,   user, siteRef and apertureRef   parameters, may be used. If unregistered values are used they should be prefixed with the string "UNR::".

NOTES –

    a) "UNR::" indicates an unregistered value;

    b) this helps eliminate potential confusion in a multi-agency cross support context;

    c) use of unregistered values is not recommended and should be avoided if possible.

D3   PATENT CONSIDERATIONS

No patent rights are known to adhere to any of the specifications of the Recommended Standard.

ANNEX E

ABBREVIATIONS AND ACRONYMS

(INFORMATIVE)

ASCII	American Standard Code for Information Interchange
CCSDS	Consultative Committee on Space Data Systems
ICD	Interface Control Document
OMG	Object Management Group
SANA	Space Assigned Numbers Authority
TBD	To Be Decided
UML	Unified Modelling Language
UTC	Coordinated Universal Time
W3C	World Wide Web Consortium
XML	eXtensible Markup Language

ANNEX F

INFORMATIVE REFERENCES

(INFORMATIVE)

[E1] Space Communication Cross Support—Service Management—Operations Concept. Report Concerning Space Data Systems Standards, CCSDS 910.14-G-1. Green Book. Issue 1. Washington, D.C.: CCSDS, May 2011.