

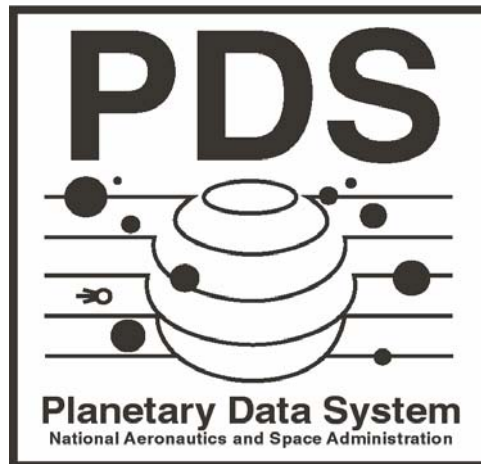
Planetary Data System

Data Product Label Design Tool Level 4 and 5 Requirements

DRAFT

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Version 1.0



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CHANGE LOG

Revision	Date	Description	Author
Version 1.0	Oct. 15, 2006	Gleaned from an initial set of requirements provided by S. Slavney and Use Cases provided by S. Hughes.	S. Hughes, R. Joyner
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RFA LIENS

The following table details the RFA liens against this document. The RFAs were generated as a result of the Tool Requirements Review held on **xxx, 2006**, covering Version 1.0 of this document.

Status	Count	RFA Number(s)
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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide level 4 and 5 requirements for the Planetary Data System (PDS) Data Product Label Design Tool (LDT).

1.1.1 Background

The PDS Management Council identified the development of a Data Product Label Design Tool as a key Engineering Node task for 2007. A working group has written a Data Product Label Design Tool Use Case document to outline the scope of the tool and to be used to drive level 4 and 5 requirements. The use cases have been derived from PDS Level 3 requirements and early PDS node input, especially a straw-man set of design tool requirements written by the Geosciences Node.

1.2 Scope

The scope of this document is to identify requirements for a design tool that data providers can use to design a PDS data product label template based on the latest PDS standards and data dictionary, without the user needing to be a PDS expert. The tool is envisioned as an interactive label editor that gets input from the user, the PDS data dictionary, and the PDS standards. This tool will help ensure a valid label template design by interacting with the user and in real time indicate what parts of the label template are non-compliant. The tool will also assist the user in adjusting the errant portions, or to generate a validation report listing what needs to be adjusted.

This tool is not intended to generate multiple labels in production mode. It is only for label design, not production. This tool creates and exports a label template that is to be used to either manually create a label using an editor or as input to another tool that can mass-produce labels for actual data files.

1.3 Notation

The numbering of the requirements in this document will be formatted as **LX.LD.AA.X**, where:

- **LX** represents the requirements level where X is a number.

- **LD** is an acronym representing label design requirements section for the specified level
- **AA** is a two letter acronym for the requirement subcategory. (Optional)
- **X** is a unique number for the type of requirement.

Following the text of a requirement may be a reference to the requirement from which it was derived. The reference will be in parenthesis.

A paragraph following a requirement, which is indented and has a reduced font size, represents a comment providing additional insight for the requirement that it follows. This comment should not be considered part of the requirement for development or testing purposes.

1.4 Audience

This document is written primarily for those who will use the requirements to design, implement and test the tool. The expected audience includes:

- PDS EN Development Staff
- PDS Node Technical Staff

1.5 Controlling Documents

[1] Planetary Data System (PDS) Level 1, 2 and 3 Requirements, May 26, 2006.

1.6 Applicable Documents

[2] Planetary Data System (PDS) Standards Reference, March 20, 2006, Version 3.7, JPL D-7669, Part 2.

[3] Planetary Science Data Dictionary Document, August 28, 2002, Planetary Data System (PDS), JPL D-7116, Rev E.

[4] Planetary Data System (PDS) Data Product Design Tool Use Cases, Sept. 08, 2006, JPL D-xxxx.

1.7 Other References

[5] Requirements for a PDS Label Design Tool, S.Slavney, PDS Geosciences Node, Nov. 17, 2005.

1.8 Document Maintenance

It is anticipated that additional phases of development will be defined and approved by the Management Council resulting in modifications to this document. This document and the requirements specified herein will be kept under configuration control with any modifications submitted to the Management Council for approval.

2.0 LEVEL 4 REQUIREMENTS

This section details the level 4 requirements for the Label Design Tool. The functional requirements are derived directly from the PDS level 3 requirements and the higher level use cases documented in the Data Product Design Tool Use Cases [4]. The requirements in this section pertain to the general operations of using the tool to design a data product label template.

- **Label Template** – An ODL specification that represents a model for a data product label and that can be used for the creation of data product labels either manually or using an automated tool.

L4.LD.1 - The Tool shall assist the user in designing a label template without using an existing data product label or an existing data product as a reference for the design of the new label template. (UC 5.1, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3)

L4.LD.2 - The Tool shall assist the user in designing a label template by using an existing data product label as a reference for the design of the new label template. The user may provide the existing data product label or may select one from a set of examples provided by the Tool. (UC 5.2, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3, Tech Session discussion 10/25/06.)

The referenced data product label may be either an attached label (i.e., a data product), or a detached label (i.e., does not include the data object(s) referenced in the label).

L4.LD.3 - The Tool shall assist the user in designing a label template by using an existing data object as a reference for the design of the new label template. (UC 5.3, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3)

The referenced data object may either be attached to a label (i.e., a data product), or detached from the label (i.e., does not include the data product label). The tool will analyze the data object to ascertain attributes appropriate to the label under construction.

L4.LD.4 - The Tool shall assist the user in designing a label template by using an existing data product label and analyzing an existing data object. The user may provide the existing data product label or may select one from a set of examples provided by the Tool. (UC 5.4, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3, Tech Session discussion 10/25/06)

The data object being analyzed by the tool need not be actually described by the data product label however the data object must be similar to one of the data objects referenced by the data product label). The data product label may be either an attached label or a detached label. The data object must be detached from the label.

L4.LD.5 – The Tool shall assist the user in designing a label template by translating existing metadata (with or without using a data product label) as input for the design of the new label template. (UC 5.5, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3, Tech Session discussion 10/25/06)

The tool shall recognize a limited set of metadata formats, including FITS headers, VICAR headers, ISIS headers, and comma-separated-value text tables in a specific format.

L4.LD.6 - The Tool shall allow the user to continue a label design session. (UC 5.6, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3)

L4.LD.7 - The Tool shall be able to determine and indicate to users the label template components that are non-compliant with the PDS Standards Reference [2]. (UC 5.7, 1.2.1, 1.2.2, 1.2.3, 1.5.1, 1.5.2, 1.5.3)

L4.LD.8 - The Tool shall be developed using best practices in software engineering together with input from the user community. (3.3.7, 2.10.2)

3.0 LEVEL 5 REQUIREMENTS

The requirements in this section have been derived from the level 4 requirement above and use cases from the Data Product Design Tool Use Cases [4] document.

3.1 General Requirements

The requirements in this section pertain to the general operations of using the tool to design and edit a data product label template.

L5.LD.GR.1 - The Tool shall accept the following as input for specifying the location of an existing data product label to be examined. (L4.LD.2, L4.LD.4, L4.LD.5)

1. File Specification
2. Uniform Resource Locator (URL)

A URL allows access to a data product from a local disk or a remote machine

L5.LD.GR.2 - The Tool shall open and read an existing label and displays it to the User as a label template, indicating required and optional objects and keywords, source of the keywords, and retaining existing keyword values. (L4.LD.2, L4.LD.4, L4.LD.5, Tech Session 10/26/06)

L5.LD.GR.3 - The Tool shall accept the following as input for specifying the location of a label fragment and include the label fragment into an existing data product label without being examined. (L4.LD.2, L4.LD.4, L4.LD.5, Tech Session 10/26/06)

1. File Specification
2. Uniform Resource Locator (URL)

A URL allows access to a data product from a local disk or a remote machine

L5.LD.GR.4 - The Tool shall accept the following as input for specifying the location of an existing container of metadata to be examined. (L4.LD.5)

1. File Specification
2. Uniform Resource Locator (URL)

A URL allows access to a data product from a local disk or a remote machine.

L5.LD.GR.5 – The Tool shall open and read a metadata file and create a new label template containing objects and keywords derived from the metadata. Depending on the type of metadata, the system may prompt the user for input as to how to map metadata information to label keywords and values. The tool shall display the new label template and indicate required and optional keywords and those keywords and values derived from the metadata file. (L4.LD.5)

L5.LD.GR.6 - The Tool shall accept the following as input for specifying the location of a data object to be examined. (L4.LD.3, L4.LD.4)

1. File Specification
2. Uniform Resource Locator (URL)
3. File Specification for PDS Product Label with pointer to data object
4. Uniform Resource Locator (URL) for PDS Product Label with pointer to data object.

A URL allows access to a data product from a local disk or a remote machine.

L5.LD.GR.7 - The Tool shall be able to accept as input the type of data object that is to be described by the data product label and subsequently display a skeleton label template for edit. (L4.LD.1, L4.LD.3, L4.LD.5)

Chapter 4 of the Standards Reference lists the set of valid data object types. These include TABLE, SPECTRUM, SERIES, SPREADSHEET, IMAGE, and QUBE. The tool will also support any specific instance of the TABLE object (e.g., INDEX, GAZETTEER, MY_TABLE, etc).

L5.LD.GR.8 - The Tool shall accept as input the following type of data objects to be described by the data product label and be able to generate the pertinent keyword values in the label by inspecting a data object. (L4.LD.3)

1. ASCII TABLE
2. SPREADSHEET

(1) The tool should be able to determine the columns and rows.

L5.LD.GR.9 - The Tool shall accept the following as input for specifying the location of the Project File for a label design session. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

- a) File Specification

L5.LD.GR.10 - The Tool shall have the capability to save the information relevant to a label design session in a Project File, overwriting any previous file with the

same identifier (Save Option). (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

This is the project file Save option. The tool maintains and saves the state of the user's work so that it can be resumed in a later session. The state includes the locations of the latest exported label template, the latest exported Specific Label Object Definition, any referenced data product labels, data objects, data products, and all data dictionaries.

L5.LD.GR.11 - The Tool shall have the capability to save the information relevant to a label design session in a Project File using a new, user supplied identifier. (Save As option) (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

This is the project file Save As option.

L5.LD.GR.12 - The Tool shall be able to resume a label design session via the information stored in a Project File. (L4.LD.5)

The tool retrieves the state of the user's work so that it can be resumed.

L5.LD.GR.13 - The Tool shall be able to provide visual cues to the user that indicate the label template components that are non-compliant with the PDS Standards Reference [2] and all Data Dictionaries in use. (L4.LD.7)

The tool shall provide visual cues to the user indicating non-compliant components in the label template. For example keywords not found in a data dictionary might be highlighted in red and have a roll-over message.

L5.LD.GR.14 - The Tool shall be able to generate a report providing a list of label template components that are non-compliant with the PDS Standards Reference [2] and Data Dictionaries. (L4.LD.7)

The tool shall list non-compliant components along with explanatory messages. For example keywords not found in a data dictionary will be listed with an appropriate message.

L5.LD.GR.15 - The Tool shall run on any PDS-supported platforms. (L4.LD.8)

The list of PDS-supported platforms will be specified in a higher-level requirement from which this requirement will be derived.

Ln.LD.GR.17 - The Tool shall have the capability to be executed from a command-line interface. (L4.LD.8, Tech Session Levied Requirement.)

L5.LD.GR.18 - The tool shall be able to provide the user with the ability to enter comments in the label template using the standard syntax for delimiting comments in a PDS label. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.GR.19 – The Tool shall have configuration parameters for controlling functional behavior. (L4.LD.8, Tech Session Levied Requirement.)

- a) Default location of the PSDD
- b) Default location of (tbd) local data dictionaries
- c) Default location of the working data dictionary

L5.LD.GR.20 – The Tool shall allow configuration parameters to be supplied in the following ways: (L4.LD.8, Tech Session Levied Requirement.)

- a) Supplied as command-line options.
- b) Supplied in the form of a configuration file.

L5.LD.GR.21 – The tool shall provide a GUI widget to allow modification of the configuration parameters. (L4.LD.8, Tech Session Levied Requirement.)

3.2 Data Dictionary Requirements

The requirements in this section pertain to the use of the PSDD and any local data dictionaries used in designing the label template.

L5.LD.DR.1 - The Tool shall be able to accept the following as input for specifying the location of the PSDD to be used in designing the label template. (UC6.13, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

1. File Specification
2. Uniform Resource Locator (URL)

A URL allows access to the PSDD from a local disk or a remote machine.

L5.LD.DR.2 - The Tool shall be able to accept the following as input for specifying the location of any local data dictionaries relevant to designing the label template. (UC6.14, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

1. File Specification
2. Uniform Resource Locator (URL)

A URL allows access to local data dictionaries from a local disk or a remote machine.

L5.LD.DR.3 - The Tool shall be able to accept the following as input for specifying the location of the working data dictionary relevant to designing the label template. (UC6.15, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

1. File Specification

L5.LD.DR.4 - The Tool shall have configurable default locations for all data dictionaries. (L5.LD.GR.19)

L5.LD.DR.5 - The Tool shall allow the user to modify the configurable default locations for all data dictionaries. (L5.LD.GR.19)

L5.LD.DR.6 - The Tool shall be able to open and read all data dictionaries specified. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.DR.7 - The Tool shall be able to display to the user the identifier, version, and location of all data dictionaries being used. (L4.LD.8)

L5.LD.DR.8 - The Tool shall preferentially reference definitions in local data dictionaries before referencing definitions in the PSDD. (L4.LD.8, Working Group Requirement)

When the tool detects duplicate definitions in more than one of the data dictionaries, the tool will resolve conflicts by preferentially operating against the local data dictionaries in the order in which they were specified, and then the tool will operate against the definitions in the PSDD.

3.3 Working Data Dictionary (WDD) Requirements

The requirements in this section pertain to the Working Data Dictionary (WDD), a internal structure that stores the descriptive information for specific objects and keywords not already contained in the PSDD or an established local data dictionary.

L5.LD.WD.1 - The Working Data Dictionary shall store the descriptive information for specific objects and keywords not already contained in the PSDD or an established local data dictionary. (UC6.15, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6, L5.LD.DR.8, L5.LD.OR.6, L5.LD.OR.7, L5.LD.KR.1, L5.LD.KR.4, L5.LD.KR.5 L5.LD.KR.6, L5.LD.KR.8, L5.LD.KR.9, L5.LD.KR.10, L5.LD.VR.1, L5.LD.VR.2)

L5.LD.WD.2 - The Working Data Dictionary shall be internal to the Label Design Tool and maintained as a component of the Label Design Tool project file.

3.4 Template Export Requirements

The requirements in this section pertain to the export of label template information into a specified file format.

L5.LD.TE.1 - The Tool shall accept the following as input for specifying the location of any file to be exported from the tool. (UC6.9, UC6.10, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

1. File Specification

L5.LD.TE.2 - The Tool shall be able to create a test PDS label in ODL format based on the label template with test values filled in as placeholders in the template. (UC6.9, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The tool writes the ODL specification as an ASCII text file with the extension ".tbd".

L5.LD.TE.3 - The Tool shall have the capability to create a Label Template File, an ODL representation of a data product label that can be used for the creation of data product labels either manually or automatically. (UC6.10, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The tool writes the ODL specification as an ASCII text file with the extension ".LBT".

L5.LD.TE.4 - The Tool shall have the capability to create a Specific Label Object Definition for the entire label template. (Working Group requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The tool writes the PSDD Specific Object definition template as an ASCII text file with the extension ".tbd".

This template is to be loaded into a data dictionary and used for label validation.

It defines a product label as a specific object with no optional sub-objects or keywords.

L5.LD.TE.5 - The Tool shall have the capability to create a Specific Object Definition for any Data Object Description in the label template. (Working Group requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The tool writes the PSDD Specific Object definition template as an ASCII text file with the extension ".tbd".

This template is to be loaded into a data dictionary and used for label validation.

It defines a specific object with no optional sub-objects or keywords.

L5.LD.TE.6 - The Tool shall have the capability to write on export, a file, overwriting any existing file with the same identifier. (SAVE option) (UC6.9, UC6.10, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.TE.7 - The Tool shall have the capability to write on export, a file using a new, user supplied identifier. (SAVE AS option) (UC6.9, UC6.10, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.TE.8 - The Tool shall ensure all lines, in the label template being exported, are terminated with a carriage return character followed by a line feed character. (UC6.9, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

This requirement is derived from section 5.1.2 [2].

L5.LD.TE.9 - The Tool shall ensure that the label template being exported is properly formatted as specified in Section 5.1.2 of the *PDS Standards Reference* [2]. (UC6.9, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The Standards recommend that the equal signs in the labels be aligned for ease of reading. Sub-objects and keywords will be indented within enclosing objects.

L5.LD.TE.10 - The Tool shall have the capability to export the descriptive information for specific objects and keywords contained in the WDD.

The tool writes the current contents of the WDD to a file in the format of the PDS LDD.

L5.LD.TE.11 - The Tool shall have the capability to import the descriptive information for specific objects and keywords and updates the WDD.

The tool reads a file that is in the format of the PDS LDD and updates the WDD.

3.5 Syntactic Validation Requirements

L5.LD.SR.1 - The Tool shall indicate where the label template under construction, is not syntactically compliant, as specified in Chapter 12 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

The tool will use a subset of the VTOOL validation capabilities, specifically those applicable to the label template.

L5.LD.SR.3 - The Tool shall indicate where date/time values, used in the label template under construction, are not valid as specified in chapter 7 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

L5.LD.SR.4 - The Tool shall constrain the user to entering a limited subset of the standard 7-bit ASCII character set as specified in chapter 5 of the *PDS Standards Reference* [2]. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L5.LD.GR.5, L5.LD.GR.6)

- a) All characters in the range of 32 through 126 (decimal).
- b) The line feed character (10 decimal).
- c) The carriage return character (13 decimal).

The remaining 7-bit ASCII characters (1-9, 11, 12, 14-31 and 127 decimal, which includes the horizontal and vertical tab and form feed characters) are not permitted in PDS labels. This requirement is derived from section 5.1.2 [2].

The future use of UNICODE encoded characters are currently under consideration for interoperability between NASA/PDS and other national space agency data archives.

L5.LD.SR.5 - The Tool shall indicate where double or single quotation marks around keyword values are not used appropriately and where they are required but not present, according to sections 12.3.3, 12.5.4.2, and 12.7.3 of the PDS Standards Reference [2]. (L5.LD.GR.13, L5.LD.GR.14)

In any case where there is any choice between the two, the tool will indicate that double quotes are to be used.

L5.LD.SR.6 - The Tool shall indicate where sequences and sets are not used appropriately, according to chapter 12 of the PDS Standards Reference [2]. (L5.LD.GR.13, L5.LD.GR.14)

3.6 Semantic Validation Requirements

The requirements in this section pertain to the validation of the label template and the indication of non-compliance to the user. Semantic validation governs ensuring the structure of the label template is compliant (i.e., the structure of the objects, groups, keywords, and keyword-values, used in labels, conforms to the Planetary Science Data Dictionary (PSDD) specification or a local data dictionary). The PSDD is described in the *Planetary Science Data Dictionary Document* [3].

L5.LD.VR.1 - The Tool shall indicate to the user where the label template under construction is not semantically compliant according to the constructs specified in one or more PDS compliant data dictionaries. (L5.LD.GR.13, L5.LD.GR.14)

L5.LD.VR.1.1 - The Tool shall indicate to the user those objects that do not exist as specified in one or more PDS compliant data dictionaries.

L5.LD.VR.1.2 - The Tool shall indicate to the user those keywords that do not exist in one or more PDS compliant data dictionaries.

L5.LD.VR.1.3 - The Tool shall indicate to the user those keyword-values that are invalid as specified in one or more PDS compliant data dictionaries, including:

- a) Those values that are inconsistent with the specified keyword value type.
- b) Those non-numeric keyword-values whose length is not within the specified length limit.
- c) Those values that do not exist in their respective keyword valid values lists (STATIC and DYNAMIC).
- d) Those numeric keyword-values that are not within the specified range.

L5.LD.VR.2 - The Tool shall indicate to the user which data dictionary was used in determining compliance for each object, keyword, and keyword value. (L5.LD.GR.13, L5.LD.GR.14)

L5.LD.VR.3 - The Tool shall indicate to the user when a data object description does not exist when referenced by a pointer in the PDS label. (L5.LD.GR.13, L5.LD.GR.14)

L5.LD.VR.4 - The Tool shall indicate to the user whenever one of the following two cases involving PDS_VERSION_ID element is not met. (L5.LD.GR.13, L5.LD.GR.14)

- a) The PDS_VERSION_ID is first line of the label template under construction, if an SFDU is not present in the label.
- b) The PDS_VERSION_ID is the second line of the label template under construction, if an SFDU is present in the label.

L5.LD.VR.5 - The Tool shall indicate to the user whenever the label template does not contain the appropriate file characteristic elements as specified in section 5.3.2 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

The file characteristic elements include RECORD_TYPE, RECORD_BYTES, FILE_RECORDS and LABEL_RECORDS.

L5.LD.VR.6 - The Tool shall indicate to the user whenever the label template does not contain the appropriate data identification elements as specified in section 5.3.4 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

Data identification elements are specified for each of the following data product types, Spacecraft Science Data Products, Earthbased Science Data Products, and Ancillary Data Products.

3.7 Object Requirements

The requirements in this section pertain to the operations involving Objects used in the label template under construction and are derived from the lower level use cases.

L5.LD.OR.1 - The Tool shall be able to provide the user with the capability to add generic and specific objects into the label template under construction. (UC6.1, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The user will be able to add any object defined in the PSDD.

L5.LD.OR.2 - The Tool shall be able to provide the user with the capability to remove generic and specific objects from the label template under construction. (UC6.7, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.OR.3 - The Tool shall be able to provide the user with the capability to convert specific objects to generic objects, and to convert generic objects to specific objects in the label template under construction. (UC6.1, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

For each type of data object, there are two variants – generic and specific. The tool will support both variants.

L5.LD.OR.4 - The Tool shall be able to provide the user with the capability to specify relative locations of data objects (e.g., ^pointers) used in the label template under construction. (UC6.1, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

Pointers are used to specify relative locations of objects used in the data product label and to reference files external to the label.

L5.LD.OR.5 - The Tool shall be able to provide the user with an indication of which objects, used in the label template under construction, are required and which are optional. (UC6.1, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The tool will “mark” each object as either required or optional.

L5.LD.OR.6 - The Tool shall be able to provide the user with an indication of which objects, used in the label template under construction, have not been defined in the PSDD. (L5.LD.GR.13, L5.LD.GR.14)

The tool will “mark” objects that are not defined in the PSDD. All specific objects created for a label will be defined in a local data dictionary or captured in the working data dictionary. For example, a specific Image object, created from a generic Image object, should be defined in a local data dictionary. Otherwise, it will be added to the working data dictionary.

L5.LD.OR.7 - The Tool shall be able to provide the user with values for the following attributes associated with each object, used in the label template under construction. (UC6.1, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

- a) object type -- GENERIC, SPECIFIC, etc.
- b) object class – OBJECT, etc.
- c) object classification type – SYSTEM, STRUCTURE, etc.

- d) description
- e) sub-objects (list)
- f) keyword names (list)
- g) alias – NONE, etc.
- h) status type – APPROVED, etc.
- i) status note
- j) change date

The attribute values are from the data dictionary.

3.8 Keyword Requirements

The requirements in this section pertain to the operations involving Keywords used in the label template under construction.

L5.LD.KR.1 - The Tool shall be able to provide the user with the capability to add keywords into the label template under construction. (UC6.2, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The user will be able to add any keyword defined in the PSDD, or defined in any local data dictionary, or not defined in either the PSDD or local data dictionary.

L5.LD.KR.2 - The Tool shall be able to present to the user a list of data dictionary keywords in a convenient and useful form. (UC6.2, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

- The keywords should be constrained where appropriate, by object type, dependencies between keywords, and logical groupings defined in the standards reference.
- Within the implicit file object and other objects with many optional keywords, search and other helpful mechanisms will be provided to help the user find and select the appropriate keyword.

L5.LD.KR.3 - The Tool shall be able to provide the user with the capability to remove keywords from the label template under construction. (UC6.8, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.KR.4 - The Tool shall be able to provide the user with an indication of which keywords, used in the label template under construction, have not been defined in a data dictionary. (L5.LD.GR.13, L5.LD.GR.14)

The tool will “mark” keywords that are not defined in the PSDD and not defined in any of the local data dictionaries.

L5.LD.KR.5 - The Tool shall be able to provide the user with an indication of which keywords, used in the label template under construction, are referenced once or more than once in the data dictionaries. (L5.LD.GR.13, L5.LD.GR.14)

L5.LD.KR.6 - The Tool shall be able to provide the user with an indication of which keyword definitions, used in the label template under construction, originate from which data dictionary. (L5.LD.GR.13, L5.LD.GR.14)

As the tool preferentially references element definitions across multiple data dictionaries, this mechanism will provide the link to the source.

L5.LD.KR.7 - The Tool shall be able to provide the user with an indication of which keywords, used in the label template under construction, are required and which are optional, and which are neither required nor optional. (L5.LD.GR.13, L5.LD.GR.14)

The tool will “mark” each keyword as either required or optional, or neither.

L5.LD.KR.8 - The Tool shall be able to provide the user with an indication of the “standard value type” referenced by each keyword, used in the label template under construction. (L5.LD.GR.13, L5.LD.GR.14)

- a) N/A
- b) DEFINITION
- c) DYNAMIC
- d) FORMATION
- e) RANGE
- f) STATIC
- g) SUGGESTED
- h) TEXT

The tool will “mark” each keyword-value as not having standard values, or as having a standard value set of type b thru g. The “standard value type” dictates varying levels of processing appropriate to incorporating additional values into the set of standard values currently defined for the keyword.

L5.LD.KR.9 - The Tool shall be able to provide the user with an indication of which keyword-values, used in the label template under construction, match one of the standard values defined for the keyword, and which keyword-values represent additions to the standard values currently defined for the keyword. (L5.LD.GR.13, L5.LD.GR.14)

The tool will “mark” each keyword-value as matching a standard value or not matching a standard value.

L5.LD.KR.10 - The Tool shall be able to provide the user with the values of the following attributes associated with each keyword, used in the label template under construction. (L5.LD.GR.13, L5.LD.GR.14)

- a) general data type -- REAL, INTEGER, etc.
- b) minimum column value – 0, 1, etc.
- c) maximum column value – 1, 100, etc.
- d) minimum length – 0, 100, etc.
- e) maximum length – 0, 100, etc.
- f) unit id – none, km, etc.
- g) description
- h) standard value description
- i) standard values (list)
- j) general classification – BIBLIO, GEOMETRY, etc.
- k) system classification – COMMON, PDS-ATMOS, etc.
- l) object names – CATALOG, DATA_SET, etc.
- m) formation rule – N/A, etc.
- n) alias – NONE, etc.
- o) status type – APPROVED, etc.
- p) change date

The attribute values are from the data dictionary.

L5.LD.KR.11 - The Tool shall be able to provide the user with the capability to specify a “unit id” as an attribute of an keyword-value, used in the label template under construction. (Working Group Requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The user will be able to associate any unit defined in the PSDD with any keyword-value used in the label. This includes associating units with a set or sequence of keyword-values.

L5.LD.KR.12 - The Tool shall be able to provide the user with the capability to remove a “unit id” as an attribute of an keyword, used in the label template under construction. (Working Group Requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.KR.13 - The Tool shall be able to provide the user with an indication of which “unit id’s”, used in the label template under construction, are identical to or differ from the “unit id” attribute of the keyword defined in the PSDD or any of the local data dictionaries. (Working Group Requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.KR.14 - The Tool shall be able to provide the user with the capability to specify a single value, a sequence of values, or a set of values as attributes of a keyword, used in the label template under construction. (Working Group Requirement, UC6.3, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The user will be able to define one value, or a sequence-array, or a set-array, with any keyword used in the label. A sequence-array is either a one or two dimensioned array of ordered values. A set-array is a one dimensioned array of unordered values. The keywords OBJECT and END_OBJECT are included.

L5.LD.KR.15 - The Tool shall be able to provide the user with the capability to specify a placeholder if a keyword-value is dynamic. (Working Group Requirement, UC6.3, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

An example of a dynamic keyword that will vary across the data product labels is: LATITUDE = nn.n

L5.LD.KR.16 - The Tool shall be able to provide the user with the ability to provide placeholder attributes. (Working Group Requirement, UC6.3, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The attributes describe the dynamics of the values replacing the placeholder across all the data product labels constructed using the label template. An example would be to constrain LATITUDE, from the original range of -90 to +90, to a range more appropriate to the expected measurements of -45 to +45.

3.9 Group Requirements

The requirements in this section pertain to the operations involving Groups used in the label template under construction.

L5.LD.GP.1 - The Tool shall be able to provide the user with the capability to add generic and specific groups into the label template under construction. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The user will be able to add any group defined in the PSDD.

L5.LD.GP.2 - The Tool shall be able to provide the user with the capability to remove generic and specific groups from the label template under construction. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

L5.LD.GP.3 - The Tool shall be able to provide the user with the capability to convert specific groups to generic groups, and to convert generic groups to specific groups, in the label template under construction. (L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

For each type of data object, there are two variants – generic and specific. The tool will support both variants.

L5.LD.GP.4 - The Tool shall be able to provide the user with the values of the following attributes associated with each group, used in the label template under construction. (L5.LD.GR.13, L5.LD.GR.14)

- a) object type -- GENERIC, SPECIFIC, etc.
- b) object class – GROUP, etc.
- c) object classification type – SYSTEM, STRUCTURE, etc.
- d) description
- e) alias – NONE, etc.
- f) status type – APPROVED, etc.
- g) status note
- h) change date

The attribute values are from the data dictionary.

L5.LD.GP.5 - The Tool shall ensure that group statements comply with the restrictions in Section 13.2.1. (L5.LD.GR.13, L5.LD.GR.14)

Group statements have a number of restrictions most of which are not dictated by rules designed into the PSDD.

3.10 Partial Label Requirements

L5.VAL.PR.1 - The Tool shall be capable of designing a PDS label fragment template as it would a PDS label template with the following exceptions. (Working Group Requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

- a) An SFDU label must not be contained in the label fragment.
- b) A PDS_VERSION_ID statement must not be contained in the label fragment.
- c) An END statement must not be contained in the label fragment.

3.11 SFDU Requirements

L5.VAL.UR.1 - The Tool shall recognize the existence of a Standard Formatted Data Unit (SFDU), if encountered in an existing PDS label. (L5.LD.GR.13, L5.LD.GR.14)

The SFDU, if recognized, will be indicated.

L5.VAL.UR.2 - The Tool shall allow the addition and the deletion of a Standard Formatted Data Unit (SFDU) to a label template. (Working Group Requirement, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The SFDU, if present, must be the first line in the label template.

3.12 POINTER Requirements

L5.LD.PR.1 - The Tool shall ensure that the Data Location Pointer statements, used in the label template under construction, adhere to Section 14.1.1 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

Data Location pointers are most commonly used to link object descriptions to the actual data. The syntax is dependent on whether the label is attached or detached from the data being described.

L5.LD.PR.2 - The Tool shall ensure that the Include Pointer statements, used in the label template under construction, adhere to Section 14.1.2 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

Include pointers reference ODL files that are external to the label. The only Include pointer that the tool will support is the ^STRUCTURE pointer.

L5.LD.PR.3 - The Tool shall ensure that the Related Information Pointer statements, used in the label template under construction, adhere to Section 14.1.3 of the *PDS Standards Reference* [2]. (L5.LD.GR.13, L5.LD.GR.14)

Related Information pointers reference documentation files that are external to the label. The only Related Information pointer that the tool will support is the ^DESCRIPTION pointer.

L5.LD.PR.4 - The Tool shall assist the user in designing a label template for either an attached label or a detached label. (UC6.12, L4.LD.1, L4.LD.2, L4.LD.3, L4.LD.4, L4.LD.5, L4.LD.6)

The tool does not support designing combined detached labels.

3.13 Documentation Requirements

Documentation requirements address the documentation needed to support tool interfacing and execution.

L5.LD.PR.1 - The Tool shall have documentation for the use of the tool. (1.5.4)

Ln.LD.PR.2 - The Tool shall have documentation detailing its installation and use. (1.5.4)

APPENDIX A ACRONYMS

Acronyms pertaining to this document:

API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
EN	Engineering Node (PDS)
JPL	Jet Propulsion Laboratory
NASA	National Aeronautics and Space Administration
ODL	Object Description Language
PDS	Planetary Data System
PSDD	Planetary Science Data Dictionary
SFDU	Standard Formatted Data Unit
URL	Uniform Resource Locator
XML	Extensible Markup Language

APPENDIX B DEFINITIONS

- **Data Element** – A term that has been defined for use in PDS data product labels or catalog templates and that has been defined in a PDS data dictionary. Also known in the PDS as a keyword.
- **Data File** – A storage entity containing one or more data objects; for example, an image or an image plus a header.
- **Data Object** – A contiguous sequence of bits, e.g., an image.
- **Data Object Description** – An ODL description of a data object.
- **Data Product** – A data product label and one or more data objects.
- **Data Product Label** – One or more data object descriptions. Also known as a PDS Label.
- **Keyword** – A term that has been defined for use in PDS data product labels or catalog templates and that has been defined in a PDS data dictionary. Also known as a data element.
- **Label Fragment** – A portion of a Data Product Label.
- **Label Template** – An ODL specification that represents a model for a data product label and that can be used for the creation of data product labels either manually or using an automated tool.
- **PDS Node** – Any PDS node including science discipline nodes, support nodes, or data nodes.
- **Project File** – A file in which the design tool saves the state of the user's work so that it can be resumed in a later session. The state includes the locations all data dictionaries in use, exported template labels and specific object definitions, and referenced labels, data objects, and metadata files.
- **Specific Label Object Definition** – A PSDD definition template to be used for label validation that defines a product label as a specific object with no optional sub-objects or keywords allowed.
- **Working Data Dictionary (WDD)** - A data dictionary with the same structure as a local data dictionary that is created and managed by the design tool for the purpose of collecting objects, keywords, and keyword values that are not present in either the PSDD or a local data dictionary.

APPENDIX C LEVEL 3 REQUIREMENTS

The following PDS level three requirements relate to PDS data product label design and are referenced above.

1.2.1 PDS will provide examples and suggestions on organization of data products, metadata, documentation and software

1.2.2 PDS will provide expertise in applying PDS standards

1.2.3 PDS will provide expertise to support the design of scientifically useful archival data sets

1.5.1 PDS will provide tools to assist data producers in generating PDS compliant products

1.5.2 PDS will provide tools to assist data producers in validating products against PDS standards

1.5.3 PDS will provide tools to assist data producers in submitting products to the PDS archive

2.10.2 PDS will follow best practices in system and software engineering for the development and operations of the PDS.

3.3.7 PDS will solicit input from the user community on services desired