

**Dawn Mission to Vesta and Ceres
Level 5
SPC Shape Models of Vesta and Ceres
Archive Volume Software Interface Specification**

Version 2.2
October 19, 2018

CHANGE LOG

DATE	CHANGES	REASON	REVISION
02/26/2016	Original		1.0
04/14/2016	Clarifications in data sources, data set identifiers, volume identifiers	Updated from initial comments from DSC/PDS	1.1
03/23/2018	Remove DSK	DSKs will be archived by NAIF	2.0
04/25/2018	Added ancillary folder	Update for volume creation	2.1
10/19/2018	Renamed ancillary folder to geometry folder; various grammatical fixes	Update from peer review	2.2

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ACRONYMS AND ABBREVIATIONS

ASCII	American Standard Code for Information Interchange
CK	C-Kernel (Attitude orientation kernel)
DOY	Day of Year
DSC	Dawn Science Center
DSK	Digital Shape Kernel
DTM	Digital Terrain Map
FK	Frame Kernel
ICQ	Implicitly Connected Quadrilateral
JPL	Jet Propulsion Laboratory
LSK	Leap Seconds Kernel
NAIF	Navigation Ancillary Information Facility
NASA	National Aeronautics and Space Administration
PDS	Planetary Data System
SIS	Software Interface Specification
SPC	Stereo-photoclinometry
SPK	Spacecraft and Planetary (Ephemeris) Kernel

1. INTRODUCTION

1.1. Purpose and Scope

This Software Interface Specification (SIS) describes the format and content of the Dawn Mission to Vesta and Ceres (Dawn) shape model archive delivered by the Dawn Gravity Science Team. The Dawn SPC Ceres shape model dataset represents the archive of the Ceres shape model derived from the Framing Camera (FC) instrument onboard the Dawn spacecraft. The Dawn SPC Vesta shape model dataset represents the archive of the Vesta shape model. The archives are generated by the Dawn Gravity Science Team and the Dawn Science Center (DSC). It is maintained and distributed by the Planetary Data System (PDS).

1.2. Content Overview

This archive contains data products derived from images taken by the Dawn spacecraft acquired while the spacecraft was conducting science observations around the respective target. This SIS describes the format and content of the Dawn shape model archives delivered by the Gravity Science Team. The data are assembled into archives by the Gravity Science Team and delivered to the Dawn Science Center (DSC). The DSC delivers the completed archives to PDS. The table below highlights the details of each archive.

Target	Data Set ID	Volume ID
Vesta	DAWN-A-FC2-5-VESTASHAPESPC-V1.0	DWNVSPC_4_01
Ceres	DAWN-A-FC2-5-CERESSHAPESPC-V1.0	DWNCSPC_4_01

The “01” portion of the Volume ID will be incremented with the release of any future volumes containing new versions of the shape model.

The specific data products included in these archives are:

- **Implicitly Connected Quadrilateral (ICQ) files:** ASCII-formatted shape model

2. REDUCED DATA RECORD ARCHIVE OVERVIEW

2.1. Instrument Overview

The Framing Camera (FC) is a multispectral CCD imager in a refracting telescope that also serves as optical navigation camera for the NASA Dawn mission to the asteroids 4 Vesta and 1 Ceres. The camera consists of two identical units, FC1 and FC2, which are mounted side-by-side on the +Z deck of the spacecraft.

For the full description of the Framing Camera instrument, please refer to the *fc2_instrument.cat* and DATASET.CAT files in the CATALOG directory.

2.2. Data Product Overview

The derived data are stored in the DATA folder in one subdirectories. The ICQ files are ASCII files with detached PDS labels describing the format. The table below describes the data products contained in these directories.

File	Abbrev.	File Type	Source of Files
Implicitly Connected Quadrilateral	ICQ	ASCII	Dawn Science Team

2.2.1. Detailed Descriptions

Implicitly Connected Quadrilateral files

The models were originally prepared in the Implicitly Connected Quadrilateral (ICQ) format, and files are provided in the DATA/ICQ directory. The filenames are of the form TTTTT_XXXYYMMDD_XXXX.ICQ, where 'TTTTT' is the applicable body (VESTA or CERES), 'xxx' is the origin of the shape model (nominally SPC, for Stereo-photoclinometry), 'yy' is the creation year, 'mm' is the creation month, 'dd' is the creation day, and 'xxxx' is the resolution of the model. A text file, 'ICQMODEL.ASC', is provided in the DOCUMENT directory describes the ICQ format.

2.3. Data Processing

Data processing is performed by the Dawn Gravity Science Team at the Jet Propulsion Laboratory in Pasadena, CA. The images are processed using a technique called Stereo-photoclinometry to produce a shape model of the target body.

2.4. Software

No software is included in this archive. The SPICE toolkit provides useful tools and algorithms for ancillary data processing that could help in the use of these products of and is located at the NAIF PDS node naif.jpl.nasa.gov.

2.5. File Naming Conventions

See Section 2.2.1 for file naming conventions in the description of each file type.

2.6. Data Product Labels

Every file in this archive is accompanied by a PDS label. The label is either attached (embedded in the file) or detached (separate file with same name except for extension '.LBL'). Depending on the file type, the detached label may provide the content and structure of the file. Labels are structured in the PDS *KEYWORD=VALUE* fashion. A description of the keywords may be found on the web at http://pds.nasa.gov/tools/ddlookup/data_dictionary_lookup.cfm.

2.7. Standard Keyword Values

The Dawn SPC Shape Model Data Archive uses the following standard keywords and values, consistent across the archive:

Keyword	Dawn Standard Values
DATA_SET_ID	DAWN-A-FC2-5-VESTASHAPESPC-V1.0 DAWN-A-FC2-5-CERESSHAPESPC-V1.0
DATA_SET_NAME	VESTA SPC SHAPE MODEL V1.0 CERES SPC SHAPE MODEL V1.0
INSTRUMENT_HOST_ID	DAWN
INSTRUMENT_HOST_NAME	DAWN
INSTRUMENT_ID	FC2
INSTRUMENT_NAME	FRAMING CAMERA 2
INSTRUMENT_TYPE	FRAME CCD REFRACTING TELESCOPE
MISSION_NAME	DAWN MISSION TO VESTA AND CERES
TARGET_NAME	1 CERES, 4 VESTA
VOLUME_ID	DWNVSPC_4_01 DWNCSPC_4_01
VOLUME_SERIES_NAME	DAWN
VOLUME_SET_ID	USA_NASA_PDS_DWNVSPC_4_01 USA_NASA_PDS_DWNCSPC_4_01
VOLUME_SET_NAME	DAWN SPC VESTA SHAPE MODEL DAWN SPC CERES SHAPE MODEL
VOLUME_VERSION_ID	VERSION 1

3. ARCHIVE ORGANIZATION

The Dawn SPC Shape Model Archives have the following directories:

- ❖ Root directory
 - CATALOG
 - DOCUMENT
 - DATA
 - ICQ
 - GEOMETRY
 - INDEX

The contents of the directories are described below.

3.1. Root Directory

This directory is the core directory on which the rest of the archive is built. It contains the following files:

1. AAREADME.TXT: Human readable description of the archive contents
2. ERRATA.TXT: Human readable list of corrections and other comments regarding the archive
3. VOLDESC.CAT: Description of the contents of the volume

3.2. GEOMETRY Directory

This directory contains recommended SPICE data kernel set for use with the ICQ files. The GEOMINFO.TXT in the GEOMETRY folder contains details on the contents of the GEOMETRY directory.

3.3. CATALOG Directory

This directory contains descriptions of the dataset, mission, instrument, and spacecraft. They are all ASCII stream files. It contains the following files:

1. CATINFO.TXT: Description of the directory
2. DATASET.CAT: Overview of the RDA
3. fc2_instrument.cat: Overview of the Framing Camera Instrument
4. dawninsthost.cat: Overview of the Dawn spacecraft
5. dawnmission.cat: Overview of the Dawn Mission to Vesta and Ceres
6. REF.CAT: References for the archive

3.4. DOCUMENT Directory

This directory contains the corresponding documentation to help the end user use and interpret the data included in this archive. The following documents are included:

Filename	Format	Description
DOCINFO.TXT	text	Description of the directory
DAWN_SPC_SHAPE_MODEL_SIS	HTML, PDF	This document
ICQMODEL	text	Description of the ICQ shape model format
SPICE_OMNIBUS_MM_SIS	HTML, PDF	Description of the SPICE system and where to get more information

3.5. INDEX Directory

This directory contains the following files:

1. INDEXINFO.TXT: Description of the directory
2. INDEX.LBL: Detached label describing INDEX.TAB
3. INDEX.TAB: Table listing all data products in the RDR archive

3.6. DATA Directory

The DATA directory contains the primary data. It contains the following subdirectories and file types:

Directory	File Type	Contents
ICQ	Implicitly Connected Quadrilateral file	Shape models in the ASCII ICQ-formatted file

4. NOTE ON DIGITAL SHAPE KERNELS (DSK)

Digital Shape Kernels (DSK) are a SPICE-compatible format of a shape model. The shape models included in this archive are also available in the DSK format on the Navigation and Ancillary Information Facility (NAIF) website. Section 5.1 details the location of the NAIF node for the Dawn mission to Vesta and Ceres.

5. RELEVANT DATA ARCHIVED AT OTHER SITES

5.1. NAIF Node

The Navigation and Ancillary Information Facility (NAIF) is the navigation node of the PDS. NAIF provides the archives for spacecraft navigation, attitude, events, clock conversion, and planetary ephemerides for most NASA missions. Additionally, NAIF provides the SPICE toolkit, containing useful algorithms to utilize and manipulate data NAIF provide.

The NAIF PDS archive for Dawn is located at:

- naif.jpl.nasa.gov/pub/naif/pds/data/dawn-m_a-spice-6-v1.0/

6. PERSONNEL

- Ryan S. Park, Chair of the Dawn Gravity Working Group, NASA Jet Propulsion Lab
- Dustin R. Buccino, NASA Jet Propulsion Lab