Wide-field Infrared Survey Explorer (WISE)
Science Data Center

Level 4 C&DH Science Data Ingest Processor Software Requirements Document (SRD)

Draft
January 19, 2007

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CHANGE LOG

Revision	Date	Description	Author
Draft	1/12/07	Initial Draft	J. LaPointe
Draft	1/18/07	Made several modifications based on initial feedback from IPAC. Added verification methods. Updated acronym list.	J. LaPointe
Draft	1/19/07	Updated Identification, Scope, and Program Set Description to make mention of EOS responsibility to procure the SDIP hardware. Removed a few unnecessary requirements per IPAC's comments.	J. LaPointe

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1.0   INTRODUCTION

1.1   Identification

This document specifies the key requirements of the C&DH Science Data Ingest Processor that is a part of the WISE Science Data Center (WSDC) and Engineering Operations systems (EOS). The C&DH Science Data Ingest Processor will be used in conjunction with other Ground Support Equipment (GSE) at Southwest Reasearch Institute (SwRI) in early 2007 for testing science data flow through the Mission Unique Board (MUB).

All software requirements in this document are allocated to the WSDC. All hardware requirements are allocated to the EOS.

1.2   Document Scope

This document provides an official record of the Level 4 Requirements of the WISE C&DH Science Data Ingest Processor. It is meant to be used by the WSDC and EOS team as a basis for implementation. It is also meant to be used by WISE systems engineering and management for informational purposes.

1.3   Notation

Requirement elements that have not been fully resolved are noted as follows:

> TBW – To Be Written
> TBR – To Be Resolved
> TBD – To Be Determined

1.4   Controlling Documents

JPL D-23713, JPL Software Development Requirements, Rev. 4, September, 2003.

JPL D-32335, WISE Project Software Management Plan, July 13, 2005.

JPL D-nnnnn, WISE MOS Management and Implementation Plan, Rev 1.1, August 19, 2005.

JPL D-36551, WISE L2.5 C&DH Science Data Ingest Processor Requirements, December 22, 2006.

1.5   **Applicable Documents**

WISE MOS/GDS Interface Control Document, JPL D-34372 .

WISE Science Data Center Work Implementation Plan.

WISE CCSDS Interface Control Document, Ball drawing number 2216143.

1.6   **Document Maintenance**

This document should be updated periodically to reflect the latest requirement changes and additional capabilities.

2.0   PROGRAM SET DESCRIPTION

The WISE C&DH Science Data Ingest Processor software is developed and maintained by the Infrared Processing and Analysis Center (IPAC). The hardware on which the software is run is procured by Jet Propulsion Laboratory (JPL). This program set is responsible for ingesting packetized science data output by the WISE C&DH High Rate Data Processor (HRDP), assembling the compressed or uncompressed data, decompressing as necessary, and outputting the resulting images.

Images can be output in both compressed and decompressed form. Decompressed images are output in either raw binary or FITS format. The C&DH SDIP is also responsible for comparing decompressed images against known input images; that is, images that were originally ingested by the C&DH Payload Simulator and passed to the MUB.

The C&DH SDIP software is run at SwRI by members of the C&DH team. The C&DH HRDP sends packetized science data needed as input for the C&DH SDIP via Secure File Transfer Protocol (SFTP). SDIP output is used at SwRI for verification and analysis of MUB performance and functionality.

3.0   INTERFACE REQUIREMENTS

3.1   External Interface Requirements

The WISE C&DH SDIP hardware shall provide a Gigabit Ethernet interface to the WISE C&DH HRDP as defined in the MOS/GDS Interface Control Document, JPL D-34372.

The WISE C&DH SDIP shall accept packetized high rate image data from the C&DH HRDP via the secure file transfer protocol (SFTP).

The WISE C&DH SDIP shall store the high rate image data sent by the C&DH HRDP locally.

3.2 Internal Interface Requirements

The WISE C&DH SDIP shall provided an interface to the USDS software simulation routines provided by the WISE Project Software System Engineer.

4.0 PROGRAM SET FUNCTIONAL REQUIREMENTS

4.1 Inputs

The WISE C&DH SDIP software shall accept as input a parameter that indicates whether decompression of the science data should be bypassed.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input a parameter that indicates whether decompressed images should be output in FITS or raw format.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input a value allowing the operator to specify the form of the name and the location of generated output files.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input a parameter that controls the level of verbosity in the output status and error messages.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input a value that specifies a unique ID for the run.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input a parameter that allows the operator to view the contents of either the first CCSDS header of an image frame, or all CCSDS headers in the image frame.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input a value that may be used to override the band number read from the CCSDS source packets.

Verification Method: Test
Comment: This value is necessary for processing raw, unpacketized image arrays. It may also be used as a debugging aid.
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The WISE C&DH SDIP software shall accept as input a parameter that indicates whether the input data is packetized.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input the name of a file containing md5 sums and the names of associated truth files. These are used for comparing decompressed images with known images.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input the following Rice algorithm parameters:
- Bits per pixel
- Pixels per block
- Blocks per reference
- References per packet

Verification Method: Test

The WISE C&DH SDIP software shall accept as input a value that indicates the maximum number errors to tolerate before forcing program termination.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input the directory where input files are located.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input the names of one or more files containing packetized science data output from the WISE C&DH HRPD as defined in section [TBR] of the WISE MOS/GDS Interface Control Document, JPL D-34372.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input one or more files, each containing a single compressed image as output by the USES software simulation program.
Verification Method: Test

The WISE C&DH SDIP software shall accept as input one or more files, each containing a single uncompressed image in raw format (16 bpp, big endian, sized at either 1024 x 1024 or 512 x 512).
Verification Method: Test

The WISE C&DH SDIP software shall accept all configuration parameters and input files as command line arguments.
Verification Method: Test

The WISE C&DH SDIP software shall optionally accept as input a single configuration file containing all configuration parameters and input files.
Verification Method: Test

4.2 Functional

The WISE C&DH SDIP software shall be capable of extracting CCSDS source packets from files that were output by the C&DH HRDP.
Verification Method: Test

The WISE C&DH SDIP software shall be capable of extracting information from the primary and secondary headers of the CCSDS source packets.
Verification Method: Test

The WISE C&DH SDIP software shall utilize the Source Packet ID (bits 88 – 95) in the CCSDS source packet headers to determine which band the image data originated from.
Verification Method: Test

The WISE C&DH SDIP software shall utilize the Grouping Flags (bits 16 - 17) in the CCSDS source packet headers to determine whether the image data contained therein is the top, middle, or end of an image.
Verification Method: Test

The WISE C&DH SDIP software shall assemble image data extracted from the Source Data section (bits 112 - 8919) of the CCSDS source packets in the order of the Source Sequence Count (bits 18 - 31) located in the CCSDS source packet headers.
Verification Method: Test

The WISE C&DH SDIP software shall utilize the Destination Application ID (bits 96 - 111) in the CCSDS source packet headers to determine how much of the data in the packet should be extracted and used for assembly.
Verification Method: Test

The WISE C&DH SDIP software shall utilize the Source Packet ID (bits 88 – 95) in the CCSDS source packet headers to determine whether the image data contained therein is compressed or decompressed.
Verification Method: Test

The WISE C&DH SDIP software shall decompress image data after it has been assembled unless any of the following is true:

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- The operator requested that decompression be bypassed.
- The assembled image data was contained in CCSDS source packets with application IDs indicative of uncompressed data.

Verification Method: Test

The WISE C&DH SDIP software shall compute the md5 sum for each decompressed image and compare it with values in the input truth table to locate a match.
Verification Method: Test

4.3   Outputs

The WISE C&DH SDIP software shall utilize a file naming convention that ensures each output file name is unique.
Verification Method: Test, Inspection

The WISE C&DH SDIP software shall include the following information in the names of output files containing image data:
- The associated input file
- The band number
- The CCSDS packet time
- The CCSDS packet ID
- Date and time of the run in GMT
- A unique ID for the run
- The frame number
- The sequence number

Verification Method: Test, Inspection

The WISE C&DH SDIP software shall output images in FITS format when the following conditions hold true:
- The operator did not request decompression be bypassed
- The operator requested output in FITS format

Verification Method: Test, Inpection

FITS files output by the WISE C&DH SDIP software shall contain a single HDU containing, at a minimum, the following information:
- SIMPLE (Indicates whether file conforms to FITS standard =T)
- BITPIX (# of bits per pixel = 16)
- NAXIS (# dimensions of image = 2)
- NAXIS1 (image width)
- NAXIS2 (image height)
- EXTEND (Indicates whether this file may contain extensions)
- BAND (band # from which the image originated = 1,2,3,4)
- DATIME (Date/Time stamp when file was created in GMT)

- PKTIME (Packet time of the image frame)
- VTC (Vehicle Time Code corresponding to the time on board the s/c when the image was received by the MUB)
- INFILE (full path and name of input file from which image was extracted)
- INBYTES (size of input file in bytes)

Verification Method: Test, Inspection

The WISE C&DH SDIP software shall output images in raw format when the following conditions hold true:
- The operator requested output in raw format
- The operator requested that decompression be bypassed

Verification Method: Test, Inspection

The WISE C&DH SDIP software shall output all uncompressed image data in big-endian format (i.e., MSB first, LSB second).
Verification Method: Test, Inspection

The WISE C&DH SDIP software shall output status and error messages to one or more of the following destinations:
- Standard output
- Standard error
- Log file

Verification Method: Test, Inspection

The WISE C&DH SDIP software shall output a message indicating whether each decompressed image matched a known image, and if so, the name of the image file it matched.
Verification Method: Test, Inspection

5.0   PERFORMANCE REQUIREMENTS

The WISE C&DH SDIP software shall be capable of ingesting packetized input files output by the C&DH HRDP that contain 30 minutes worth of data per band in a single instantiation of the executable.
Verification Method: Test (or Analysis)

5.1   Computer Resource Requirements

The WISE C&DH SDIP hardware shall provide greater than 90GB [TBR] of disk space for storing input and output data.
Verification Method: Inspection

5.2   Safety Requirements

N/A

5.3　Security and Privacy Requirements

The WISE C&DH SDIP software shall run on a computer that meets JPL IT and WSDC Security requirements.
Verification Method: Inspection

Pushing and pulling of input and output ancillary files from external data stores shall be performed utilizing a secure file transfer protocol.
Verification Method: Test, Inspection

6.0　QUALITY REQUIREMENTS

The WISE C&DH SDIP software shall include comments in the code to aid in future software maintenance.
Verification Method: Inspection

The WISE C&DH SDIP software shall be implemented such that potential errors are trapped and handled gracefully.
Verification Method: Test

7.0　DELIVERY, INSTALLATION, AND ENVIRONMENTAL REQUIREMENTS

The WISE C&DH SDIP software shall be configuration controlled using a software configuration management tool.
Verification Method: Inspection

For every external build, a copy of the WISE C&DH SDIP software shall be delivered and installed on a computer owned by JPL.
Verification Method: Inspection

Versions of the WISE C&DH SDIP software delivered externally and used operationally shall be extracted directly from the software configuration management tool.
Verification Method: Inspection

7.1　Computer Hardware Requirements

The computer on which the WISE C&DH SDIP software will run shall provide two Gigabit Ethernet ports for intranet/internet connectivity.

Verification Method: Inspection

The computer on which the WISE C&DH SDIP software will run shall provide at least two USB 2.0 ports.
Verification Method: Inspection

7.2   Computer Software Requirements

The computer on which the WISE C&DH SDIP software will run shall provide a Secure FTP server.
Verification Method: Inspection

The computer on which the C&DH SDIP software will run shall provide a Secure FTP client.
Verification Method: Inspection

8.0   DESIGN AND IMPLEMENTATION CONSTRAINTS

N/A

APPENDIX A   ACRONYMS

C&DH	Command and Data Handling
CCSDS	Consultative Committee for Space Data Systems
FITS	Flexible Image Transport System
FTP	File Transfer Protocol
GB	Giga Byte
GDS	Ground Data System
GMT	Greenwich Mean Time
GSE	Ground Support Equipment
HDU	Header Data Unit
HRDP	High Rate Data Processor
IT	Information Technology
JPL	Jet Propulsion Laboratory
LSB	Least Significant Byte
MOS	Mission Operations System
MSB	Most Significant Byte
MUB	Mission Unique Board
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
SDIP	Science Data Ingest Processor
SFTP	Secure File Transport System
SRD	Software Requirements Document
SwRI	Southweset Research Institute

TBD	To Be Determined
TBR	To Be Resolved
TBW	To Be Written
USDS	Universal Source Decoder for Space
USES	Universal Source Encoder for Space
VTC	Vehicle Time Code
WISE	Wide-field Infrared Survey Explorer
WSDC	WISE Science Data Center

APPENDIX B   TRACEABILITY

TBD.