PDS4 IRAS Bundle Overview

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1. Introduction

IRAS was launched on January 26, 1983 on a Delta rocket from Vandenburg Air Force Base in California at 02h 17m Greenwich Mean Time. The project was initiated in 1975 as a joint program of the United States, the Netherlands, and the United Kingdom. The satellite consisted of two main parts, the spacecraft and the telescope system. The primary mission of IRAS was to conduct a sensitive and unbiased survey of the sky in four wavelength bands centered at 12, 25, 60, and 100 microns.

2. Archive Contents and History

The IRAS FPA instrument data have been archived in PDS in the PDS3 archiving standard.

Table 1. PDS3 IRAS FPA data sets included in this bundle

Data Description	PDS3 Data Set ID	Date archived	PDS node
IRAS 9P Images	DI/IRAS-C-FPA-5-9P-IMAGES-V1.0	2003-10-30	SBN
IRAS 9P Photometry	DI/IRAS-C-FPA-5-9P-PHOT-V1.0	2003-10-30	SBN
IRAS Data IMPS	IRAS_A_FPA_3_RDR_IMPS_V6_0/	2004-05-20	SBN
IRAS Data Zodiacal	IRAS-D-FPA-3-RDR-ZOHF-LOW-RES-V1.0 & IRAS-D-FPA-3-RDR-ZOHF-LOW-RES-V1.0	1994-07-22	SBN
IRAS Satellite Status	IRAS_6_SDR_SATELLITE_STATUS_V1_1	1997-03-24	SBN
IRAS Instrument	IRAS_FPA_6_RDR_INSTRUMENT_INFO_V1_1	1997-03-24	SBN

During 2021-2022, the PDS3 IRAS FPA holdings were migrated to the PDS4 archiving standard by the Small Bodies Node, using the On-Line Archiving Facility (OLAF). The data files are unchanged. This bundle contains the IRAS 9P Images data, the IRAS 9P Photometry data, the IRAS Minor Planet Survey (IMPS) data , the IRAS Data Zodiacal data, the IRAS Satellite status data, and the IRAS Instrument dataset which were all separate PDS3 data sets.

Document and metadata changes made during the migration of the data sets include:

- No primary data files were modified.
- Metadata in the PDS3 labels were migrated to PDS4 labels.
- A new IRAS mission dictionary was created to support previous PDS3 keywords
- The “NATIVE_START_TIME” and “NATIVE_STOP_TIME” were converted to PDS4 UTC compliant time

- All previous PDS3 bundles were combined to create one IRAS bundle
- The miscellaneous collection was created to house *filter_response, satellite_scan* and *fpa_instrument_states* subdirectories
- All documentation was moved to a new document collection
- A new bundle overview document (the one you are currently reading) was created
- Previous data documentation was restructured to create a more human readable format

3. IRAS Bundle Contents

The IRAS bundle contains four data collections, a miscellaneous collection, and a document collection:

The **data_zodiacal** collection contains the low- and medium-resolution IRAS zodiacal history data, in original binary and converted ASCII (see section 4).

The **data_9P_photometry** collection contains 12-, 25-, 60-, and 100-micron photometry of the dust coma of comet 9P/Tempel 1 during its 1983 apparition. This data collection is organized into 2 subdirectories the Additional/Pointed Observations Additional/Pointed Observations (ao) data and the Sky Survey Atlas (ISSA) scans survey data. (See section 5).

The **data_9P_images** collection contains the images of comet 9P/Tempel, from its 1983 apparition, as derived from 12-, 25-, 60-, and 100-micron observations data. The data collection is organized into two subdirectories. The additional observations (ao) subdirectory contains the Radiance images, noise maps, and effective resolution tables derived from reprocessed IRAS Additional/Pointed Observations and the Radiance images and noise maps derived from reprocessed IRAS Sky Survey Atlas scans. The survey subdirectory contains the JPEG-rendered images of the dust trail based on data in the ISSA Reject Set (See section 6).

The **data_simps** collection contains the additional and revised diameters and albedos for asteroids detected by the 1983 IRAS mission (See section 7).

The **miscellaneous** collection contains three subdirectories. The satellite_scan_info subdirectory contains the Spacecraft position vectors and individual scan parameters for the IRAS mission. The fpa_instrument_states subdirectory contains the Filter curves and detector parameters for the IRAS Focal Plane Array (FPA). The filter_response subdirectory contains the tables (See section 8).

The **document** collection contains the bundle over view description (the document you are reading now), the mission description document, the spacecraft description document, the instrument description document, the zodiacal history description, the reference list, the personnel list, the miscellaneous collection description, the imps collection description, the 9P images collection description, the 9P photometry collections description, and two IRAS data publications. The documents are organized into subdirectories by data collection for documents that pertain only to that data collection.

4. The Zodiacal Data Collection

The zodiacal data collection contains four sub directories:

The **low_resolution** subdirectory contains the IRAS Low Resolution tables.

The **medium_resolution** consists of two sub directories (medium_resolution_ir0002 and medium_resolutin_ir0003). Both subdirectories contain the medium resolution tables.

The **binary_versions** subdirectory which contains the original data stream output (in binary form) of the Infrared Astronomical Satellite (IRAS) as organized in the Medium and Low Resolution Zodiacal History Files.

All data was generated by the Infrared Processing and Analysis Center (IPAC) at the California Institute of Technology. They were organized along with the supporting calibration and index files by the Dust Subnode of the Small Bodies Discipline Node of the NASA Planetary Data System for distribution to the general community.

5. The 9P Photometry Data Collection

The 9P Photometry Data collection contains two subdirectories.

The **ao** subdirectory contains the ASCII tables containing aperture photometry derived from reconstructed AO data.

The **surveys** subdirectory contains ASCII tables containing aperture photometry derived from reconstructed ISSA data.

The photometry was derived from reconstructed observations acquired by the Focal Plane Array (FPA) instrument on the Infrared Astronomical Satellite (IRAS). The types of observations were Sky Survey Atlas (ISSA) scans and Additional/Pointed Observations (AO). A comprehensive discussion of these data was provided by Carey Lisse and included in the document collection.

6. The 9P Images Data Collection

The 9P Images Data collection contains two subdirectories:

The **ao** subdirectory is contains two directories. The *effres* directory contains the effective resolution (beamsize) tables for AO images. For these data, IRAS was aimed at Tempel 1 and images were acquired at microns 12, 25, 60, and 100 microns by the FPA. Russell Walker combined the images by satellite operations plan number, reprocessed the data, and produced adiance and noise maps in FITS format and effective beam resolutions in ASCII table format. An extensive discussion of these data, provided by Walker, is included in the documentation directory on this volume.

The *images* directory contains the Radiance and noise images from IRAS AO data. Walker identified ISSA scans that contained Tempel 1, then combined the scans by satellite operations plan number, reprocessed the data, and produced radiance and noise maps in FITS format. An extensive discussion of these data is included in the documentation directory on this volume

The **survey** subdirectory contains the Radiance and noise images from ISSA data. Fifty-six (56) images in the ISSA showed the dust trail of Tempel 1. These unprocessed images were

converted from FITS to JPEG and included in this data set as documentation for future reference. A discussion of these images is included in the document collection.

7. The IMPS Data Collection

The IRAS Minor Planet Survey (IMPS) as archived in PDS was updated six times with improved and additional data. The final version was given the name Supplemental IRAS Minor Planet Survey (SIMPS).

Using orbital elements for 26,791 numbered asteroids, SIMPS found 2228 different multiply-observed asteroids associated with IRAS sources, an increase of 432 (24%) over IMPS. Diameters and albedos were re-derived.

The data set includes the following files, listed by their SIMPS product numbers and by their filenames

Product #	Filename	Contents
FP202	diamalb	The SIMPS albedos and diameters catalog provides averaged results for the 2228 numbered asteroids with at least two accepted observations.
FP203	single	The SIMPS singleton catalog provides albedos and diameters for 242 numbered asteroids that have only a single accepted sighting in a single band.
FP204	reject	The SIMPS Rejected Sightings File is a summary of the number of rejected sightings for each asteroid and possible reasons for rejection. There is an entry for each asteroid for which at least one sighting was rejected, collated by asteroid in ascending numerical order.
FP205	missed	The SIMPS Missed Predictions file is a summary of the always-missed asteroids, i.e., those asteroids which were predicted to have crossed the IRAS focal plane array but which were never detected. The entries are collated by predicted asteroid in ascending numerical order.
FP206	Eleml1,2, 3	Three orbital element files at epochs separated by 100 days used in the SIMPS data processing
FP207	addl	This table contains additional data in support of the Supplemental IRAS Minor Planet Survey, including the input values of absolute magnitude, slope, albedo, and diameter used in calculating the results.

Product #	Filename	Contents
FP208	sightings	The SIGHTINGS.TAB file corresponds to the Supplemental IRAS Minor Planet Survey Final Product 208, the SIMPS Sightings file. It contains a listing of 9244 sightings associated with asteroids. SIGHTINGS.TAB contains the observation index, the identification of asteroids sighted, information pertaining to observation times, positional information on the observations of asteroids detected, geometric albedos, diameters, and their associated uncertainties, input values used in the calculations of the geometric albedos and diameters using the asteroid standard thermal model, the observed flux densities in each band, detector crossing information, correlation coefficients, and status flags for reduction steps.

8. The Miscellaneous Data Collection

The miscellaneous data collection contains three subdirectories

The **filter_response** subdirectory contains four tables which describe the detailed optical system transmission, detector spectral response, and overall relative spectral response for each of the 4 IRAS passbands. These bands are centered on 12, 25, 60, and 100 microns.

The **satellite_scan** subdirectory contains two tables which describe the Spacecraft position vectors and individual scan parameters for the IRAS mission.

The **fpa_instrument_states** subdirectory contains the filter curves and detector parameters for the IRAS Focal Plane Array (FPA).

9. The Document Collection

The document collection contains four subdirectories which are organized by data collection. The documents in the main document directory pertain to all the data collections and overall mission.

Main Directory

The **IRAS_bundle_overview.pdf** (The document you are reading now) describes the contents of the IRAS bundle.

The **mission_description.pdf** describes the IRAS mission

The **IRAS_instrument_description.txt** describes the instrument used in the IRAS mission.

The **IRAS_spacecraft_description.txt** describes the IRAS spacecraft

The **reference_list.pdf** contains the reference list for the IRAS data sets

IRAS_Mission_Neugebaueretal1984.pdf The IRAS Explanatory Supplement (Beichman et al. 1988).

IRAS_Explanatory_Supplement_Catalogs_Atlases.pdf is the catalogs and atlases explanatory supplement document. [BEICHMANETAL1988]

9p_data_documents

9p_images_collection_description.pdf contains information for all the data in the 9P Images data collection

IRAS_9P_Archive_ICD.pdf This is the Interface Control Document (ICD) for the IRAS Data of Comet 9P/Tempel 1 which describes the 9P Images data collection and was written by Applied Coherent Technology Corporation

9p_dust_images_supplement.pdf describes the IRAS Sky Survey Atlas (ISSA) images the show the dust trail of comet 9P/Tempel 1. This document is contained in the Dust_Images_Supplement directory which also contains all the images that accompany this paper.

9p_additional_observations_supplement.pdf describes the processes used to generate radiance and noise maps from IRAS additional observations of comet 9P/Tempel 1.

9p_survey_images_supplement.pdf describes the processes used to generate radiance and noise maps from IRAS survey scans that contain comet 9P/Tempel 1.

9P_photometry_collection_description.pdf contains information for all the data in the 9P Photometry data collection

9p_images_photometry_supplement.xml The document describes the process used to generate photometry from reprocessed IRAS Additional Observations and Survey Scan images of comet 9P/Tempel 1.

simps_documents

simps_collection_description.pdf contains information for all the data in the SIMPS data collection.

zodiacal_documents

The **zodiacal_collection_description.pdf** contains all the information for the zodiacal data collection.

miscellaneous_documents

Miscellaneous_collection_description.pdf contains information for all the data in the miscellaneous data collection.

10. References

Infrared Astronomical Satellite Catalog and Atlases, Volume 1, Explanatory Supplement, C.A. Beichman, G. Neugebauer, H.J. Habing, P.E. Clegg, and T.J Chester, NASA RP-1190, 1988.

Tedesco, E.F., P.V. Noah, M. Noah, and S.D. Price 2002. The Supplemental IRAS Minor Planet Survey. Astronomical Journal 123, 1056-1085.