AIM Mission Archive Plan

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1 . Introduction

In order to achieve the goals of the AIM mission, data collected, generated, and analysed as part of the AIM program must be shared among AIM investigators, the scientific community and the general public. This document describes existing and forthcoming AIM data products, documentation, and analysis tools, and the plan to serve these to the public for the duration of the mission and beyond. The AIM Science Data System (SDS) is a distributed system which will provide the mechanism through which the data collection, processing, validation, archiving and sharing will take place during the mission lifetime. The designated long-term archive for the AIM mission is the National Space Sciences Data Center (NSSDC). The AIM Project Data Center, a part of the AIM SDS, is responsible for preparing and delivering the final version of the AIM data products to the NSSDC.

2. Data Services

Throughout the life of the AIM mission, the data products and supporting documentation will be served via the AIM SDS. The operation of the AIM SDS is described in detail in the AIM Data Management Plan (AIM-DMP), however it will be briefly summarized here as part of the description of its role as the source for the final archive which will be delivered to the NSSDC. The AIM SDS will coordinate with the Virtual Ionosphere Thermosphere and Mesosphere Observatory (VITMO) to provide metadata that will enable VITMO users to easily access the AIM data products.

2.A. The AIM Science Data System

The AIM SDS is responsible for the acquisition, generation, distribution, and archiving of science data necessary to support the AIM mission. In this capacity, the SDS provides useful data products to the AIM program elements, the scientific community, K-14 educators and the general public.

The SDS is a distributed system consisting of individual Data Processing Centers (DPC) for each instrument, and the Project Data Center(PDC). The DPC for CIPS and CDE are located at LASP and the DPC for SOFIE is run by GATS, Inc. The AIM PDC is located at Hampton University.

Each instrument DPC is responsible for:
- Producing, managing, and archiving the level 1-4 products for their instrument.
- Producing, managing, and archiving the survey data products for their instrument.
- Managing and archiving the analysis data products generated by the science team associated with their instrument.
- Providing necessary data processing support for the science team associated with their instrument.
- Supplying the PDC with data product metadata and generation status information.
- Disseminating the science data products for their instrument, as well as information and documentation pertaining to their instrument, to the scientific community and public.
- Supplying data product holdings to the PDC for inclusion in the final archive.
- Participating in the review of the final archive.

The AIM PDC is responsible for:

- Providing a meta-data catalog of all the AIM science data products with links (URLs) to the appropriate dissemination facility, to the scientific community and public.

- Producing, managing, and archiving the Common Volume Observation (CVO) data products.

- Disseminating the CVO data products to the scientific community and public.

- Maintaining information about available data products and data quality.

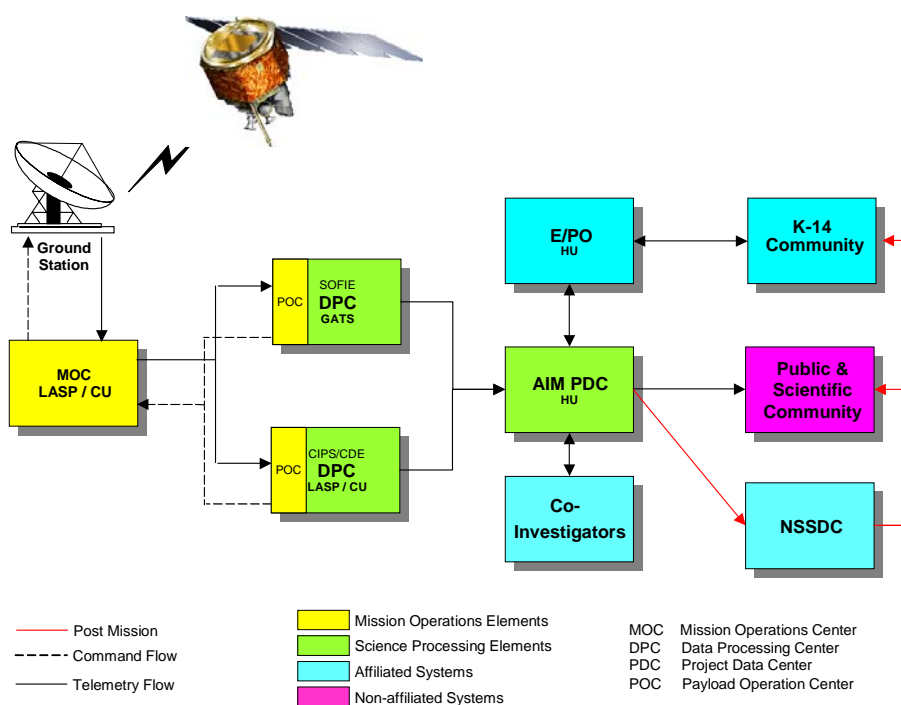- Producing the long-term data set and supporting documents and delivering them to the final archival facility.

Figure 2-1 AIM Science Data System

Figure 2-1 AIM Science Data System shows the various AIM program elements and external users of the SDS. The SDS will supply data to both AIM program elements and external users. AIM program elements require science data products as input to instrument operations and data analysis. For external users (i.e. the scientific community and the public), the AIM SDS is the principal means of access to AIM data products during the course of the mission.

2.B. Service through VITMO

The AIM SDS will work to make its data accessible through the Virtual ITM Observatory (VITMO). VITMO is one of the recently awarded domain specific NASA virtual observatories. VITMO focuses on data covering the Ionosphere, Thermosphere, and Mesosphere and connections to the primary energy drivers of this region.

VITMO does not host any data, but rather acts as a central place to search multiple data sets from different instruments.   As such, the interaction between AIM and VITMO will revolve around ensuring that the AIM PDC and DPC interfaces for searching the AIM data and metadata is compatible with the VITMO search engine.

VITMO will supply metadata templates for the AIM PDC that are compatible with the Space Physics Archive Search and Extract(SPASE) data model. This will ensure that AIM metadata will be compatible with VITMO. In addition, VITMO will be maintaining a metadata catalog of tools and models across the VITMO domain. AIM will support VITMO by supplying descriptive metadata of AIM data and tools that the AIM community develops. These data and tools will be available through the AIM SDS and VITMO will present these through the VITMO interface. The data from AIM will provide a valuable addition to VITMO and make it easier for scientists to analyze connections between PMCs and other regions of the upper atmosphere.

2.C. The Final Mission Archive

The designated long-term archive for the AIM mission is the National Space Sciences Data Center (NSSDC). The NSSDC will maintain the AIM data only after mission closeout. During the mission access to the AIM data products and documents will be provided by the PDC and instrument DPCs. As discussed in section 2.A, data products from the various remote sites will be collected by the PDC and placed in the appropriate archive format for the NSSDC. The AIM Science Working Group will determine the contents of the archive.

The baseline long-term archive contents are as follows:
- Mission documentation and status data products
- The most current version of the data products defined in Table 3-1
- Software for the production of the most current version of the routine data products
- Algorithm Theoretical Basis Documents
- Support products available only through the AIM program
- Utility software for data display and processing
- Bibliography of AIM related publications

There will be multiple versions of the long-term archive, depending on reprocessing activities. Only the final version will be delivered to the NSSDC; the other archives will serve as test beds for the archive production process.

2.D. Final Products Schedule

Beginning 1 year after the commissioning of AIM (June 2008), a prototype version of the Mission Archive will be established which will initially hold sample subsets of the various data products that will be delivered in the final mission archive. This prototype archive will be used to test and validate the tools for creating, modifying and accessing the archive. After the initial testing and validation of the archive related software, the prototype will transition into an interim archive which will contain the latest versions of all data products. This interim archive will generally include all data taken up to but

not including the current data taking season. During normal operations, this will cover all but about 6 months of data. Continued testing of the archive tools will be done to ensure proper scalability with the larger data sets.

In the final months of the AIM mission the Interim Archive will transition into the Final Mission Archive in preparation for delivery to the NSSDC. In Table 2-1 is given the expected time-line following the date of mission completion for final archiving of each of the data products listed in Table 3-1. Since the data products will be available within 96 hours of data taking, the processing of the data sets will be completed shortly after mission completion. Any refinements to the data processing requiring a final reprocessing of the data will be implemented. The data products stored at the individual DPCs will be packaged for shipping to the AIM PDC, where it will be incorporated into the final mission archive. This process should take no more than 2 months. Final versions of the documentation will be completed and incorporated into the final mission archive shortly thereafter. Verification of the final mission archive will follow and take approximately 2 weeks. Following verification, the archive will be delivered to the NSSDC.

Product Name or Task: Product to be delivered to AIM PDC or action to be taken.

Source: The SDS facility responsible for the product delivery or action.

Format: File format of the product. TBD if not yet determined.

Month: Month after the mission end that the actions on the task will be completed.

Table 2-1: Final Products Schedule

Product Name or Task	Source	Format	Month
CDE Level 1-4 Data	CDE DPC	NetCDF	2
CIPS Level 1A & 1B Data	CIPS DPC	NetCDF	2
CIPS Level 2, 3A & 3B Data	CIPS DPC	NetCDF	2
CIPS Level 4 Data	CIPS DPC	NetCDF	2
SOFIE Level 1 Data	SOFIE DPC	NetCDF	2
SOFIE Level 2 Data	SOFIE DPC	NetCDF	2
SOFIE Level 3 Data	SOFIE DPC	NetCDF	2
CVO Level 1 Data	AIM PDC	NetCDF	2
CVO Level 2 Data	AIM PDC	NetCDF	2
Data Product Catalog	AIM PDC	TBD	3
Documentation Archive	AIM PDC	TBD	3
Final Archive Verification	AIM PDC	--	3
Mission Archve Delivery	AIM PDC	--	3

3. Data Products

The AIM mission produces a variety of data products, many of which are made available to the public via the AIM Science Data System website at: http://aim.hamptonu.edu/sds/. For each data set that is nearing release or has been released to the public, a document describing that data set can be found at the AIM documentation library at: http://aim.hamptonu.edu/library/documentation/data/. The data products to be ultimately produced by the AIM mission are listed below in Table 3-1. The columns of the table are as follows:

Product Name: A unique name for the product.

Product Description: A short description of the product.

Source: The SDS facility responsible for the product generation and distribution (during the mission).

Reference: The URL or reference document in the AIM library providing details of the format, contents and size of this product.

Status: The current status of the product production. The status may be:

Coded: The software to produce the product is finished, but not yet fully tested.

Tested: The software to produce the product is finished and has passed all tests.

Online: The data product is available online at: http://aim.hamptonu.edu/sds/

Table 3-1 AIM Data Products

Product Name	Product Description	Source	Reference	Status
Data Product Catalog	Project wide listing of available data products	AIM PDC	http://aim.hamptonu.edu/sds/	Online
CDE Level 1 Data	Time of impact, Pulse-height and engineering & housekeeping data	CDE DPC	cde_level_1_product_details.doc	Coded
CDE Level 2 Data	Time of impact, mass[g] of the detected dust particle	CDE DPC	cde_level_2_product_details.doc	Coded
CDE Level 3 Data	Total mass per orbit and Impact rates [hits in mass resolved with factors of 2 /orbit/area]	CDE DPC	cde_level_3_product_details.doc	Coded
CDE Level 4 Data	Total mass correlation with CIPS total particle mass and PMC brightness	CDE DPC	cde_level_4_product_details.doc	Coded
CIPS Level 1A Data	Calibrated and geolocated albedo images with spikes removed.	CIPS DPC	cips_1a_product_details.doc	Tested
CIPS Level 1B Data	Projected, merged, and registered image regions – "Stack."	CIPS DPC	cips_1b_product_details.doc	Tested
CIPS Level 2 Data	Calibrated albedo images for one orbit merged into single image	CIPS DPC	cips_2_product_details.doc	Online
CIPS Level 3A Data	Daily merged image, each orbital merged image for a day merged into single image	CIPS DPC	cips_3a_product_details.doc	Online
CIPS Level 3B Data	Cloud season movie. Daily merged images combined into an animated sequence.	CIPS DPC	cips_data_products.doc	Online
CIPS Level 4 Data	Cloud properties: phase function, particle size, and ozone, resolved to 'tiles' of a few pixels square.	CIPS DPC	cips_4_product_details.doc	Online

Product Name	Product Description	Source	Reference	Status
SOFIE Level 1 Data	Uncorrected measurements for all 16 channels and 8 difference signals. Corrected (offsets, drift, imbalance, dark current, etc.) measurements for all 16 channels and 8 difference signals, sun sensor pixel sum, and spacecraft PVAT data., offset angle (lockdown) in Azimuth and Elevation between the solar image top edge and FOV, apparent solar extent (angular), apparent elevation angle, refraction angle for solar top & bottom edges, impact tangent altitude for solar top and bottom edges, T,P profiles, tangent point lat & lon, field of view vector, sun center vector, and registration uncertainty	SOFIE DPC	SOFIE_l1_netcdf_file_description_V1.0.doc	Coded
SOFIE Level 2 Data	Primary absorber mixing ratios (CO_2, CH_4, NO,H_2O,O_3), 10 aerosol extinction profiles, uncertainity profiles for mixing ratios and extinctions, 83 km measurement lat./long., T, P, Time, [0.150 km sampling, 150km to 3.0km, 30 profiles/day] Vertical resolution: Gases 1km T&P $\leq$ 3.5km PMC 1km	SOFIE DPC	SOFIE_l2_netcdf_file_description_V1.0.doc	Online
SOFIE Level 3 Data	Daily plots of longitude vs. height for each species	SOFIE DPC	SOFIE_Level3_Product_Description_V1.0.doc	Tested
CVO Level 1 Data	Date, Time, Occultation mode, Tangent point latitude & longitude. Common Volume location, PMC presence	AIM PDC	AIM_common_volume_products_V1.0.doc	Coded
CVO Level 2 Data	Date, Time, Occultation mode, Tangent point latitude & longitude. Common Volume location, PMC presence, PMC altitude, vertical thickness, vertical optical depth, vertical column ice mass. Mesopause height, temperature, water vapor mixing ratio. 83km temperature & water vapor mixing ratio. PMC size distribution, extinction non-uniformity correction factor, altitude corrected for non-uniformity.	AIM PDC	AIM_common_volume_products_V1.0.doc	Coded

4. Spacecraft, Instrument, and Calibrations

A variety of documents have been developed describing the AIM spacecraft and instruments, and calibrations. Table 4-1 lists the documents that will be made available as part of the mission archive. Completed documents can be found in the AIM documentation library at: http://aim.hamptonu.edu/library/documentation/instruments/.

Table 4-1 includes the following columns:
Document Name: A unique name for the product.

Product Description: A short description of the product.

Source: The AIM facility responsible for maintaining and updating the document.

Reference: The URL or reference document in the AIM library.

Status: The current status of the document. The status may be:

> *Planned:* The document has not yet been written.

> *Draft:* The document has not yet been released to the public.

> *Complete*: The final document is available with no further expected changes.

Table 4-1 Spacecraft, Instrument, and Calibration Documentation

Document Name	Document Description	Source	Reference	Status
CIPS ATBD	CIPS Algorithm Theoretical Basis Document	CIPS DPC	cips_atbd.doc	Draft
CIPS Camera Orientation Document	description of image orientation – crucial for using raw images	CIPS DPC	CIPS_camera_orientation.doc	Complete
CIPS On-board Image Processing Description	description of CIPS image compression scheme and its effect on data	CIPS DPC	cips_onboard_image_processing.pdf	Complete
CIPS Science Processing Design Description	formal description of CIPS processing algorithms	CIPS DPC	cips_science_proc_design_descr.doc	Draft
CIPS Algorithm Overview	very useful presentation for understanding the science behind CIPS data	CIPS DPC	CIPS Algorithm Overview 1_10_06.ppt	Complete
CIPS Calibration Plan	formal description of CIPS calibrations	CIPS DPC	cips_calibration_plan.doc	Draft
CIPS Ground Calibration Summary	Review of CIPS ground calibration results	CIPS DPC	cips_calibration_processing.ppt	Complete
CIPS CTH	CIPS Command and Telemetry Handbook	AIM MOC	cips_cmdtlm.pdf	Complete
CDE ATBD	CDE Algorithm Theoretical Basis Document	CDE DPC	aim_cde_atbd.doc	Draft

Document Name	Document Description	Source	Reference	Status
CDE_SDC Algorithm Structure	CDE processing algorithm overview	CDE DPC	CDE_SDC Algorithm Structure.ppt	Complete
CDE/SDC Calibration Procedures	formal description of CDE calibrations	CDE DPC	cde_sdc_calibrations.doc	Complete
CDE PSR	PSR presentation of CDE calibrations	CDE DPC	CDE_PSR_Science_and_Calibration-James.ppt	Complete
CDE CTH	CDE Command and Telemetry Handbook	AIM MOC	cde_cmdtlm.pdf	Complete
SOFIE Calibration Summary	This describes dark current, FOV, boresight, relative spectral response, gain calibration, and non-linearity studies	SOFIE DPC	SOFIE_Calibration_Product_Summary_V1.1.doc	Complete
SOFIE CTH	This is the SOFIE Command & Telemetry Handbook	SOFIE DPC	SOFIE_cth_V1.0.pdf	Complete
SOFIE ATBD	SOFIE Algorithm Theoretical Basis Document	SOFIE DPC	SOFIE_atbd_V1.1.doc	Complete
SOFIE Level 0 to level 1 ICD	Interface Control document between the SOFIE Level0b and SOFIE Level 1 processing.	SOFIE DPC	SOFIE_Level0b_to_level1_icd_V1.0.doc	Complete
SOFIE Level 0b Design Review	Overview of the SOFIE Level0b software design.	SOFIE DPC	SOFIE_Level0b_Design_Review_V1.0.ppt	Complete
SOFIE POC Calibration Events Description.	Explanation of the pointing requirements for the s/c and AIM Planning & Scheduling folks for on-orbit calibration events.	SOFIE DPC	SOFIE_CalibrationEventsDescription_V1.0.doc	Complete
Data Quality Report	Assessment of data quality	AIM MOC	--	Planned

5. Documentation and Metadata

Where applicable, the references in Table 3-1 and Table 4-1, provides the document which details the contents and interpretation of the associated data product, instrument or calibration. The most current version of this documentation is available for download at the AIM PDC. The final versions of these documents will be included in the final archive.

The AIM metadata scheme is based largely upon the metadata for the TIMED mission and is generally compatible with the SPASE data model. The AIM metadata provides the SPASE equivalent of Numerical Data, Display Data, and some Catalog data at the "granule" and "physical parameter" levels. As mentioned in Section 2.B, VITMO will provide AIM with a SPASE compatible metadata template,

which will be used to ensure that the metadata made available through VITMO and in the final mission archive are entirely SPASE compatible.

6. Analysis Tools

The software tools listed in Table 6-1 will be provided to the scientific community to ease the analysis of AIM data. The web based tools will be hosted by the individual SDS facilities. Other tools will be provided to the community via a subversion repository hosted at the AIM PDC containing official releases of the tools and providing version control. This will enable a centralized reference for the version of publicly released tools. The individuals/teams responsible for the tools development will maintain the software in their own private version control repositories and push tagged branches to the AIM PDC. The PDC will maintain a central bug reporting system and direct bug reports to the provider who will address the reported issues at their own discretion.

The table contains the following columns:
Tool Name: Short name for tool reference
Provider: Institution responsible for the tools development.
Description: A brief description of the tool and expected use.
Reference: URL for online tools, or documentation, if applicable.
Status: The status of the tool development. The status can be:
  In Development: The software is in development. At least some features are not complete.
  Implemented: The software is finished, but not yet fully tested.
  Tested: The software is implemented and has passed all tests.
  Completed: The final product is available with no further expected updates.
  Online: The tool is available for use by the public via the web.
  Offline: The tool is intended for use by the public via the web, but has not yet
                              been made publicly available.

Table 6.1 Analysis Tools

Tool Name	Provider	Description	Reference	Status
AIM Orbiter	AIM PDC	Quick orbital prediction for approximate location of AIM, and future/past SOFIE and CIPS measurements.	http://aim.hamptonu.edu/orbit/	Online, In Development
AIM Quick Search	AIM PDC	Quick search software for identifying and surveying AIM data of interest.	TBD	Offline, In Development
CIPS Data Viewer	CIPS DPC	IDL based quick look tool for viewing CIPS images and performing common analysis tasks.	view_cips_data.sav	Tested
CIPS Stack Explorer	CIPS DPC	Enables phase function analysis.	stack_explorer2.sav	Tested
CIPS Wind Explorer	CIPS DPC	Enables mesopheric wind analysis via CIPS images.	compare_l1b_wind.pro	Tested

Tool Name	Provider	Description	Reference	Status
CIPS File Reader	CIPS DPC	Reads the contents of a CIPS file and returns the contents in an array of IDL structures. Note that this is provided for convenience. There are many 3rd party netCDF file readers that will parse our data products.	read_cips_file.sav	Tested
CDE Data Viewer	CDE DPC	Enables common CDE analysis tasks from data files.	view_cde_data.sav	Implemented
SOFIE File reader	SOFIE DPC	example IDL SOFIE netCDF file reader	sofie_read_l2_netcdf_V1.0.pro	Implemented
SOFIE	SOFIE DPC	Web based SOFIE data viewer	http://sofie.gats-inc.com/	Online, Completed