Letter of Understanding
between the
Planetary Data System's Small Bodies Node
and the
NASA Space Science Data Coordinated Archive

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1 INTRODUCTION

This is a Letter of Understanding (LOU) between the NASA Space Science Data Coordinated Archive (NSSDCA) and Planetary Data System's (PDS) Small Bodies Node (SBN) at the University of Maryland. It documents the roles of those organizations in the acquisition, management, dissemination, and long-term preservation of data from the Asteroid Terrestrial-impact Last Alert System (ATLAS). This LOU may be amended as a result of further agreements between the NSSDCA and SBN.

ATLAS is an asteroid impact early warning system developed by the University of Hawaii and funded by NASA. (Tonry *et al.* 2018, doi:10.1088/1538-3873/aabadf; ATLAS website https://fallingstar.com/) It presently consists of four telescopes that look for moving objects by automatically imaging the visible sky down to ~19.5 magnitude, covering the whole sky once every two nights.

ATLAS began operating from the two Hawaii sites in 2015. The Chile and South Africa sites came on-line in 2021. Data from the survey telescopes are compressed FITS image files and are transmitted to SBN for serving to the public and archiving in decompressed form in PDS. The volume of compressed data acquired from 2015 to 2023 is ~2.16 PB (~8 PB decompressed, given a compression ratio slightly better than 1:4). Compressed data are expected to continue to accrue at a rate of ~90 TB per site per year for the duration of the ATLAS project.

SBN will prepare a full PDS4 archive of ATLAS data, consisting of FITS image files that have been locally decompressed and organized into unique PDS4 bundles by lunation for delivery to the NSSDCA for long-term preservation. SBN will retain the original compressed data but delete their copy of the decompressed data after deep archiving at the NSSDCA.

Since the mid-1990's, the NSSDCA has maintained the permanent, deep archive for the PDS, as prescribed by the Memorandum of Understanding (MOU) between the PDS and the NSSDCA dated 13 May 2016. This MOU governs the delivery of archived data products from the PDS to the NSSDCA.

This LOU supplements to the PDS / NSSDCA MOU to describe the delivery of ATLAS data from SBN to the NSSDCA.

2 RESPONSIBILITIES

2.1 SBN

- SBN shall decompress the compressed FITS image files and prepare a full, PDS4-compliant archive of the decompressed data.

    - SBN shall use the RICE_1 algorithm of *CFITSIO fpack* utility program to decompress FITS image files. (The ATLAS team uses the RICE_1 algorithm of *CFITSIO fpack* utility program to compress FITS images).
    - SBN shall organize the decompressed data products by observing night by lunation.
    - SBN shall produce one collection of data per night.
    - For each lunation, SBN shall produce one unique PDS4 bundle that contains one unique collection of data for each observing night and, if necessary, one documentation collection.
    - Each data product shall consist of a decompressed FITS image file and the XML metadata label that describes the decompressed FITS image file.
    - SBN shall validate each bundle before delivery to the NSSDCA.
- SBN shall generate and deliver to the NSSDCA one PDS4 Submission Information Package (SIP) for each bundle of decompressed ATLAS data. This requires SBN to:
    - Generate a SIP consisting of the required manifest file and its XML metadata label in the prescribed format (https://nasa-pds.github.io/deep-archive/).
        - SBN shall generate SIPs for the decompressed ATLAS data (i.e., the manifest shall specify URLs and checksums for the decompressed FITS image files).
        - Given concerns about checksum calculations, SBN shall consult with PDS Engineering Node to determine if the existing PDS Deep Archive tool should be used or if another method is preferred.
    - Make the SIP available online for the NSSDCA to download.
        - SBN shall consult with PDS Engineering Node to determine if the SIP should be posted in a repository at SBN or in the PDS SIP repository (https://pds.nasa.gov/data/pds4/manifests/).
        - SBN shall inform NSSDCA which repository to use.
- Each delivery to the NSSDCA shall consist of one SIP (one ATLAS bundle).
    - SBN may delete their copy of the decompressed ALTAS data after the NSSDCA has marked the SIP as "Ingested".
- SBN should prepare a detailed dataset description document for the ATLAS archive.
- SBN may assign a DOI to these data.

2.2 NSSDCA

- As requested by SBN, NSSDCA shall ingest and archive the decompressed form of the FITS image files.
- For each ATLAS delivery, the NSSDCA shall use its existing PDS4 processes (https://nssdc.gsfc.nasa.gov/pds/PDS4_Submission_Process_v1.3.docx) to download, ingest, archive, and report the status of a SIP. This includes:
    - Downloading the SIP from the specified repository.
    - Automatically opening the appropriate NSSDCA collection records in the NSSDCA Master Catalog and making the IDs available via the NSSDCA PDS4 Reporting Interface.
    - Downloading each unique product specified in the SIP.
    - Creating an Archival Information Package (AIP) for each unique product.
    - Marking the SIP as "Ingested" after all AIPs have been created, which indicates the NSSDCA has accepted archival responsibility.
    - Writing the AIPs to archival tape for permanent preservation.
    - When done, marking the SIP as "Archived".
- NSSDCA shall distribute these data, as requested, after SBN deletes their copy.
- NSSDCA shall electronically return the deep-archived form of the data (i.e., the decompressed form) to SBN, if requested.
- NSSDCA shall negotiate with the SBN any amendments to this LOU, as needed.
    - This shall include keeping open the possibility of SBN delivering and NSSDCA ingesting compressed ATLAS data in the future, which would require revisions to existing PDS4 processes.