

Interim Report

Nimbus 2 Data Recovery

Status as of February 8, 2017

Version 2.16

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Contents

1 Introduction.....	3
2 Requirements	3
3 Nimbus 2 Data Recovery Process.....	4
Figure 1: Nimbus 2 Data Recovery Process	5
4 Nimbus 2 Recovery status	6
4.1 HRIR Radiation Data.....	7
4.2 MRIR Radiation Data	7
5 Nimbus 2 Film Data.....	8
Appendix A: Nimbus 2 Documentation	8
Acronym and Abbreviation List.....	9
Table 1: Nimbus 2 Data Chart.....	7
Table 2: Nimbus 2 Documents.....	8

1 Introduction

This document describes the overall process and status of the Nimbus 2 data. Of the experiments on Nimbus 2, Goddard Earth Sciences Data and Information Services Center (GES DISC) is responsible for the High Resolution Infrared Radiometer (HRIR) radiation data and the Medium Resolution Infrared Radiometer (MRIR) radiation data. This document attests to the recovery of those data sets from tapes formerly stored at the Federal Record Center (FRC) and National Space Science Data Center (NSSDC). The recovered data has been placed in the GES DISC archive, one of NASA's Earth Science Distributed Active Archive Centers (DAACs), under the auspices of the Earth Science Data and Information System (ESDIS) Project.

In addition, there are scanned negatives of photofacsimile 70mm film strips from the Nimbus 2 HRIR film data that will be addressed in Section 5.

The following sections provide the goals and requirements for this effort, describe the steps involved in recovering the data, and conclude with the overall status of the recovery.

2 Requirements

The Nimbus 2 data recovery requirements include:

- Recover the Nimbus 2 data from the tapes and recover the data to files on disk
- Assess the overall success and identify when orbit documentation records and observational data bytes could not be successfully recovered from the original or backup tape
- Compute and archive checksums of all Nimbus 2 files recovered
- Ingest Nimbus 2 data into the S4PA (Simple, Scalable, Script-Based, Science Product Archive) system at GES DISC
- Make Nimbus 2 data available to users via web
- Publish Nimbus 2 metadata to ECHO/Reverb and by doing so make it searchable for the public
- Provide documentation on-line for a user to understand how to write a utility to read Nimbus 2 data and know the quality of the data
- Arrange for the destruction of the original media after data has been successfully recovered and archived or it has been determined that the data is unrecoverable from the media

3 Nimbus 2 Data Recovery Process

The overall process for the recovery of Nimbus 2 products is illustrated in Figure 1. This document focuses only on the NASA (GES DISC) validation and QA which can be divided into the following steps:

- Assess completeness of the catalog and inventory
- Read and extract Nimbus 2 data from the tapes
- Evaluate data quality of each recovered Nimbus 2 file
- Rename the recovered Nimbus 2 files
- Identify and remove duplicate files
- Destroy original media

The data extraction from tape is being done by John Bordynuik Inc (JBI), a company which specializes in media recovery.

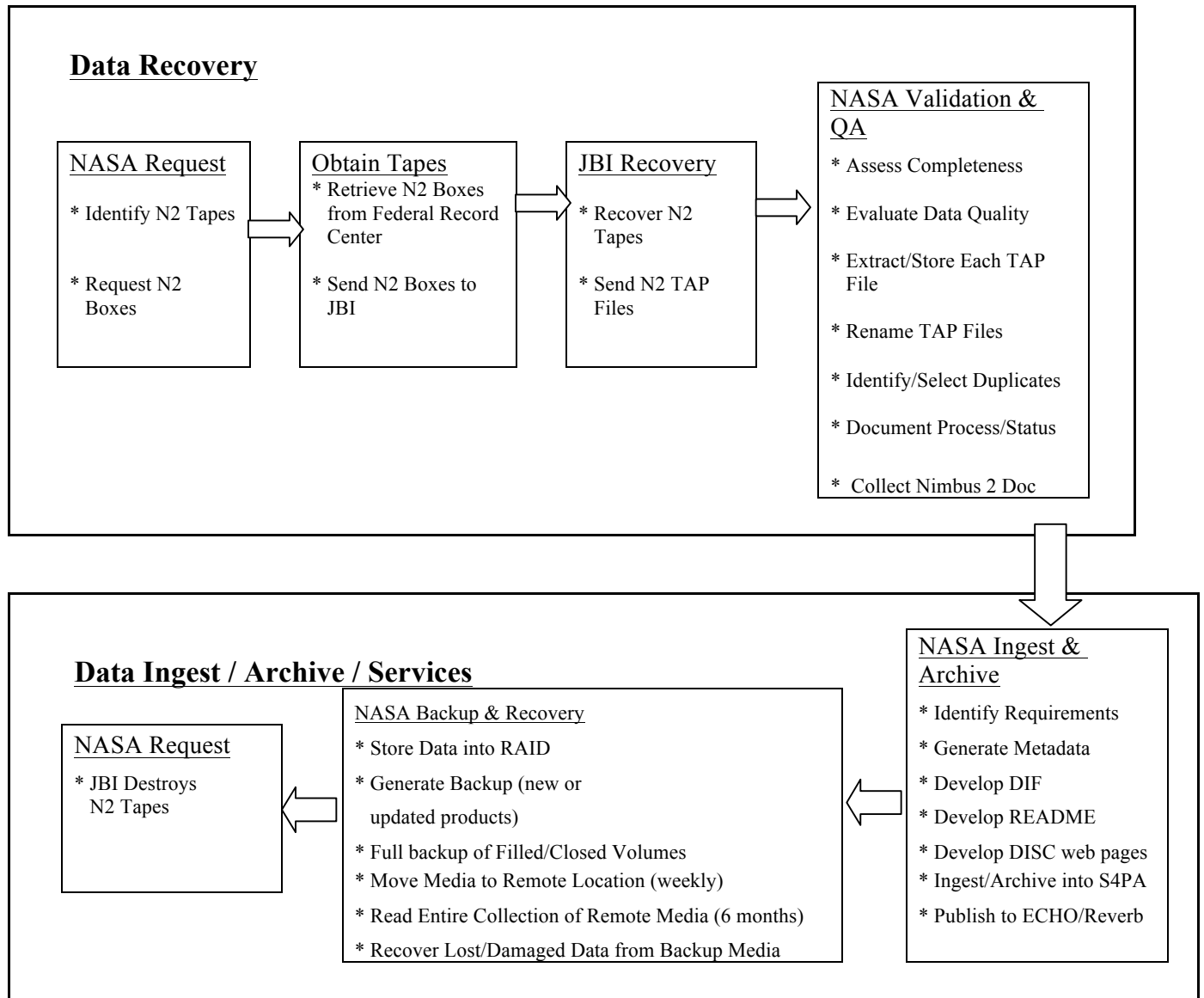


Figure 1: Nimbus 2 Data Recovery Process

4 Nimbus 2 Recovery status

The first step was to obtain information from the NSSDC catalog on the known set of Nimbus 2 products. The next step was to compare the list of tapes that GES DISC received from NSSDC and verify the dataset completeness. Note: A few of the initial deliveries to JBI were sent directly from the FRC. However, since the GES DISC had no direct insight into the delivery contents, that made it difficult to perform a detailed reconciliation with the files returning from JBI. In subsequent orders, the tapes were delivered from FRC to the GES DISC to be inventoried before being shipped to JBI.

There are four types of tapes: DD, DC, DR and DS. DD tapes are the original primary tapes. DC tapes are the original backups of the DD tapes. Sometimes the DD tapes were later copied to higher capacity DR primary tapes, often many DD tapes could fit onto a single DR tape. DS tapes are backup tapes of the DR tapes. It is assumed in these cases that the original DD tapes were destroyed after the transfer to the DR tapes. When shipping the tapes to JBI, GES DISC shipped primary tapes separately from backup tapes to ensure both copies of the data were preserved.

Table 1 has a count of tapes sent to JBI and a count of what was returned and ingested.

There are detailed spreadsheets for each dataset listed in Appendix A: Table 2. Each spreadsheet has 3 tabs: processing results, tape shipment, and tape lists. The Results tab lists the renamed science file name, which includes metadata in the name. There are comments and errors columns that list those files that are excluded or were duplicates and thus overwritten, or that failed due to errors. The successful files have an ingestion date. Tape error statistics and data orbit statistics are also provided. The Shipping tab lists the tapes sent out per shipment and the status of what was received back, which has several possible states: returned, not yet delivered, tape missing, or tape failed to be read. The Tape Lists tab of the inventories lists all the primary and associated backup tapes. These spreadsheets are on the web and thus are available to the public.

A TAP file is a proprietary tape emulation format developed by JBI. A TAP file contains header records that indicate the length of the previous and next record. The Nimbus 2 record format was not changed as part of the recovery effort. Each Nimbus 2 TAP file delivered by JBI is an image of the original tape and so may contain one or more individual files. To avoid confusion and simplify processing, each file was extracted and stored on disk as a separate file. The final data filename includes the original tape name that the data was extracted from. The TAP files are archived in S4PA in their original form prior to extraction.

Nimbus 2 Data		
Shipment # & Date	Tapes Sent Out	Tap Data Received
Ship 1: Jan 2009	1703 HRIR primary	1703 TAP files
Ship 2: Mar 2009	8 MRIR backup	8 TAP files
Ship 3: May 2009	14 HRIR primary	13 TAP files
Ship 4: Aug 2009	7 HRIR primary 11 HRIR backup 7 MRIR primary	Shipment missing
Ship 5: Oct 2009	41 HRIR backup	36 TAP files
Ship 7: Apr 2010	7 HRIR backup	6 TAP files
Ship 9:	1 MRIR primary	1 TAP file
Ship 13:	12 HRIR backup	Not back yet

Table 1: Nimbus 2 Data Chart

4.1 HRIR Radiation Data

The NSSDC catalog records indicate there were originally 1740 DD (primary) tapes. All but 30 of these have DC (backup) tapes. Most of the primary tapes were sent to JBI for recovery, some of the backup tapes were sent if the primary tapes were missing.

We received 1703 Nimbus 2 HRIR TAP files from JBI. 2470 files were ingested and put on the public website. On March 25 2011, 13 TAP files were received from JBI from Shipment 3. 19 files were ingested on September 14, 2012. On March 27, 2012, we received 42 additional files from Shipment 5 and 7. 48 files were ingested on November 7, 2012.

After JBI read the N2 HRIR tapes and the GES DISC processed the data, ESDIS gave permission for JBI to destroy the successfully read tapes.

4.2 MRIR Radiation Data

The NSSDC catalog records indicate there are 98 DD (primary) tapes. 92 tapes were transferred onto 8 DR tapes and those 8 DR tapes were copied onto DS tapes. 6 DD tapes were bad and thus were not transferred over. The tapes that GES DISC received from NSSDC were the 8 DR and 8 DS tapes. The 8 DR tapes were lost in Shipment 4. The 8 DS tapes were successfully read. One additional DR tape was found and sent to JBI.

1771 TAP files were returned from JBI. On May 11, 2009, 1616 files were ingested into S4PA and put on the public website.

After JBI read the N2 MRIR tapes and the GES DISC processed the data, ESDIS gave permission for JBI to destroy the successfully read tapes.

5 Nimbus 2 Film Data

There are scanned negatives of photofacsimile 70mm film strips from the Nimbus 2 HRIR. The images contain orbital nighttime (3.5 to 4.1 microns) cloud cover of the Earth's surface temperature. Each orbital swath picture is gridded with geographic coordinates and covers a distance approximately from the north pole to the south pole. The images are saved as JPEG 2000 digital files. About 7 days of images are archived into a TAR file. The processing techniques used to produce the data set and a full description of the data are contained in section 3.4.1 of the "Nimbus 2 Users' Guide." These images can be used to supplement the radiance data files from tape data. The image files can be viewed with any application that supports the JPEG 2000 format. The film is currently stored by ESDIS.

A list of images available is on the film inventory spreadsheet, "Film Data Inventory".

Appendix A: Nimbus 2 Documentation

Several documents have been generated to provide a full traceability of all the NSSDC tapes recovered, the names of the Nimbus 2 files ingested at the GES DISC, and general information such as errors detected and orbit information. Table 2 describes the content of each document. These documents are located on the GES DISC web pages.

Document Name	Description
N2 HRIR Inventory 20170208.xls	HRIR Inventory, results/shipping/tape lists
Nimbus 2 MRIR Inventory 20160714.xls	MRIR Inventory, results/shipping/tape lists
Film Data Inventory	Film Data Inventory spreadsheet

Table 2: Nimbus 2 Documents

Acronym and Abbreviation List

Ch: Channel

DC: backup copy of DD tape

DD: original primary tape

DR: transferred primary tape

DS: backup copy of DR tape

ECHO: Earth Observing System Clearinghouse

ESDIS: Earth Science Data and Information System

FRC: Federal Record Center

GES DISC: Goddard Earth Sciences Data and Information Services Center

HRIR: High Resolution Infrared Radiometer

JB: John Bordynuik Inc

MRIR: Medium Resolution Infrared Radiometer

NSSDC: National Space Science Data Center

QA: Quality Assurance

S4PA: Simple, Scalable, Script-Based, Science Product Archive

TAP: (a proprietary tape emulation format developed by JB)

THIR: Temperature-Humidity Infrared Radiometer

WNRC: Washington National Records Center