Rosetta Mission Amateur Data Archive

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Rosetta Mission

Rosetta is a mission from the European Space Agency launched to orbit and land on a comet. This mission is the first time people have ever sent a craft to orbit or land on a comet.

Rosetta Launch: March 4, 2004
Rosetta 67P rendezvous: January 2014
Philae Lander deployment: November 2014
Mission End: September 2016
Rosetta Mission Probes

Rosetta Orbiter
11 Instrument Packets
• Alice Ultraviolet Imaging Spectrometer
• CONSERT Comet Nucleus Sounding Experiment by Radio wave Transmission
• COSIMA Cometary Secondary Ion Mass Analyzer
• GIADA Grain Impact Analyzer and Dust Accumulator
• MIDAS Micro-Imaging Dust Analysis System
• MIRO Microwave Instrument for the Rosetta Orbiter
• OSIRIS Optical, Spectroscopic, and Infrared Remote Imaging System
• ROSINA Rosetta Orbiter Spectrometer for Ion and Neutral Analysis
• RPC Rosetta Plasma Consortium
• RSI Radio Science Investigation
• VIRTIS Visible and Infrared Thermal Imaging Spectrometer

Philae Lander
10 Instrument Packets
• APXS Alpha Proton X-ray Spectrometer
• ÇIVA Panoramic and microscopic imaging system
• CONSERT Comet Nucleus Sounding Experiment by Radio wave Transmission
• COSAC Cometary Sampling and Composition experiment
• PTOLEMY Evolved Gas Analyzer
• MUPUS Multi-Purpose Sensor for Surface and Subsurface Science
• ROMAP Rosetta lander Magnetometer and Plasma Monitor
• SD2 Sample and Distribution Device
• SESAME Surface Electric Sounding and Acoustic Monitoring Experiment
67P Facts
Mass: \(10^{13}\) kg
Volume: 25 km³
Density: 0.4 g/cm³
Rotation Rate: 12.4043 hours
Orbital Period: 6.55 years
Perihelion: 186 million km (1.243 AU)
Aphelion: 849.7 million km (5.68 AU)
Orbital Eccentricity: 0.640
Orbital Inclination: 7.04°
Large Lobe Size: 4.1 x 3.2 x 1.3 km
Small Lobe Size: 2.5 x 2.5 x 2.0 km
Year of Discovery: 1969
How big is Comet 67P/Churyumov-Gerasimenko?
Amateur Observer Campaign

Rosetta’s Amateur Observation Campaign was created to have amateur observers gather usable data that is applicable to real science products.

The campaign began April 2015 and is coordinated by Dr. Padma A. Yanamandra-Fisher
Benefits of Amateur Observations

Amateur observers advantages:
• Not bound by telescope availability
• Can view from all over the world
• Can work at almost any time of night
• Telescope networks are very easily accessible and offer a wide variety of viewing options
• Public Outreach
Observer Locations
Telescope Facilities

Many observers in the Rosetta Amateur Campaign use telescopes from prebuild networks such as iTelescope and Slooh. These services provide fully automated telescopes that can be remotely operated by members.
Amateur Data Pipeline

• Gather Data
• Rename/Reorganize/Reformat Data
• Upload Data to PSA
Gathering Data

The first step of the archival process is to gather the data from observers. To achieve this we contact each observer in groups of 25 and await responses. If we hear back from an observer we send them an invitation and instructions to send us their raw and calibrated data.
Large File Transfer

The LFT is a service provided for JPL/NASA employees that allows users to transfer up to 10gb worth of files in a single transfer. Observers with data over the typical size limit of 25 mb are invited through the LFT to upload their files. The LFT provides a simple way to gather massive amounts of data.
IDL

Interactive Data Language, or IDL, is a programming language designed for use with astronomical data. The Flexible Image Transport System, or FITS, file format is a common customer of IDL since it has functions designed directly for work it. The observer data comes in FITS format which is quite standard, and consists of an image array and a header text file.
Renaming Script

The heart of the Amateur Data Pipeline is the Renaming/Reformatting script that takes all the collected data and lays it out in a format accepted by the Planetary Science Archive. The program has gone through several iterations, some more useful than others. The goal of the program is to grab FITS files, rename them based on their information and save them for upload.
Directory Layout

- Master Directory
- Observer Directory
- Date Directory
- Individual FIT File

...
Renamer Version 1.0 Outline

Define Input and Output Directories Manually
Find All FIT Files in Input Directory
For Loop
  Read All FIT Files
  Gather Necessary Data for Renaming
  Concatenate New Name
  Write FIT File in Output Directory with New Name
End Loop
END
Renamer Version 2.0 Outline

Read Current Directory
Define Input and Output Directories Automatically
Verify and/or Correct Directory Format
Search Individual Date Directories
Search for FIT Files in the Date Directories
For Loop
  For Loop
    Read All FIT Files in Specific Date
    Gather Necessary Data
    Concatenate New Name
    Write FIT File in Output Directory with New Name
  End For Loop
End For Loop
End For Loop
END
Renamer Version 3.0 Outline

Read Current Directory
Search for All FIT Files within Current Directory
For Loop
  Read All FIT Files
  Gather Necessary Data
  Determine All Observers and All Specific Observation Dates
  Create Directory Structure
  Write All FIT Files to New Directory Format
End Loop
Read All Dates
For Loop
  Read all FIT files
  Concatenate New Name
  Write FIT File in Output Directory with New Name
END
Crucial Functions

FILE_SEARCH  Used to find any and all files under a specific search criterion

READFITS  Used to open FITS files and read its header

WRITEFITS  Used to write the file in new directories with new names

MKDIR  Used to create directories
Uploading to PSA

Once the data is processed the final step is to upload the data to the Planetary Science Archive. This entails following the PSA guidelines for uploading data. Including correct directory format and file nomenclature. The PSA handles the data so that it can be found using a variety of criterion.
Summary

• Amateur Observation Campaigns are a viable way of collection excess data for ongoing missions.

• The completion of an End to End pipeline for amateur data will make their vast amounts of data extremely accessible.

• The consistent data in the PSA will allow future scientists to analyze significantly more data for comet research.
Acknowledgments

Dr. Bonnie J Buratti
Dr. Padma A. Yanamandra-Fisher
Professor Paul McCudden
Dr. John Sepikas

Consortium for Undergraduate Research Experience
NSF Grant #1460538

Jet Propulsion Laboratory
National Aeronautics and Space Administration
European Space Agency
Rosetta's twelve-year journey in space