

Near Earth Asteroid Scout CubeSat Science Data Retrieval Optimization Using Onboard Data Analysis

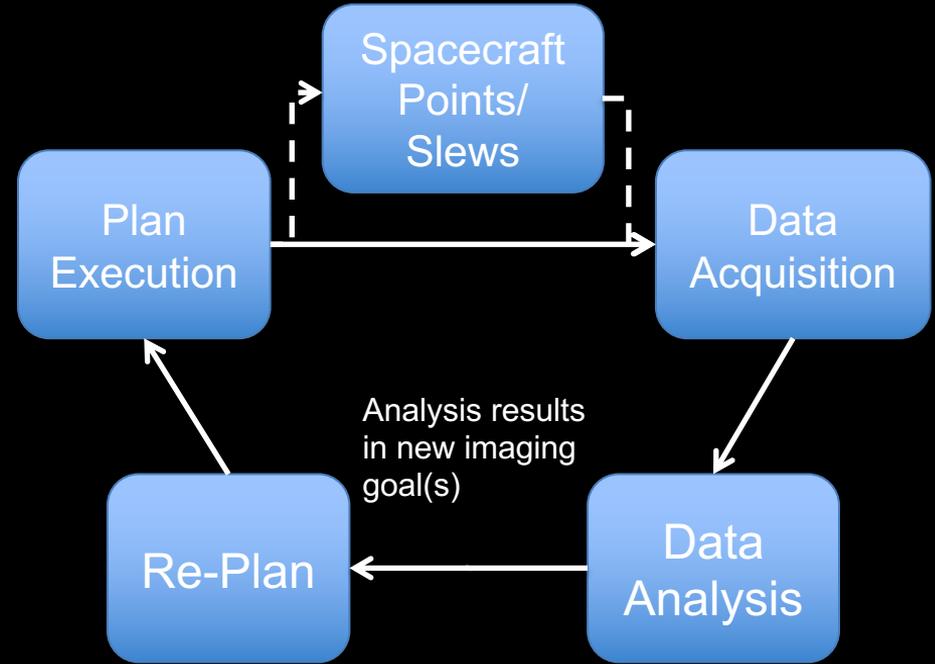
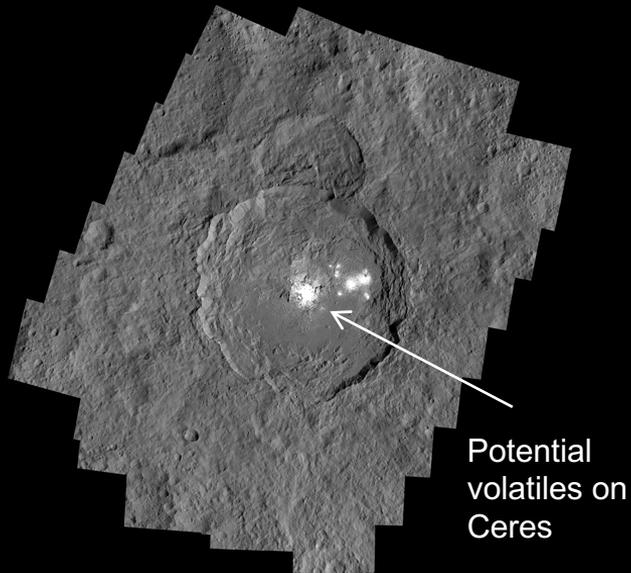
**Jack Lightholder
David R. Thompson
Julie Castillo-Rogez
Christophe Basset**

Jet Propulsion Laboratory,
California Institute of Technology
4800 Oak Grove Dr.
Pasadena, CA 91109
626-710-3246
Jack.a.lightholder@jpl.nasa.gov

JPL
Jet Propulsion Laboratory
California Institute of Technology

The Agile Science Paradigm

Analyze data acquired onboard spacecraft and respond based on analysis



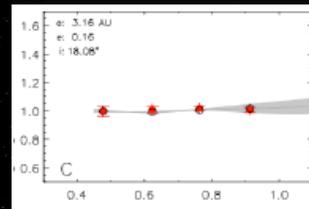
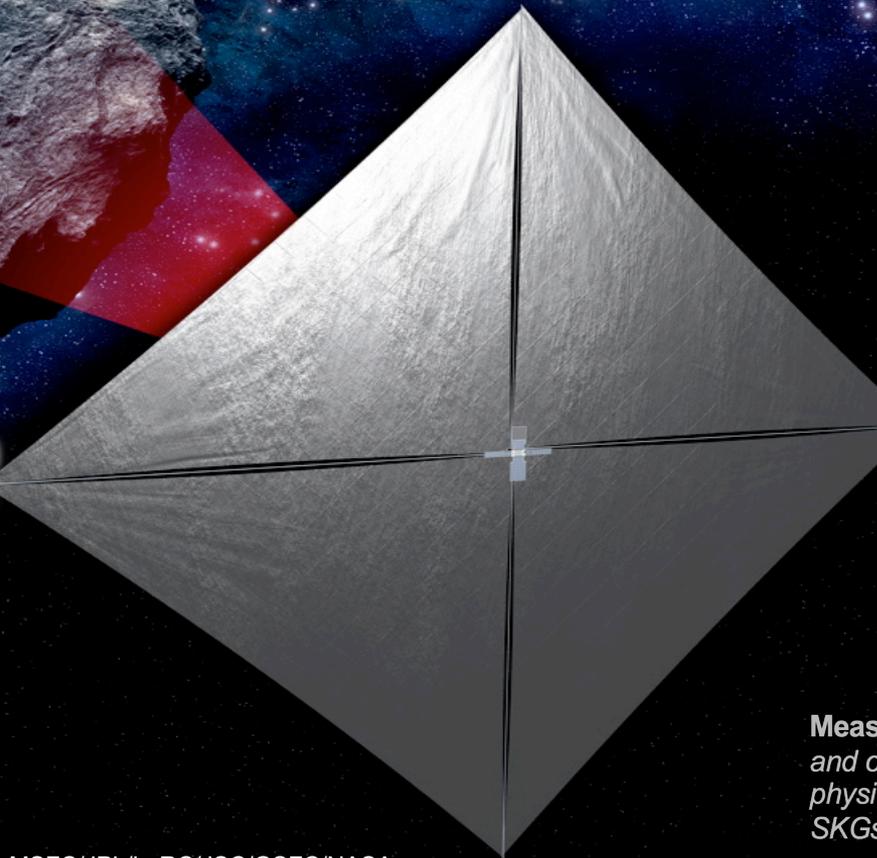
Near Earth Asteroid Scout



GOALS

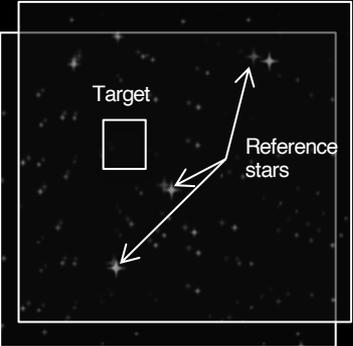
Characterize one candidate NEA with an imager to address key Strategic Knowledge Gaps

Demonstrates low cost capability for HEOMD for NEA detection and reconnaissance



Measurements: NEA volume, spin and orbital properties, address key physical and regolith mechanical SKGs.

Imaging Challenges



Target Detection and Approach

Ephemeris determination

Target Position Uncertainty

Spacecraft Pointing and Camera Limitations

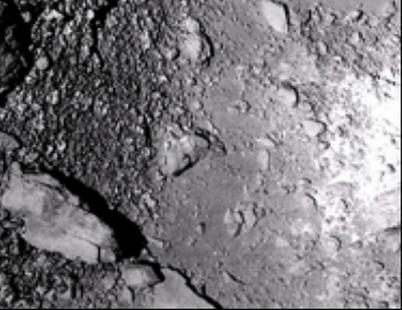


Medium Field Imaging

Shape, spin, and local environment

Short Flyby Time (<30 minutes)

Uncertain Environment



Close Proximity Imaging

Local scale morphology, terrain properties

Data Value Analysis and Sorting

Short Time at Closest Approach (<10 minutes)

Limited Downlink of 1 Kbps

Raw Data is Messy



- Rosetta OSIRIS Narrow Angle Camera Detection of 2867 Steins

Raw Data is Messy

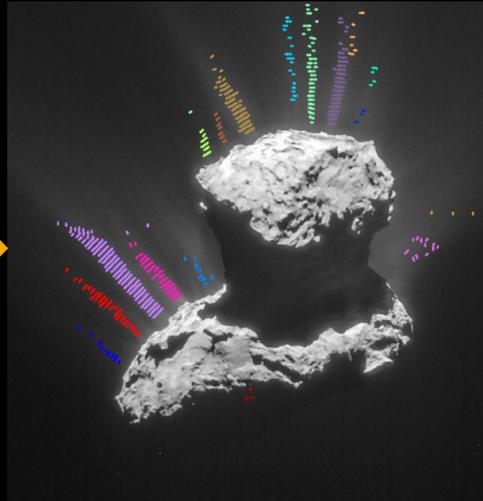


- Rosetta OSIRIS Narrow Angle Camera Detection of 2867 Steins

Mission Operations Flexibility



Data Calibration



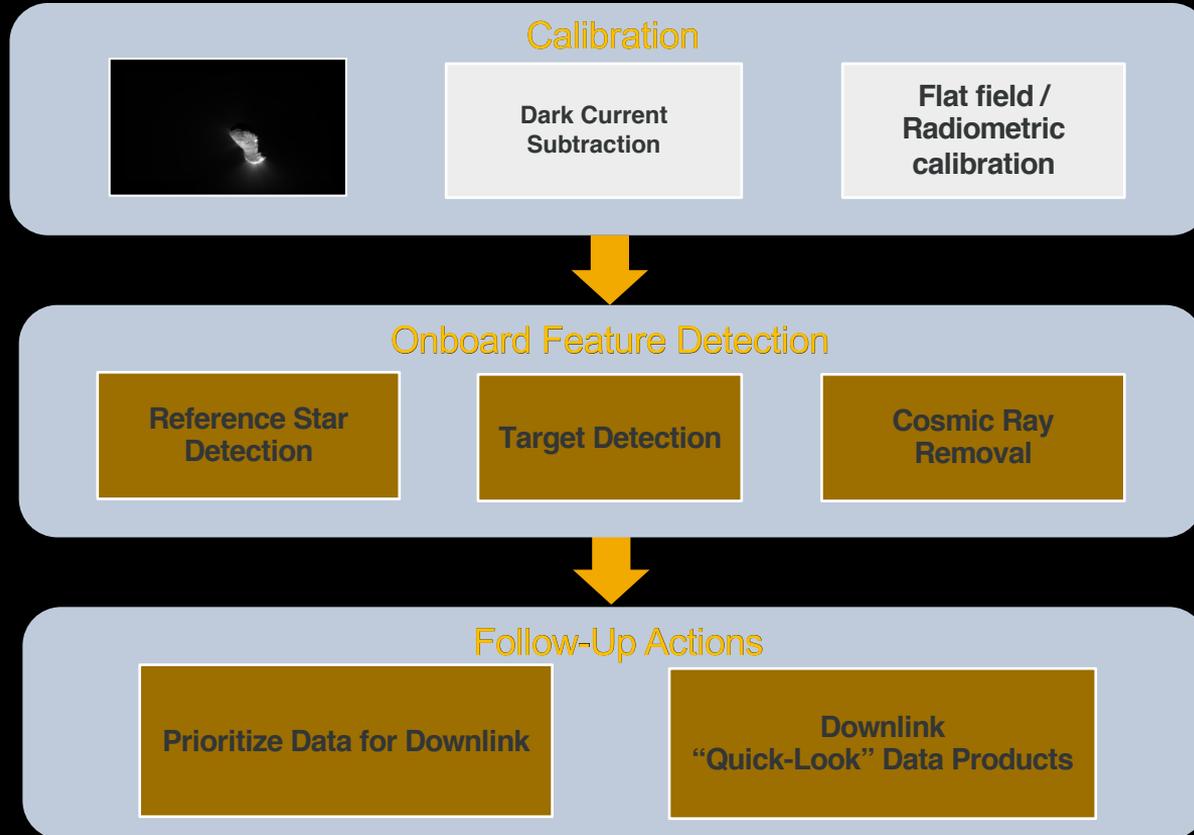
Feature Detection



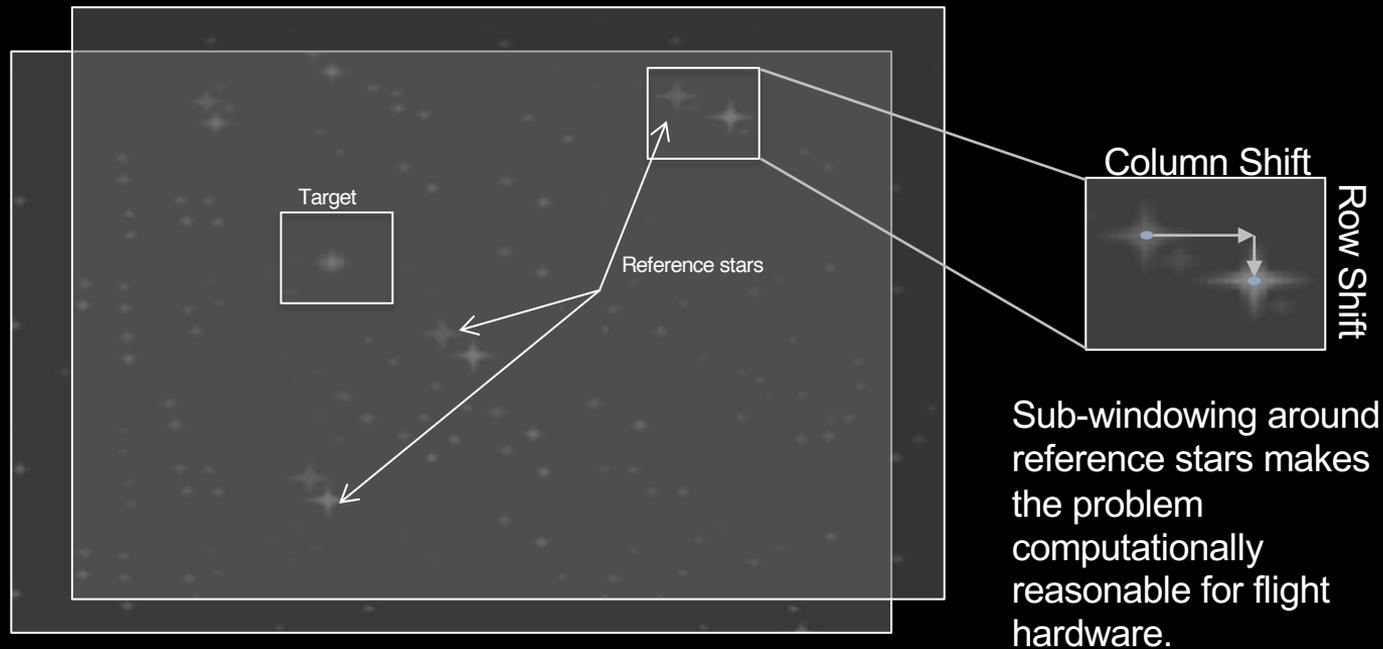
Operational Decisions



Mission Operations Flexibility



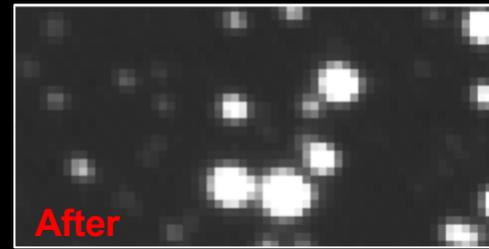
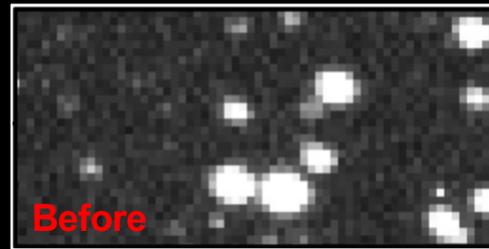
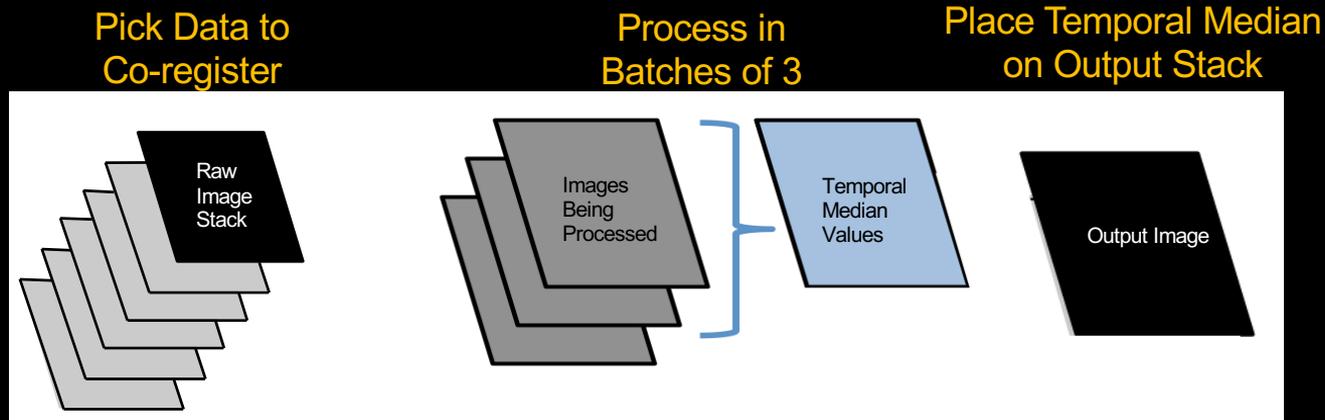
Cleaning Up the Noise



Onboard co-registration of images improves SNR and reduces downlink requirements

Computation is additionally constrained by
onboard memory limitations.

< 100 MB RAM



Stepwise processing keeps the necessary memory small.

Processed Data



Rosetta OSIRIS Narrow Angle Camera Detection of 2867 Steins

Identify Targets with Onboard Image Subtraction



Determine the shift between two images, subtract with (x,y) offset.

This type of information has many mission applications.

Current trajectory verification
and refinement

Automated target tracking

Target of opportunity detection

Target survey and classification

Does Your Target Look “As Expected”?

New Horizons Long Range Reconnaissance Imager Detection of Pluto/Charon



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