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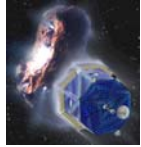
PDR



Science Operations

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January 20, 2000

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Science Operations

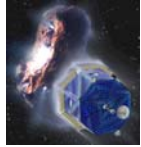
SCIENCE OPERATIONS CENTER

- Overview
- Sequencing software
- Sequencing process

SCIENCE DATA CENTER

- Overview
- Data calibration
- Data archival

INTERFACES AND RESPONSIBILITIES



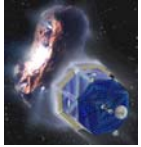
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Science Operations Center

General

- **Located at Cornell**
- **SOC will serve as interface between instrument teams and APL for coordinating development of and delivering science activity command sequences**
- **Efficient and reliable link with MOC at APL demonstrated by NEAR**
- **Instrument team locations:**
 - **CIDA – MPI, Garching**
 - **NGIMS – GSFC**
 - **CRISP/CFI - Cornell**



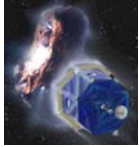
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Science Operations Center

General (continued)

- **Heritage from NEAR:**
 - Cornell staff responsible for instrument activity sequences for MSI (multispectral imager), NIS (near-infrared spectrometer)
- **Heritage from STARDUST:**
 - CONTOUR CIDA is duplicate of STARDUST instrument
- **Heritage from CASSINI:**
 - NGIMS activity sequences similar to Cassini INMS



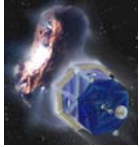
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Science Operations Center

High-level Responsibilities

- **Design instrument activity plans required to meet science objectives**
- **Define required instrument software performance**
 - rates of commanding
 - rates of data acquisition and data flow to recorder
- **Create conflict-free instrument activity sequences for calibrations, Earth flybys, comet encounters**
- **Develop contingency sequence plans for alternate miss distances at comets**



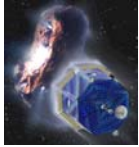
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Science Operations Center

Command Load Generation - Software

- **Opportunity analysis - NEAR 'Orbit' software**
 - reads SPICE ephemeris kernels
 - generates visual representation of comet and instrument FOVs, simulates s/c pointing
 - saves graphically generated activities as SEQGEN commands
- **Sequence generation - SEQGEN**
 - reusable command blocks or "CASs"
 - includes instrument and spacecraft functions
 - same software at SOC, MOC, and instrument institutions
 - models performance of integrated command load



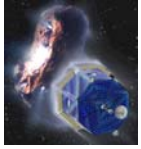
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Science Operations Center

Command Load Generation - Process

- **SEQGEN CASs developed by APL, with input from instrument teams**
- **Detailed command sequences for science instruments generated at home institutions**
 - **CIDA - MPI, Garching**
 - **CRISP/CFI - Cornell (includes OPNAV)**
 - **NGIMS - GSFC**
- **Sequences merged, conflicts resolved at SOC**
 - **Performance modeled**
- **Merged SEQGEN activity request file delivered to MOC for integration with spacecraft commands**



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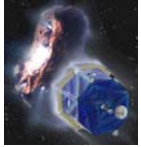
Science Data Center



- **Located at Cornell**

High-level Responsibilities

- **Convert telemetry to experimental data records (EDRs)**
- **Validate and calibrate data**
- **Distribute data to science team**
- **Archive data to PDS**



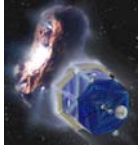
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Science Data Center

Conversion of Telemetry to EDRs

- **Instrument data written in near-real time to PDS format**
 - binary data with descriptive ASCII header
 - science team will work with PDS to define file headers
- **Attitude and timing data recorded in SPICE files**
 - SP Kernels (ephemerides) from JPL NAV, s/c attitude telemetry from APL MOC
 - Cornell SDC creates:
 - I Kernel (instrument definition)
 - C Kernel (pointing)
 - E Kernel (instrument events)
 - Target Attitude and Shape (Thomas)



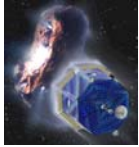
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Science Data Center



Data Calibration and Validation

- **Validation verifies that commanded instrument sequences have been executed**
- **Validation determines that binary and header data are accurate**
- **Calibrations utilize results of on-ground and in-flight tests**



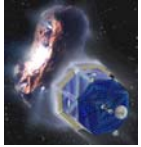
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Science Data Center

Data Calibration and Validation (continued)

- **CFI and CRISP activities focused at Cornell**
- **NGIMS activities focused at GSFC: results transmitted to SDC at Cornell**
- **CIDA activities focused at MPI-Garching: results transmitted to SDC at Cornell**
- **High degree of heritage from previous missions**
 - **CRISP/CFI will adapt proven software from NEAR MSI and NIS**
 - **NGIMS will adapt Cassini INMS software**
 - **CIDA will adapt software from STARDUST CIDA**



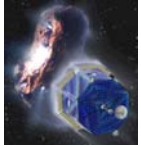
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Science Data Center

Data Distribution and Archiving

- Selected images and other data will be released to the public on Web as soon as possible after each flyby
- Calibrated data distributed near-real time to science team via Web
- Calibration papers planned for each instrument
- Schedule for archiving to PDS
 - File formats, keyword definitions (launch + 30 days)
 - Calibration papers (launch + 6 mo)
 - Instrument EDRs, calibration routines (Encke: Encounter + 9 mo, Others: Encounter + 6 mo)



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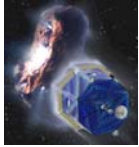


Science Data Center

CONTOUR Data Volume

- **Estimated at 4 Gbits / Encounter**
 - **CIDA \leq 0.5 Gbits**
 - **NGIMS \leq 0.3 Gbits**
 - **CRISP/CFI \cong 3.2 Gbits**
- **CIDA Team accustomed to handling such data volumes: Rosetta, Stardust**
- **NGIMS Team very experienced: Galileo, Cassini, etc.**
- **CRISP/CFI - Cornell accustomed to handling voluminous imager/spectrometer data: NEAR MSI/NIS**

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Operational Interfaces and Responsibilities

