SOFIA

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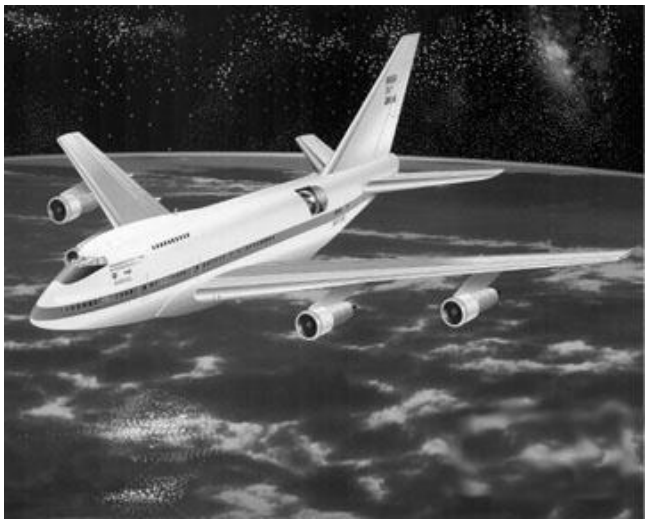
SOFIA Description

Salient Features

- 2.5-meter, airborne telescope optimized for mid- to far-IR observations, mounted in 747SP
- Access to full spectral range from 0.3 to 1600 μm
- Range covered by numerous state-of-the-art focal plane instruments
- Stratospheric operation for over 6 hours per mission, 960 observing hours per year
- Diffraction limited beyond 10-15 microns
- Deployable for all-sky/opportunity coverage



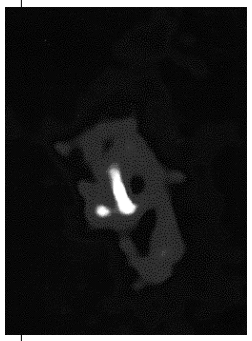
Implementation Characteristics

- Cooperative 25-year program with Germany under formal MOU
  - U.S.: Aircraft modification, onboard mission control system, ground support system, integration, FAA Certification, 80% of operations
  - Germany: Telescope Assembly, support for integration, 20% of operations
  - U.S. and Germany share telescope time in same proportion – 80:20
- Single prime contract for U.S. development and operations as a GOCO facility
- Science-led development and operations: prime contractor is USRA
  - Operations out of Moffett Field, CA, as proposed by USRA team
- Lead NASA Center: Ames Research Center

SOFIA Science

- Uniqueness: Only SOFIA opens the entire visible-to-millimeter spectrum
- Versatility: High resolution, good sensitivity, and long life make SOFIA a versatile Origins observatory

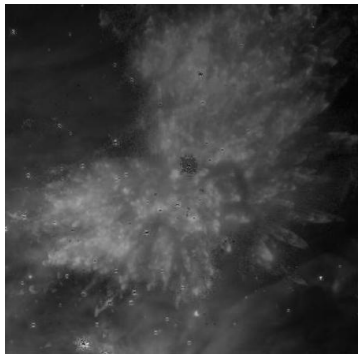
Galactic Center and AGN:



Ring of matter in galactic center

-How fast does matter fall in?
-How much energy is released?
-How is the galactic center similar to Active Galactic Nuclei?

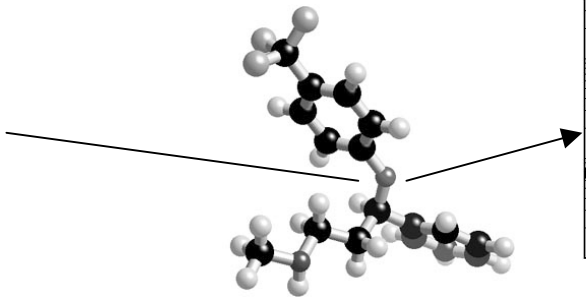
Star and Solar System Births:

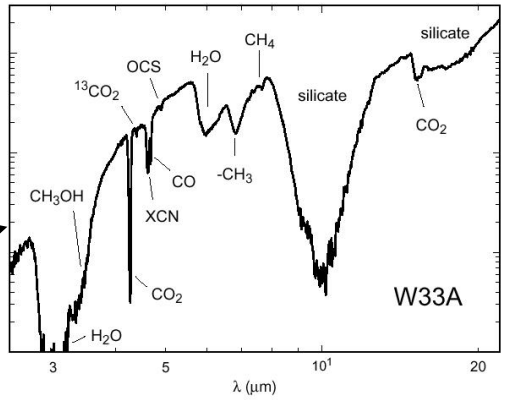


Young stars and jets in Orion seen by HST / NICMOS

-Dynamics of protostar mass infall & outflow
-Observe protostars at peak wavelengths
-Disk evolution and planet formation

Evolution of Organic Matter in the Interstellar Medium:

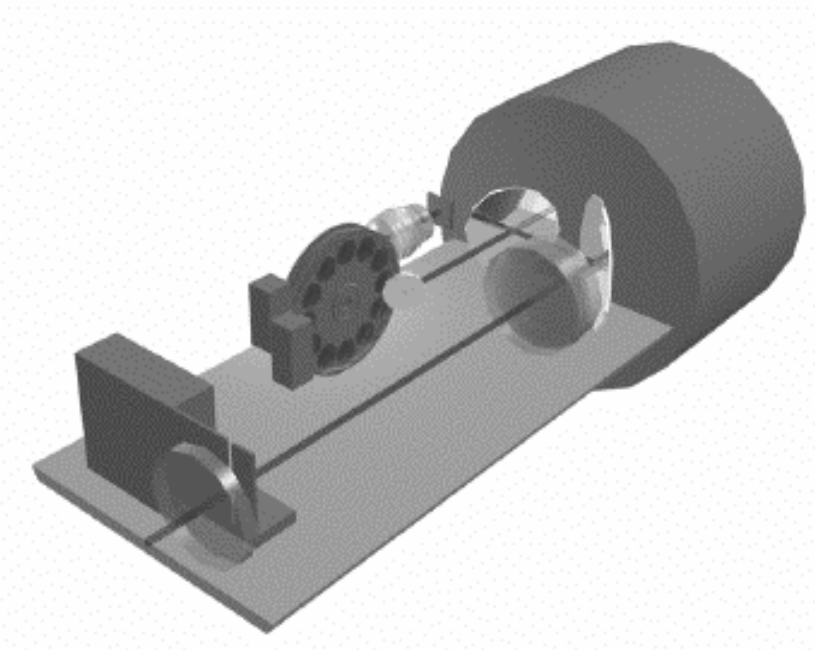




Only SOFIA will provide high-resolution 5-10μm spectroscopy needed to see evolution of organic matter from the ISM to protostellar environments

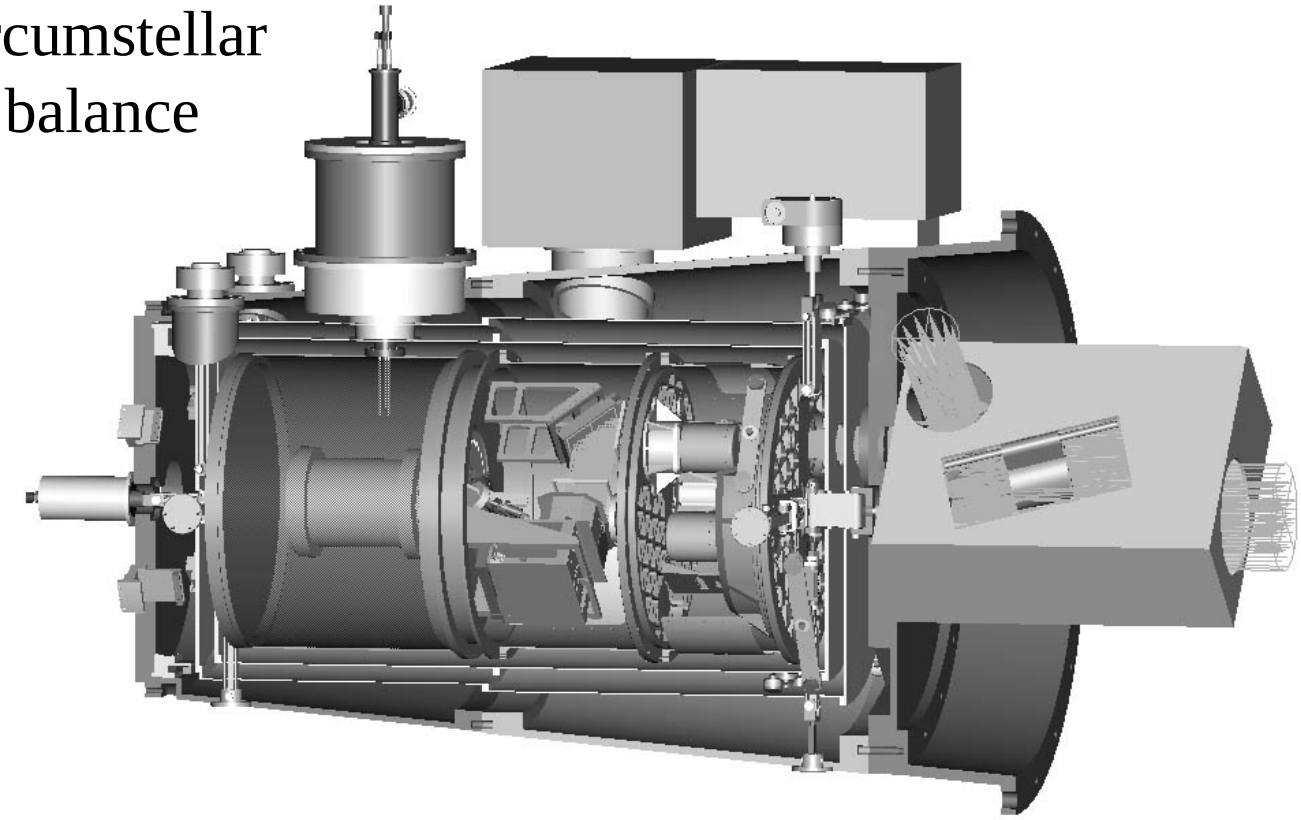
Flitecam: First-Light Infrared Experiment Test Camera

- Resolves SOFIA PSF (space and time) and provides pupil imaging mode (1 mm resolution on primary).
- Evaluate exhaust plume effects at very low elevations.
- Can calibrate SOFIA H_2O monitor.
- 1 – 5 μm imaging with ALADDIN 512 x 512 InSb quadrant.
- Frame rate > 15 Hz with subarray readout.
- 2 plate scales: 0.12″ and 0.48″/pxl
  (1′ x 1′ and 4′ x 4′ FOV)
- R=500 and R=2000 grisms



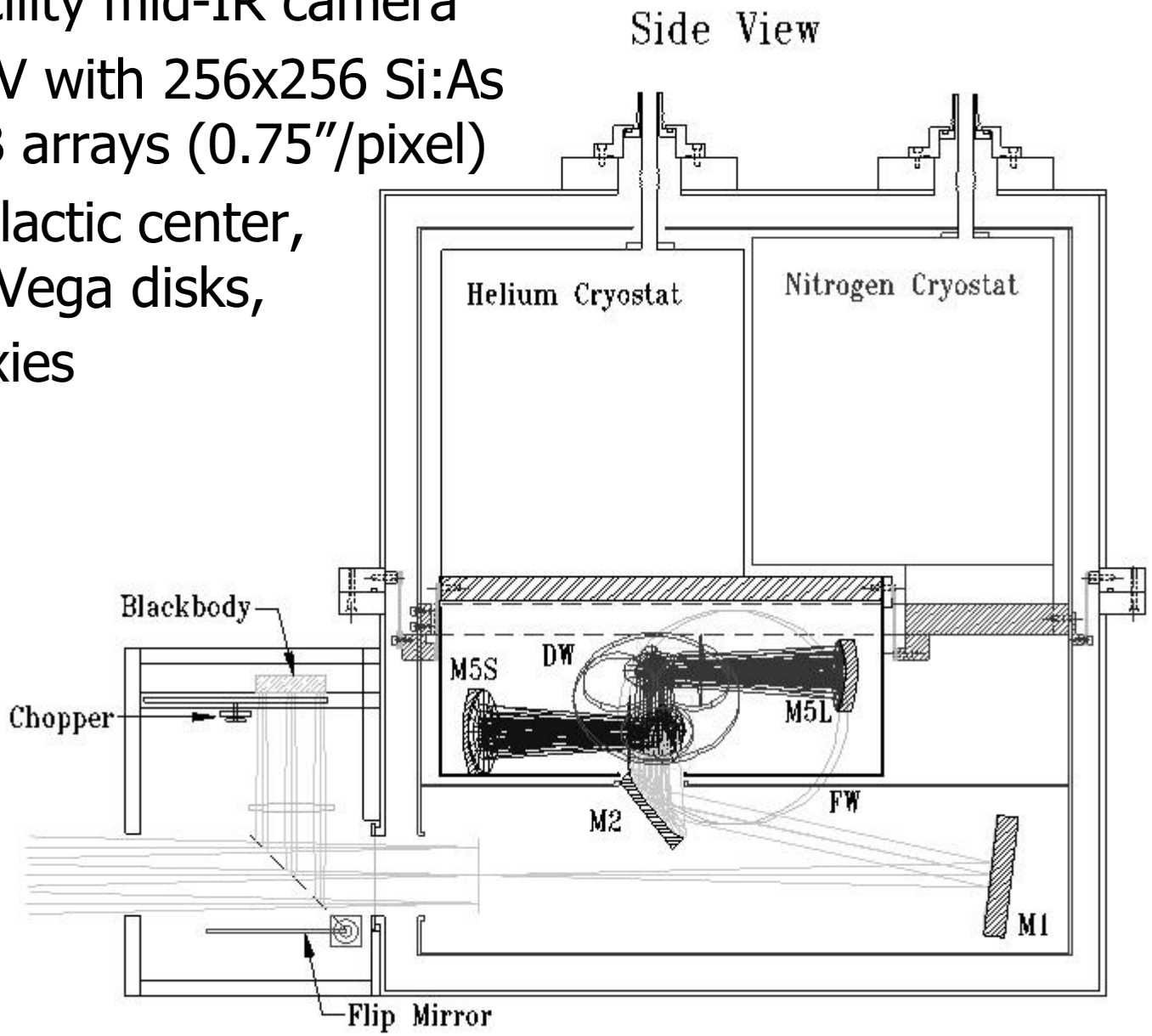
HAWC - High-resolution Airborne Wideband Camera

- Facility Far-IR camera (40 – 300 μm) with 12 x 32 pixel bolometer (GSFC) array
- 3 bands (60, 110, 200 μm centers) with 3 platescales.
- 200 mK ADR and 4K He cooling
- Star formation, circumstellar disks, energy balance



FORCAST: Faint Object IR Camera for SOFIA Tel.

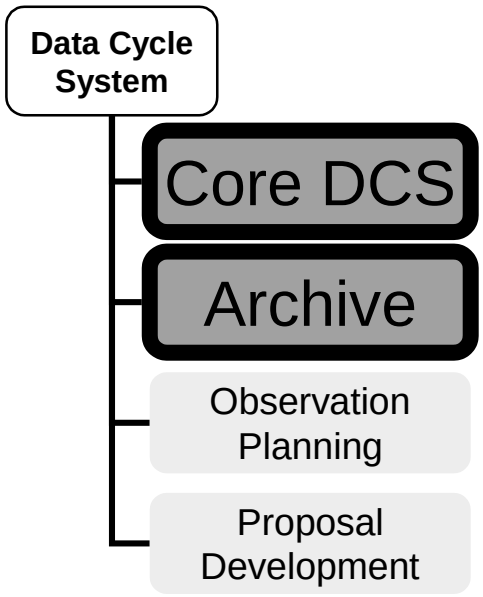
- Wide-field facility mid-IR camera
- 3.2′ x 3.2′ FOV with 256x256 Si:As and Si:Sb BIB arrays (0.75″/pixel)
- Will image galactic center, circumstellar Vega disks, and galaxies



The Data Cycle System (DCS)

- The DCS is the interface that a general observer uses on SOFIA for:
  - Proposal preparation
  - Observation planning
  - (Facility instrument) configuration (Web → AOT → AOR → Instrument)
  - Archive science and housekeeping data
  - (Facility instrument) data reduction: Quick Look and Pipelines
  - Archival research and analysis

DCS Design: Components



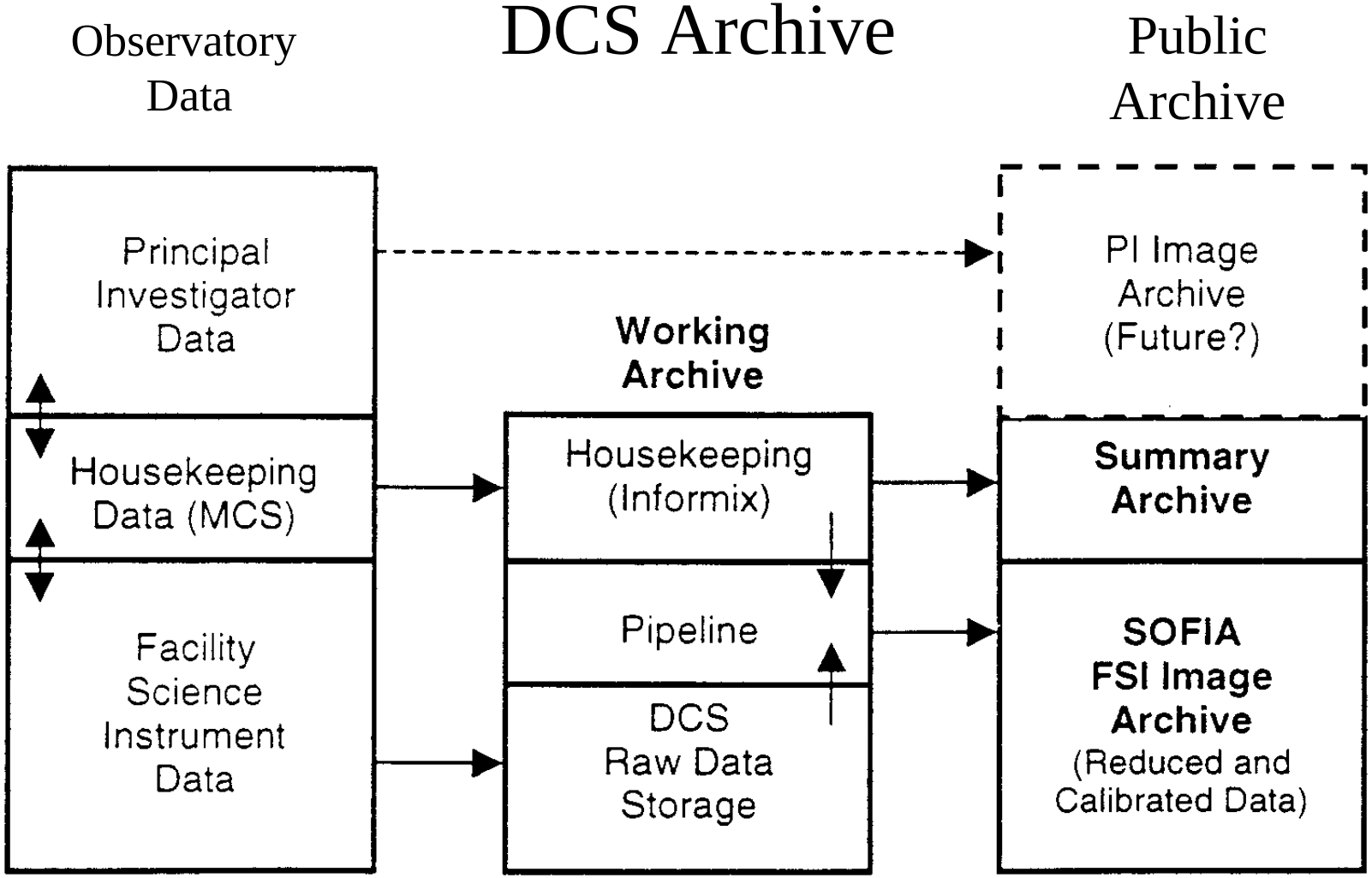
- Core DCS
  - Primary user interface
  - Ast. Observ. Record (AOR) generation
  - Pipelined data reduction
- Archive
  - Repository for SI And MCCS Data
  - Retrieval of data products
- Observation Planning & Visualization
  - Graphical interface and data overlays
  - Observing time estimators
- Proposal Development
  - Proposal preparation & submission tools
  - Proposal parsing and management

DCS Core Technologies

Implementing the DCS requires technologies which provide:

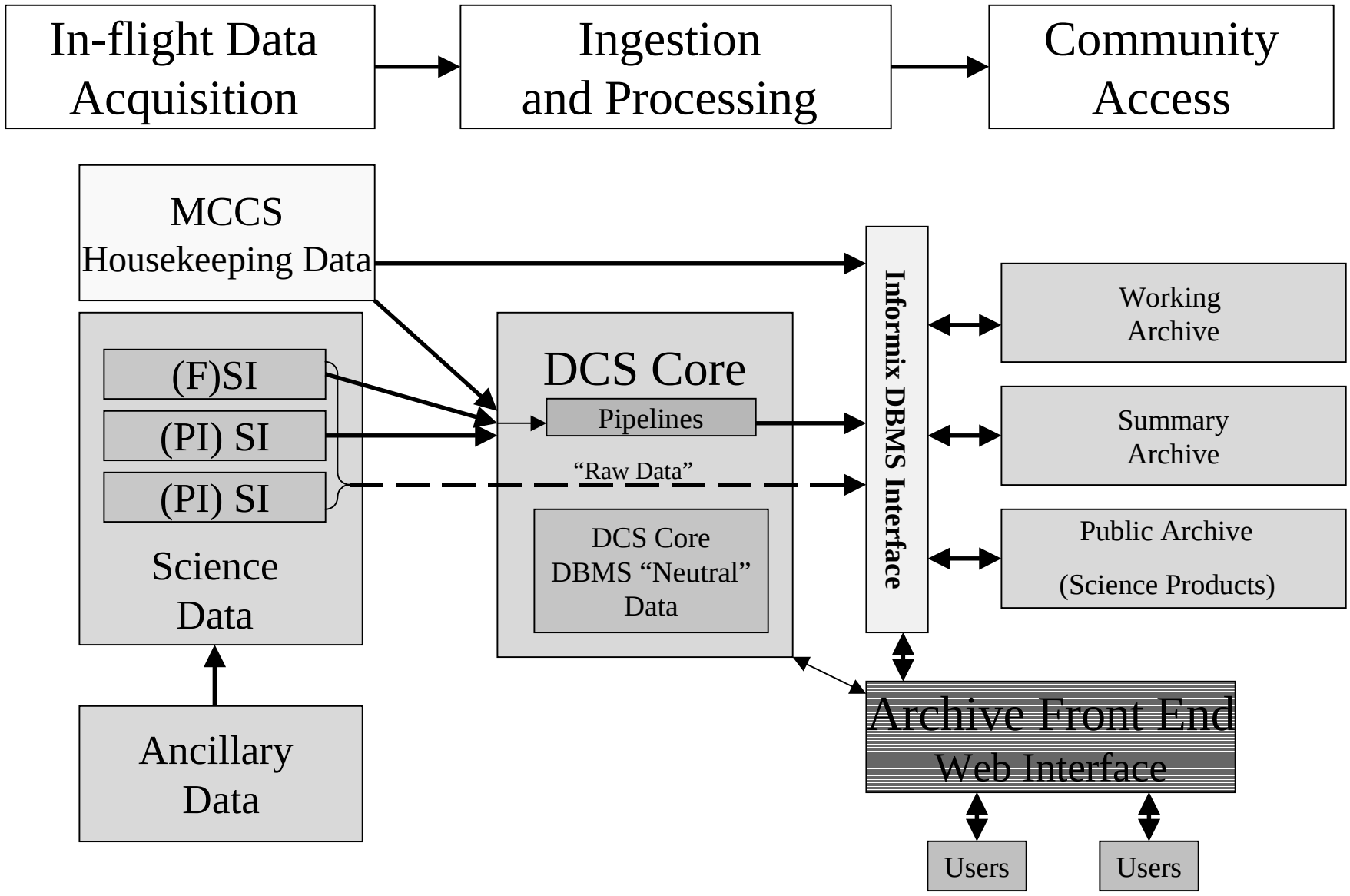
- Communication between objects distributed across the system
  - CORBA (Common Object Request Broker Architecture) selected for this task; also used in SOFIA MCS
- Extendable and flexible information exchange format
  - XML (Extensible Markup Language) selected for internal data storage and exchange
  - Data can be easily translated to and from other formats (e.g. FITS)
- Portability
  - JAVA and C++ languages

DCS Archive



Raw science data are accessible via archive in addition to pipe-reduced data and housekeeping data

DCS Data Acquisition, Processing, and Retrieval



Opportunities for IT Research and Applications

- Mine housekeeping data to:
  - Help with continuous improvement by identifying times of excellent observatory performance
  - Track health of observatory systems and predict failures
- Science data
  - Smart pipelines
  - Automated data understanding
  - Visualization
  - Innovative analysis tools