MODIS DATA SYSTEM STUDY

TEAM PRESENTATION

March 17, 1989

AGENDA

1. MODIS Data System Study Team Presentation to the MODIS Science Team (Preliminary for Review and Comment)

MODIS DATA SYSTEM STUDY TEAM

PRESENTATION TO THE

MODIS SCIENCE TEAM

MARCH 23, 1989

AGENDA

- OVERVIEW — D. Han
- HOW THE MODIS DATA SYSTEM WORKS — P. Ardanuy
  - Introduction and Configuration
  - MODIS Science Team Member Activities
  - Specific MODIS Science Team Member Scenarios — M. Andrews
- OUTSTANDING ISSUES — A. McKay
- REQUIREMENTS AND FUTURE PLANS — D. Han

OVERVIEW

- Introduction of the Study Team Members
- Role of the Science Data Support Team
- Accomplishments
- Schedule and Key Milestones

STUDY TEAM MEMBERS

–	Daesoo Han	GSFC/636
–	James Ormsby	GSFC/624
–	Lee Kyle	GSFC/636
–	Vince Salomonson	GSFC/600
–	Philip Ardanuy	RDS
–	Al McKay	RDS
–	Doug Hoyt	RDS
–	Robin Tomlinson	RDS
–	Stan Jaffin	RDS
–	Bruce Sharts	GSC
–	Dave Folta	GSC
–	Mike Andrews	GSC

ROLE OF THE SCIENCE DATA SUPPORT TEAM

- To Ensure That EosDIS Develops a System That Meets MODIS Team Member Requirements
- To Develop the MODIS Level-1 Processing Software
- To Develop the MODIS Instrument Monitoring and Characterization Software
- To Collect and Integrate Algorithms Developed by the MODIS Team Members and Deliver to the Central Data Handling Facility (CDHF)

ACCOMPLISHMENTS

- Completed Earth Location Determination Analysis
- Collected and Documented Level II Functional Requirements
- Developed Operations Concept Document
- Developed System Specification and Preliminary Design Document
- Coordinated With HIRIS Instrument Team to Develop HIRIS/MODIS Level I Functional Requirements Document and MODIS/HIRIS Commonality Report
- Collected Requirements on Data from Proposals and Produced MODIS Data Product Table and Data Product Analysis Report

SCHEDULE AND KEY MILESTONES

- Non-Advocacy Review: June 1989
- Phase C/D of MODIS Data Support Contract Award: December 1990
- Delivery of Initial Algorithm with Complete Documentation From Team Members to the Science Data Support Team: December 1994
- Delivery of Integrated MODIS Data Processing Software With Complete Documentation to EosDIS: December 1995
- Launch of NPOP-1: December 1996

HOW THE MODIS DATA SYSTEM WORKS

(team members' requirements will determine how the data system works)

- Introduction and Configuration
- MODIS Science Team Member Activities
- Specific MODIS Science Team Member Scenarios

INTRODUCTION AND CONFIGURATION

- Data Types
- Data Processing and Handling Priorities
- The MODIS Data Flow From Instrument to User
- Context and Data Flows for the MODIS Data System
- Functional Allocations within the MODIS Data System
- Context and Data Flows for the Team Member Computing Facility
- Functional Allocations within the Team Member Computing Facility

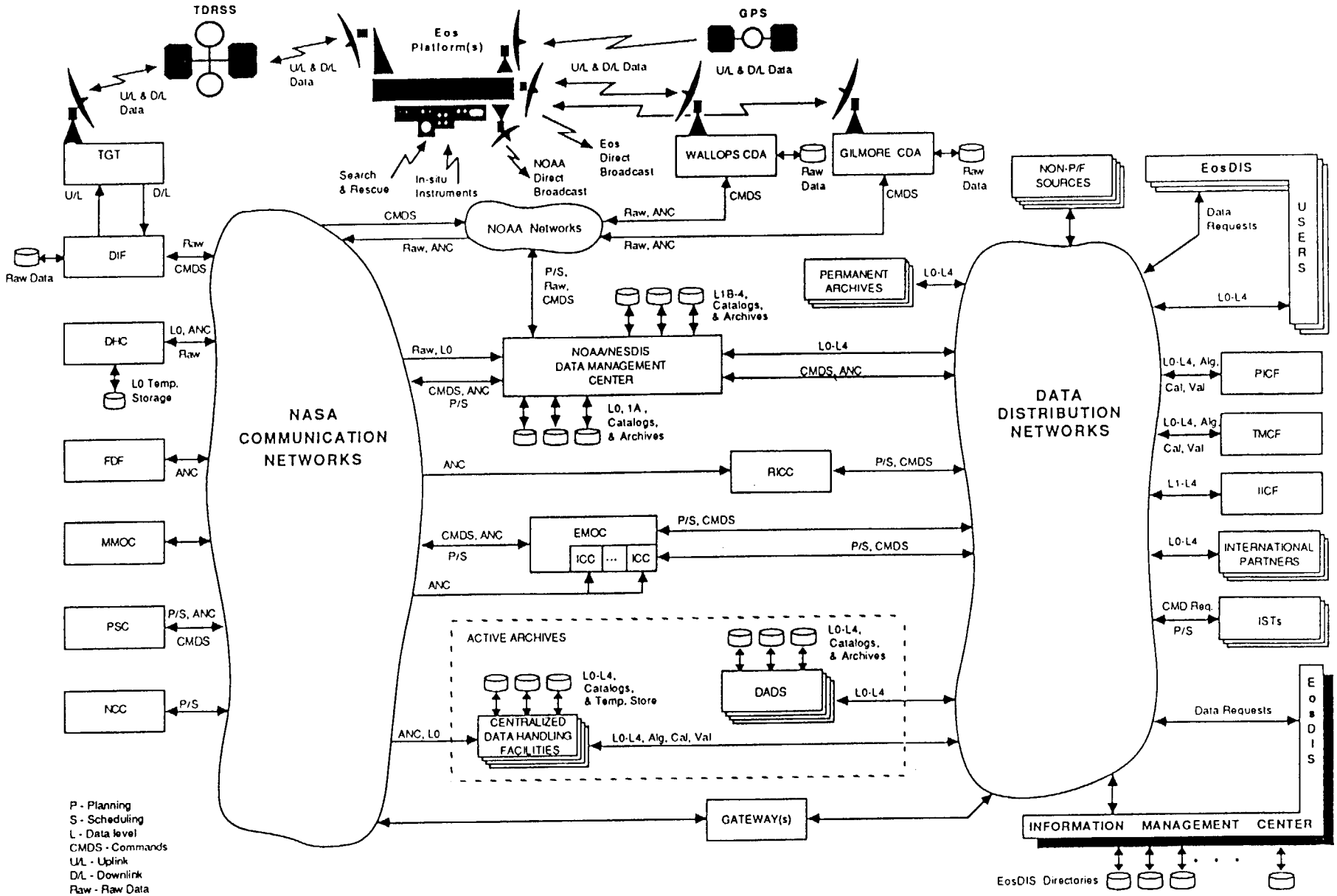
DATA TYPES

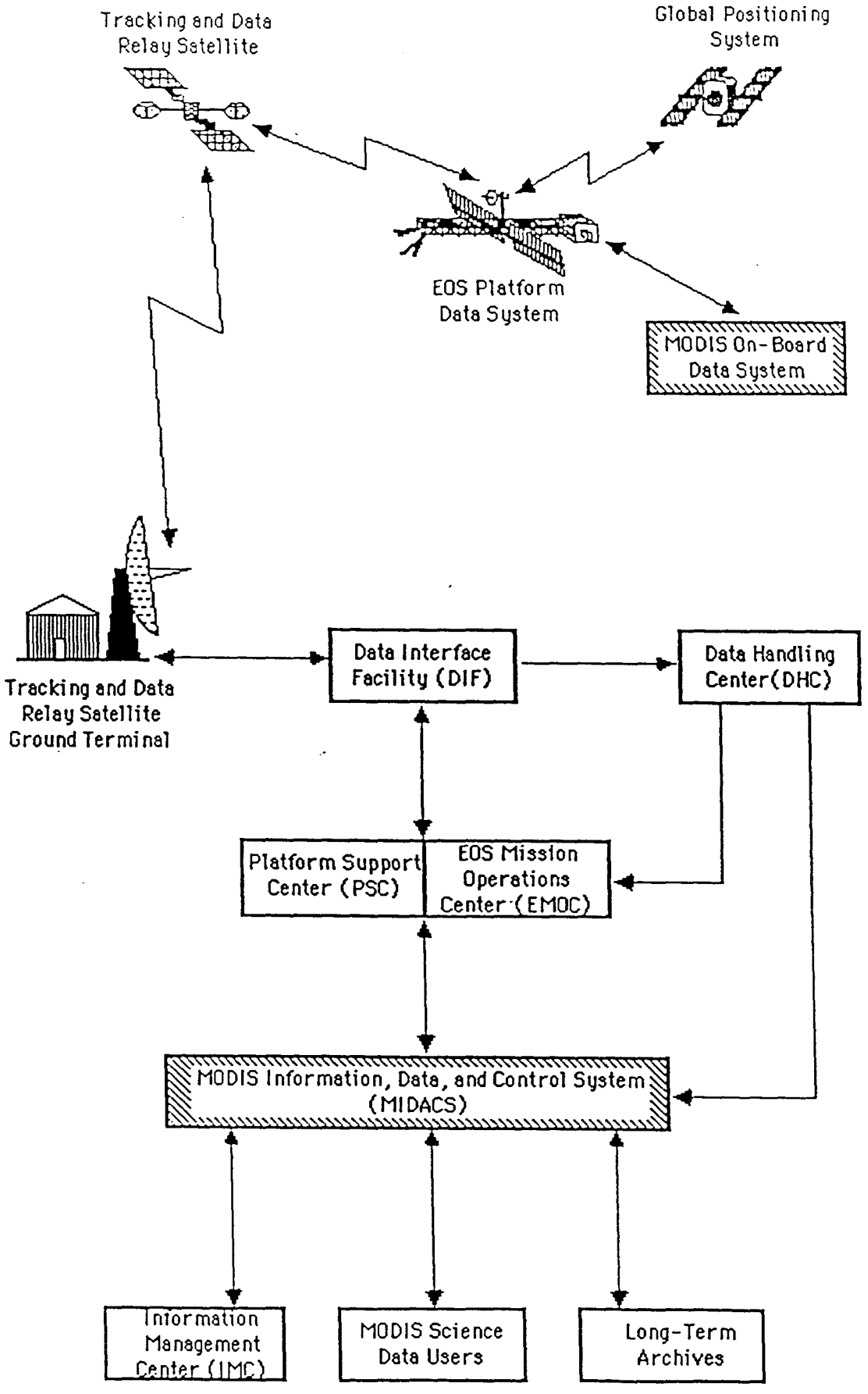
- Standard versus Specialized Data
- Instrument and Geophysical Data
  - Level-1
  - Level-2
  - Level-3
  - Level-4
- Browse Data
  - Level-1 and -2 FOV Browse
  - Level-3 Global Coverage Browse
  - Level-3 Regional Browse
- Metadata

DATA PROCESSING AND HANDLING PRIORITIES

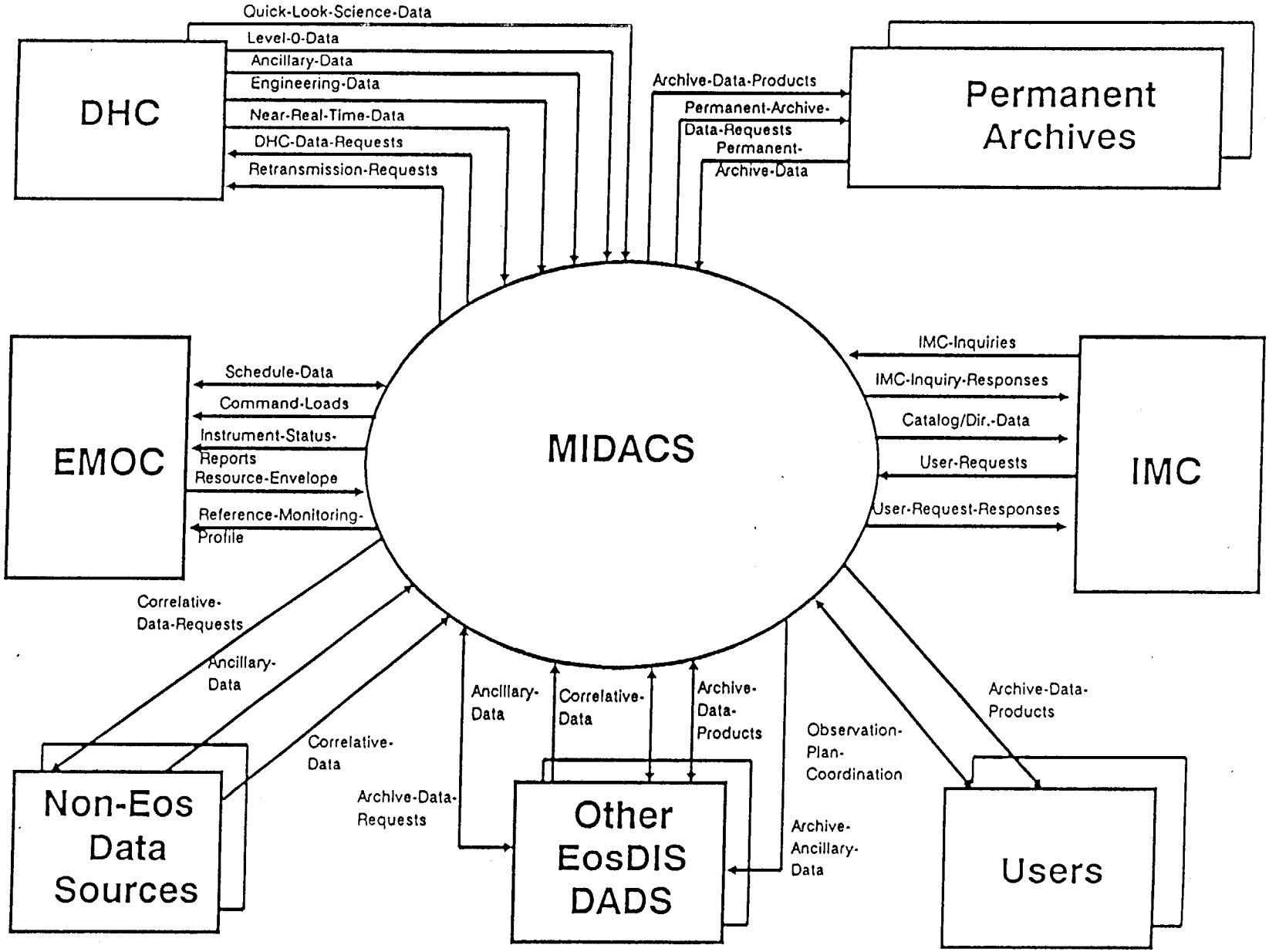
- Routine Processing
  - Level-0 (24 hours)
  - Level-1 (48 hours)
  - Level-2 (72 hours)
  - Level-3 (96+ hours)
  - Level-4 (1 week?)
- Near-Real-Time Processing
  - Field Experiment Support
  - Three to Eight Hours After Observation
- Real-Time Processing
  - Instrument Monitoring
  - Limited Field Experiment Support
  - Within One-Half Hour of Observation
  - (Some Data May be Tape Recorder Dump?)

PRELIMINARY EosDIS CONCEPT DIAGRAM

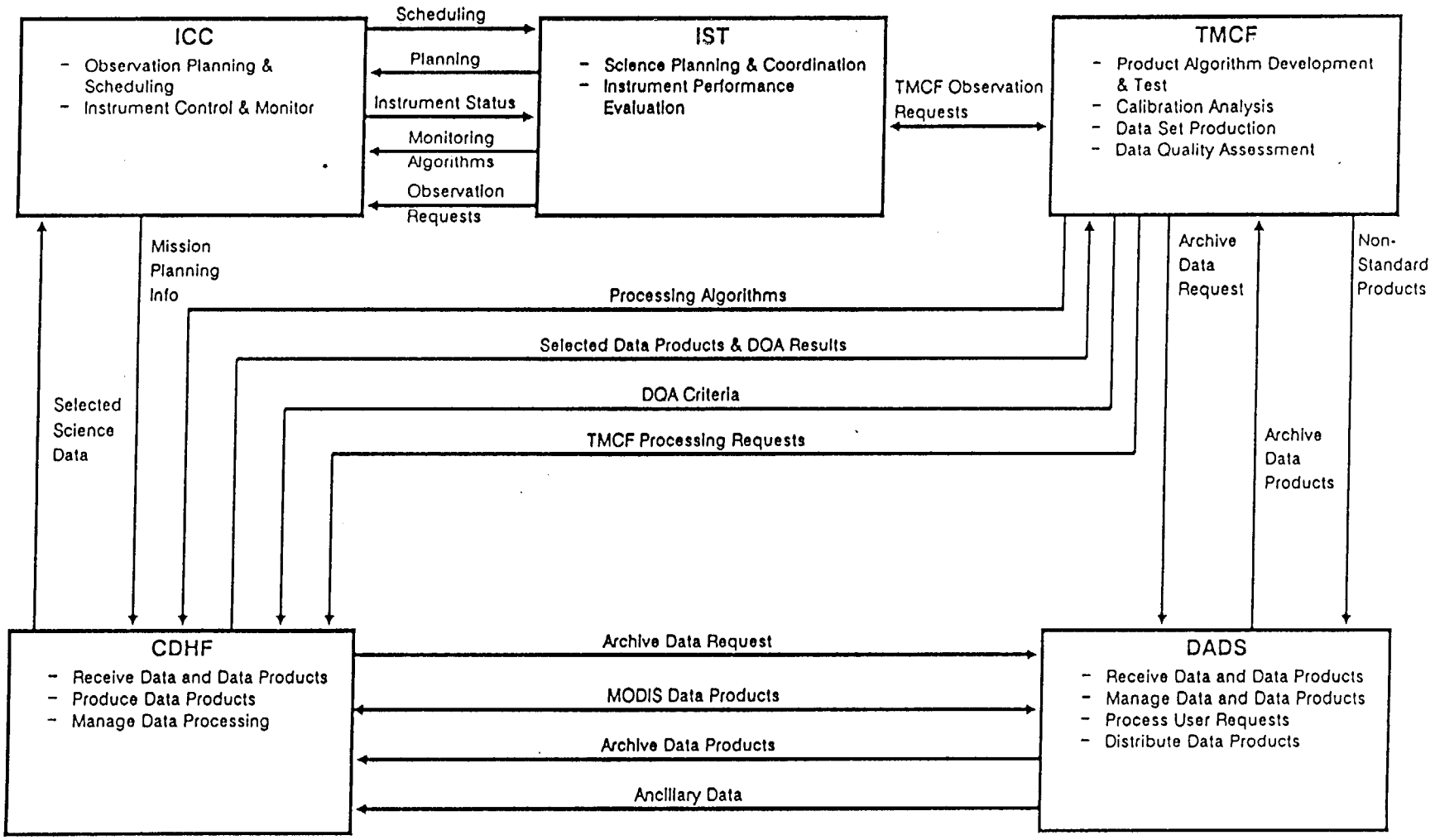




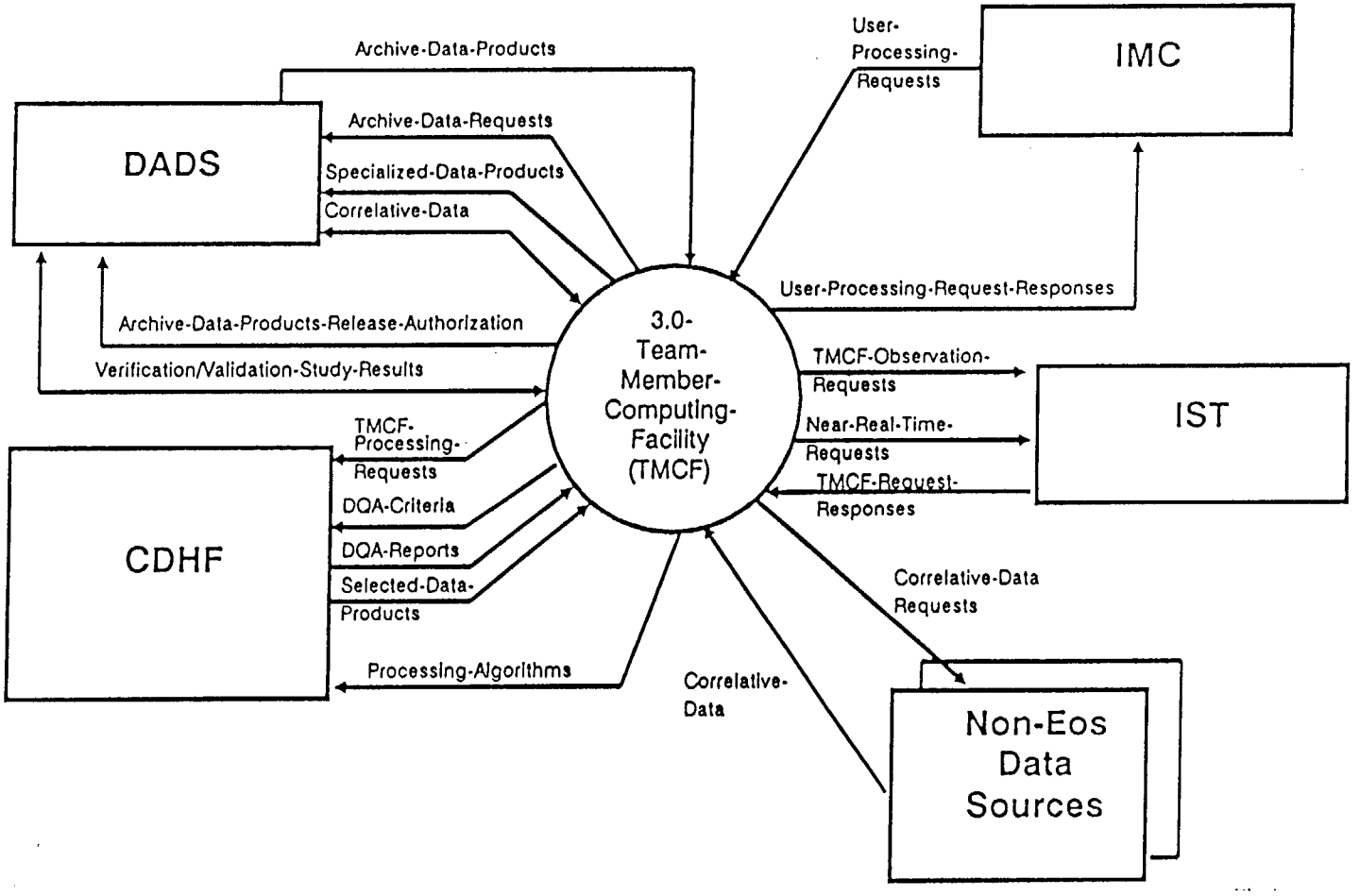
MODIS Data Flow From Instrument to User



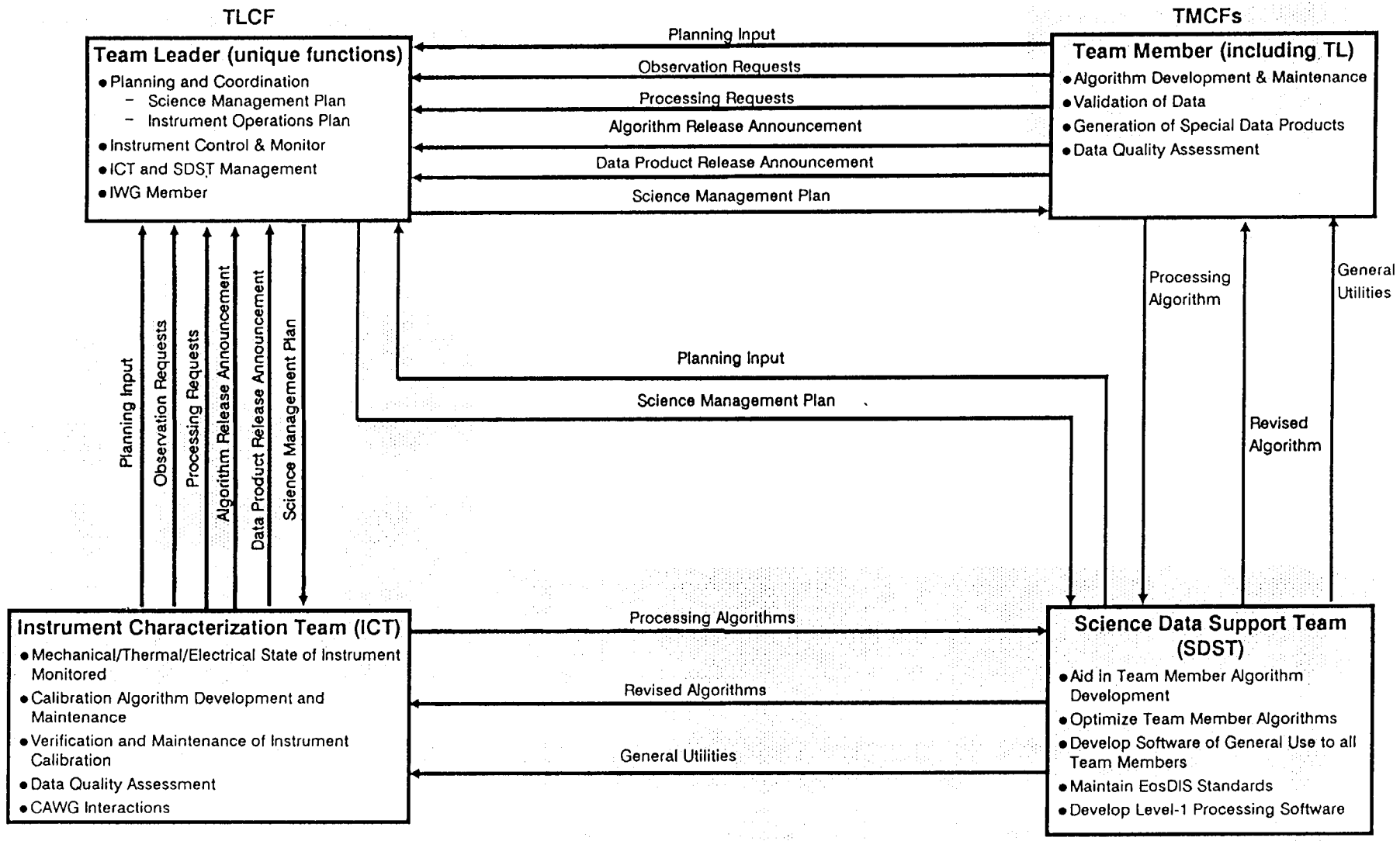
MIDACS Context Diagram



MIDACS Functional Allocation Diagram



The TMCF Context Diagram



TMCF Functional Allocation Diagram

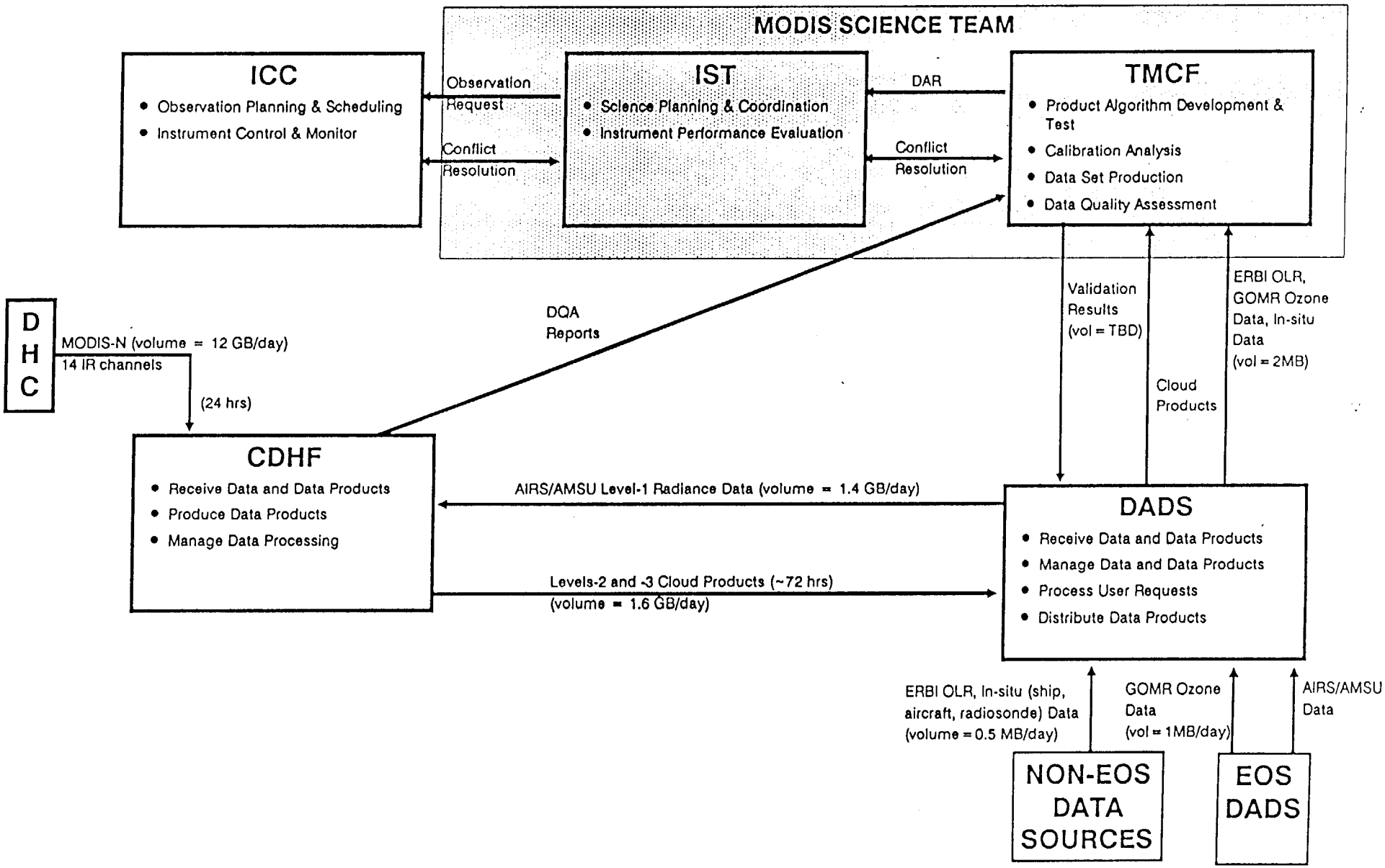
MODIS SCIENCE TEAM MEMBER ACTIVITIES

(team members' requirements will determine how these activities are supported)

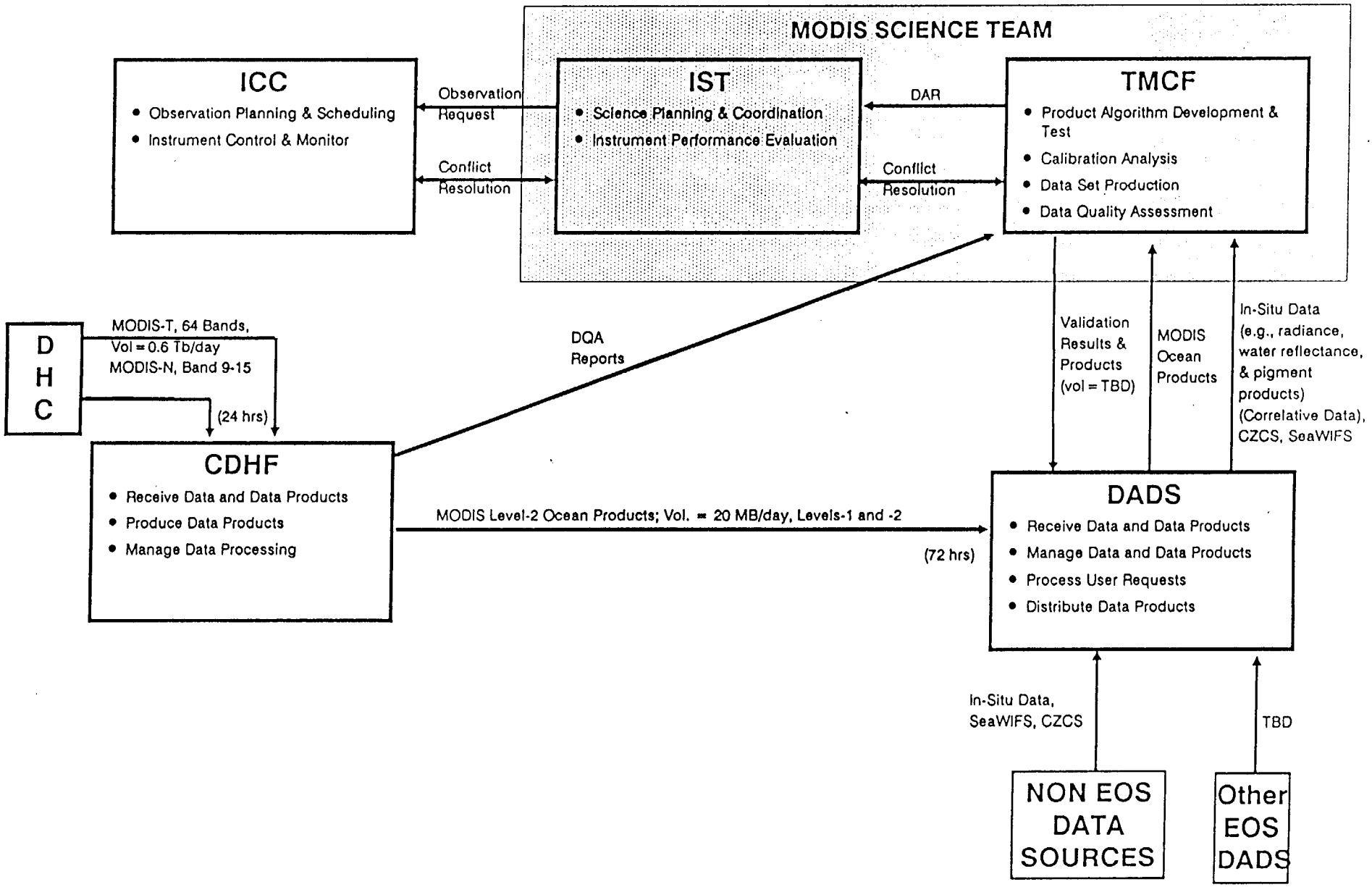
- Team Member Planning and Coordination
- Data Acquisition
- Develop and Maintain Algorithms
- Produce and Archive Special Data Products
- Perform Correlative and Modeling Studies
- Maintenance of the MODIS Calibration

SPECIFIC MODIS SCIENCE TEAM MEMBER SCENARIOS

- Specific Scenario Illustrating Routine Interactions
  - Atmosphere
  - Ocean
  - Land (Snow)
- Specific Scenario Illustrating Targets of Opportunity
- Specific Scenario Illustrating Field Experiments
- Specific Scenario Illustrating MODIS Calibrations
- Specific Scenario Illustrating Algorithm Development and Implementation



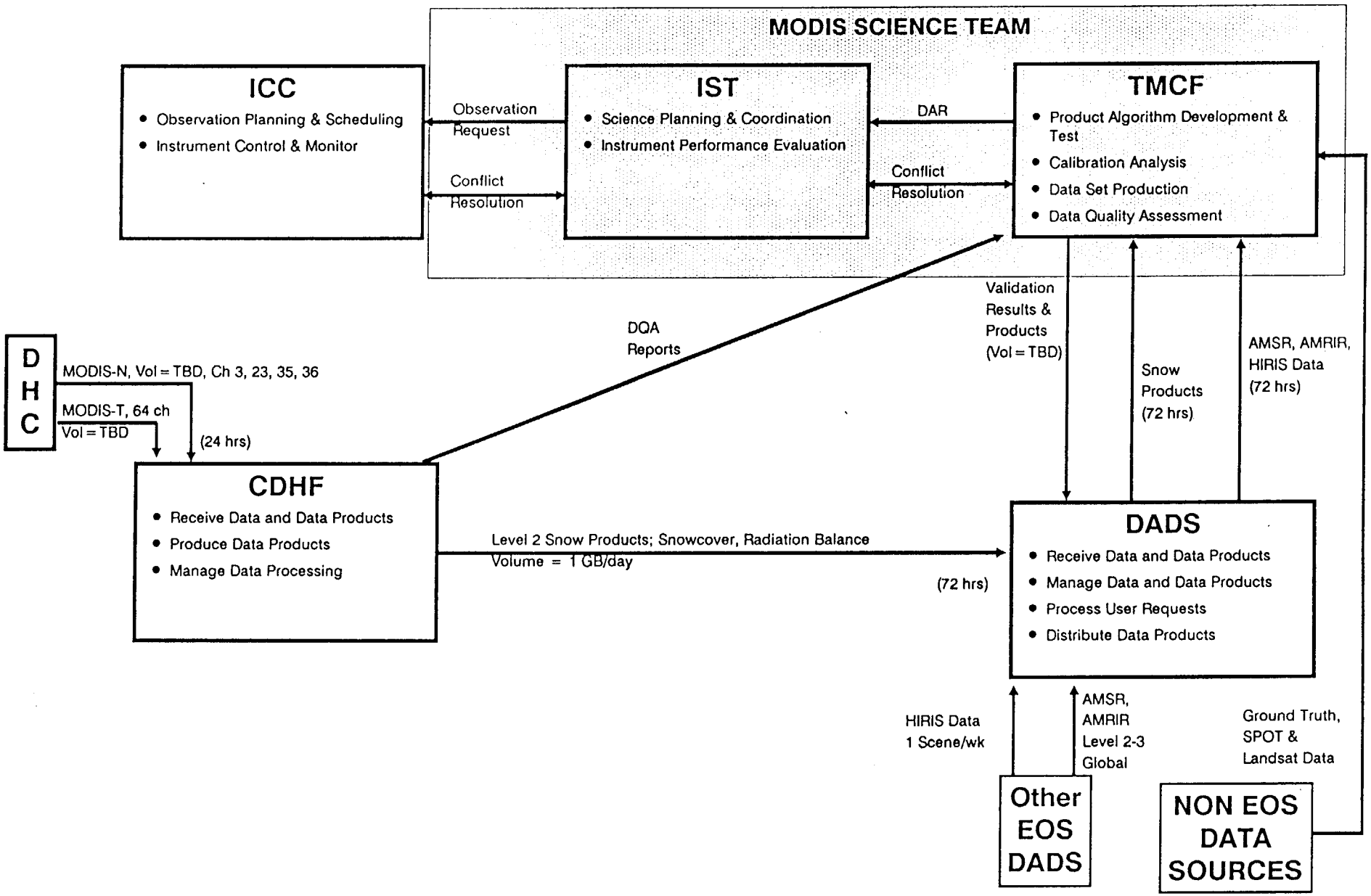
Routine Interaction Scenario for Atmosphere



Routine Interaction Scenario for Ocean

ROUTINE INTERACTION SCENARIO FOR SNOW

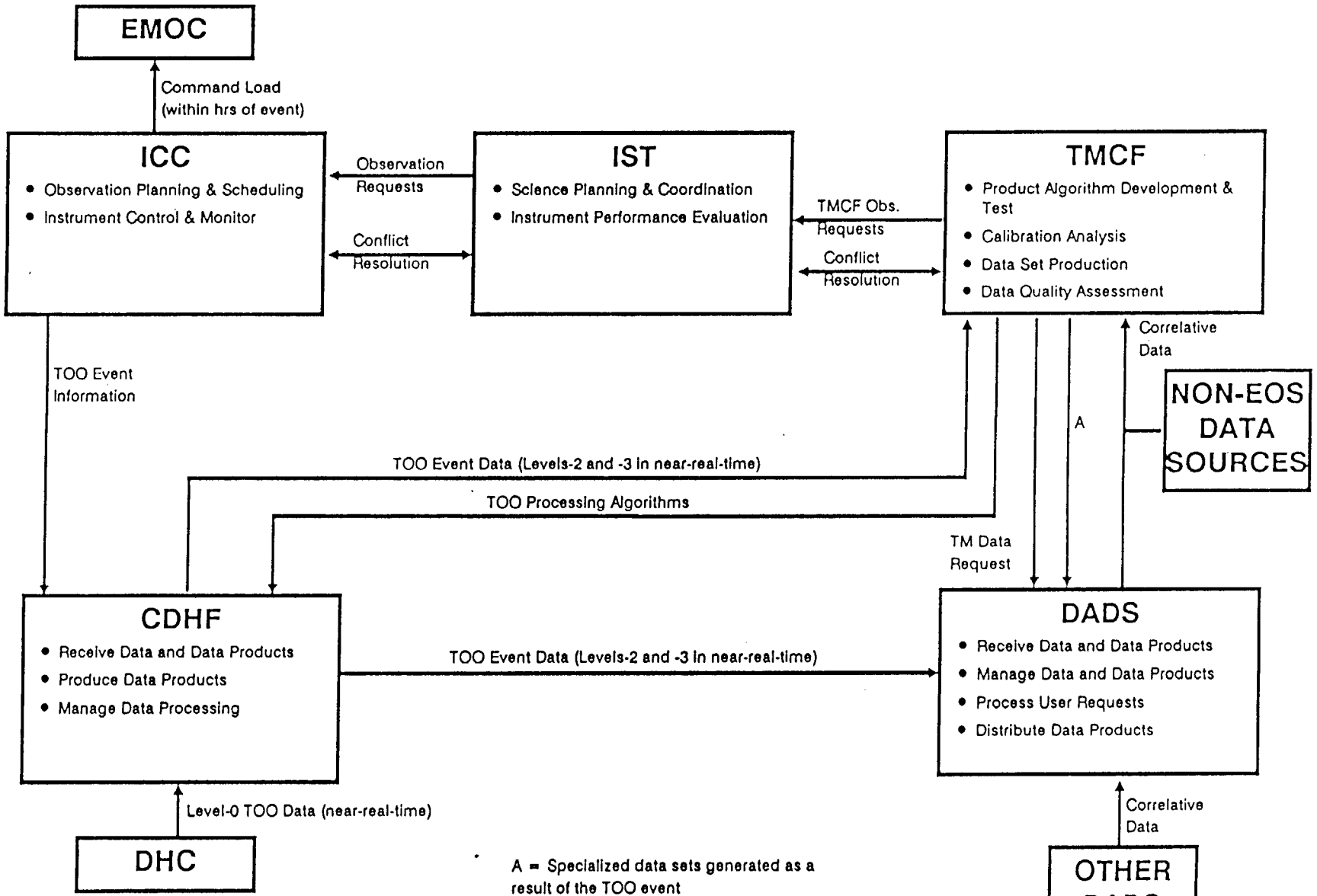
- Algorithms Previously Developed and Implemented on CDHF
- Data Collected as Part of Routine Observation in Response to Standing Order
- Data Processing is Automatically Done Without Team Member Involvement
- DQA Will Be Performed on all Data Products
- Data Products, Through Level-2, Produced and Archived at DADS Within 72 Hours
- All Data Archived in the DADS are available to the General Public
- Team Member Obtains Data From the DADS



Routine Interaction Scenario for Snow

TARGET OF OPPORTUNITY SCENARIO

- Explosive Eruption of Mt. St. Helens (Hypothetical)
- Team Leader Modifies Planned Observations
- Existing, Previously Certified Algorithms are Activated on the CDHF
- Near-Real-Time Processing Done on CDHF
- MODIS Data Sent Directly to TMCF
- Other EOS Data Obtained Through DADS
- All Analysis Results Archived in DADS

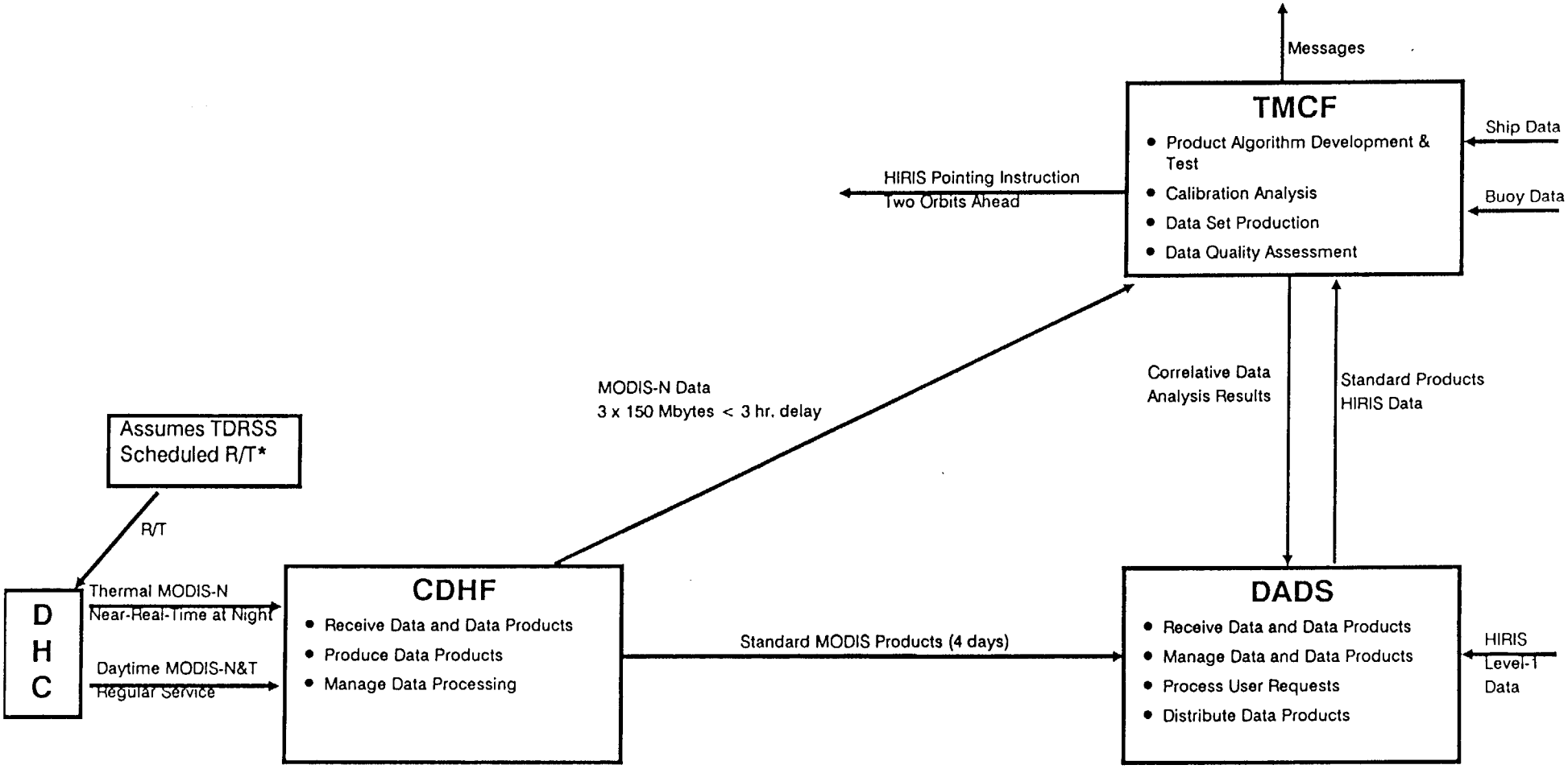


Target of Opportunity Scenario

FIELD EXPERIMENT SCENARIO

- Coordinated Observation of Gulf Stream Atlantic Ocean Interaction (Hypothetical)
  - Three MODIS Team Members
  - Two Research Institutes
- Significant Planning, Scheduling, and Algorithm Development Required
- Data From Thermal Channels of MODIS-N at Night Used to Guide Experiment the Next Day
  - HIRIS Pointing
  - Buoy Deployment
  - Ship Movements
- Near-Real-Time Level-1 Processing on CDHF to Pass the Data to TMCF

- Team Member Processes Data on TMCF and Issues Messages and Instructions
- All Analysis Results Archived in DADS

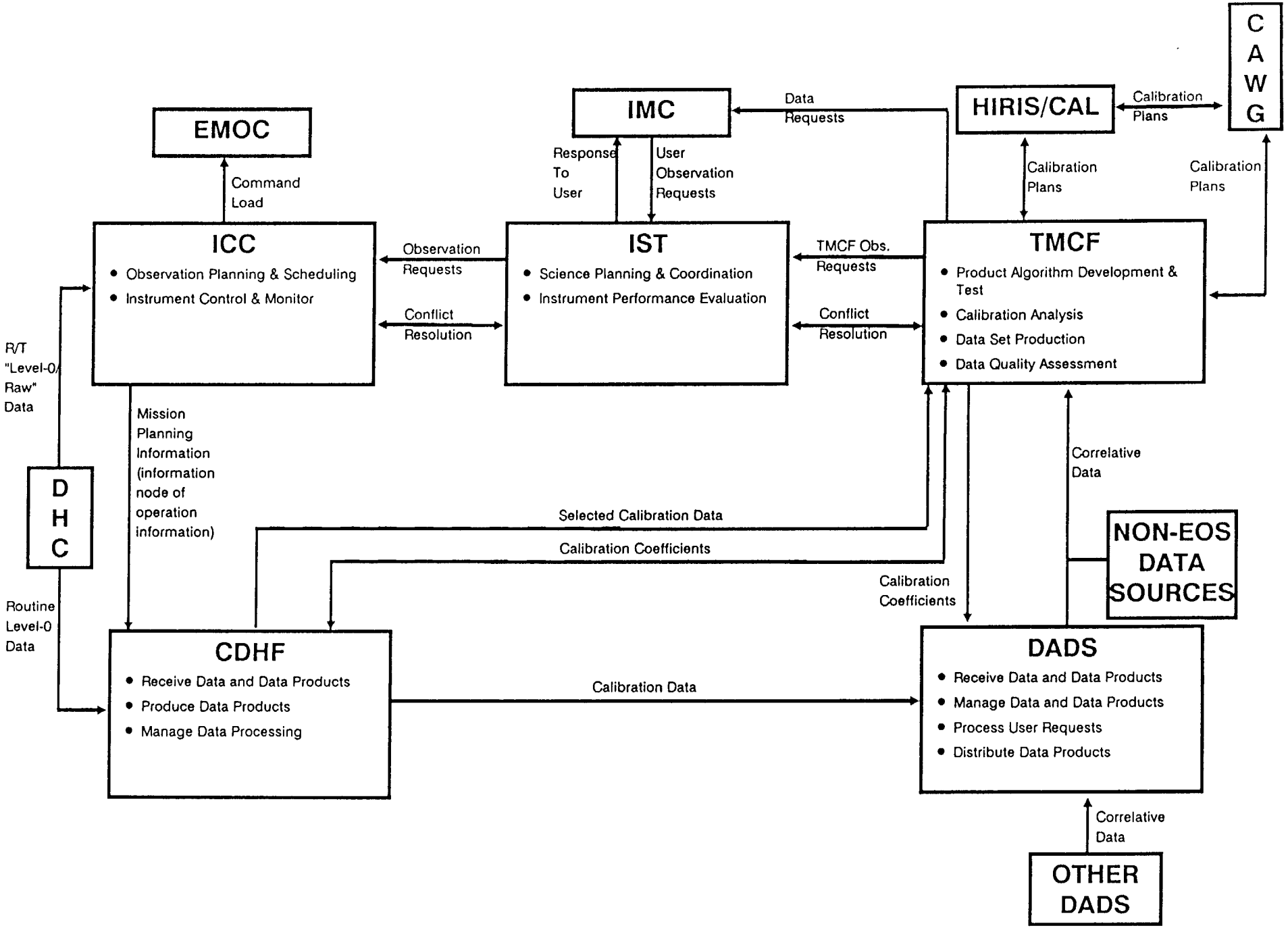


*In general, however, TDRSS may not be scheduled and data will be tape recorder playback

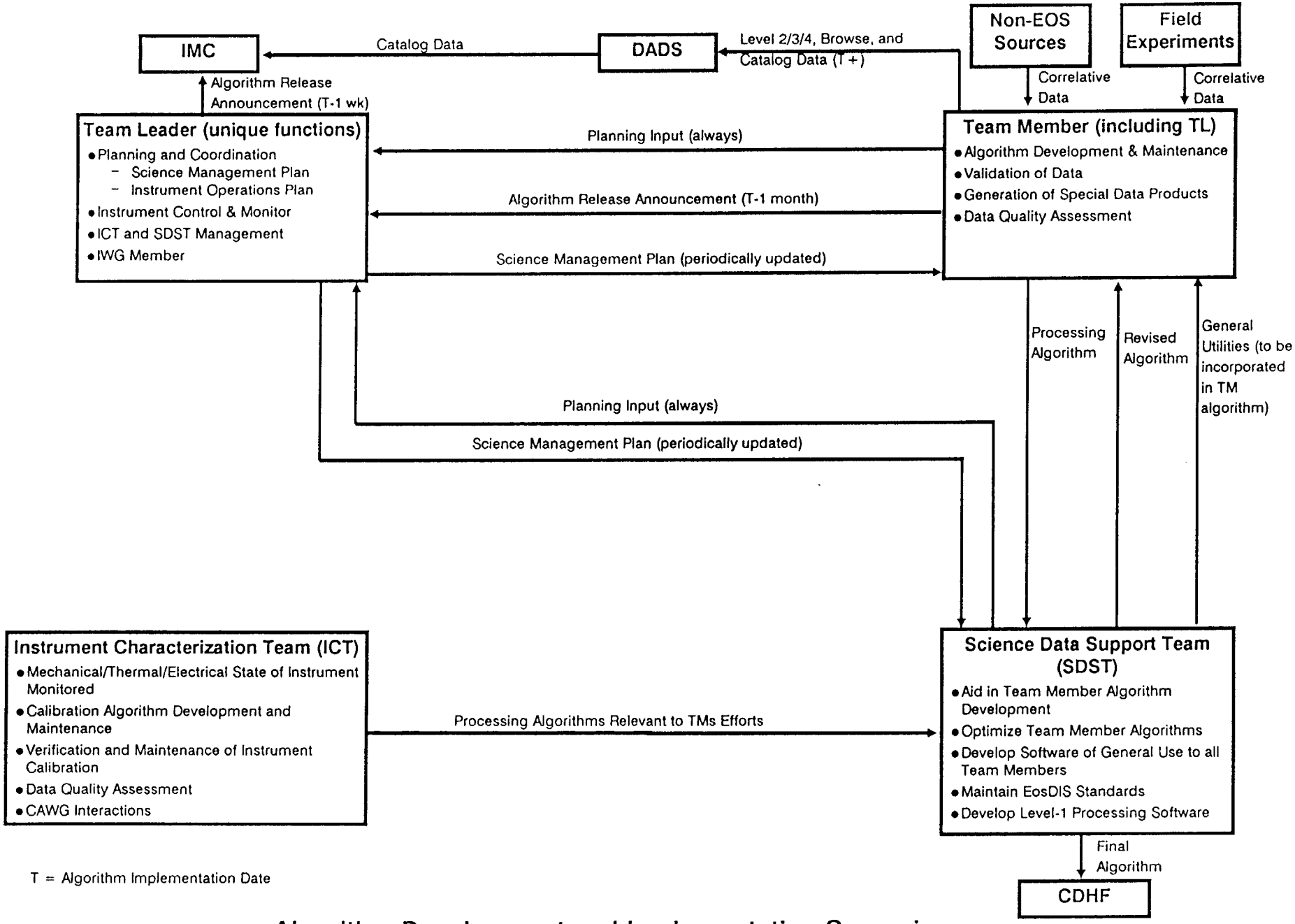
Field Experiment Scenario

CALIBRATION SCENARIO

- Anomaly is Detected and the ICT is Notified
- ICC Monitors Engineering Data in Real-Time and Selected Science Data in Real-Time or Near-Real-Time
- Special Calibration Observations are Scheduled
- Routine Processing is Performed on Calibration Data to Determine Calibration Coefficients
- New Calibration Coefficients are Put Into Use and Archived at the DADS



Calibration Scenario



Algorithm Development and Implementation Scenario

OUTSTANDING ISSUES

- Data Completeness Requirements for MODIS Level-0 Data
- Interdependence of MODIS and Other EOS Products
- Field Experiment Support
- Data Block Identification
- Interdependence of MODIS and Other Instrument Control Plans
- Use of Existing Facilities for TMCF Functions
- Processing and Availability of Instrument Monitoring Data
- Data Attributes Used for Data Selection
- Timeliness of DADS Response

DATA COMPLETENESS REQUIREMENTS FOR MODIS LEVEL-0 DATA

- Several problem events can affect the operation of the data system that returns MODIS instrument data to the ground for processing

- Truly random errors that affect all data equally may be more tolerable than systematic errors

- The EosDIS Level-I Requirements Document establishes a goal for data completeness but not a firm requirement. "The EosDIS shall deliver, as a goal, at least 99.8% of the data acquired by the NOAA/Eos payloads to the intended ground destinations" [paragraph 2.2.1 (k)].

- Those associated with the development of the data system have repeatedly expressed the opinion that the actual performance achieved by the system will be far below the announced goal.

QUESTIONS:

- What level of completeness or guarantee of delivery does the Science Team require for data used to support field experiments? (99.8%, 99%, 95%, 90%, or 50%?)

- What level of completeness is required for routine MODIS data routinely used to generate Standard and Specialized MODIS Data Products? (99.8%, 99%, 95%, 90%, or 50%?)

- What level of data completeness is acceptable for data used to generate temporal or spatial averages? (99.8%, 99%, 95%, 90%, or 50%?)

INTERDEPENDENCE OF MODIS AND OTHER EOS PRODUCTS

- Besides the assumed dependence of MODIS Level-2 parameters on basic MODIS Level-1 data (radiances), MODIS products may possibly depend on any level of other instrument data as shown by the dashed lines in the figure. Within the MODIS data system, interdependencies between various MODIS data products may also exist

- The MODIS data team requires a precise statement of product dependencies from the MODIS science team

- From information available in the proposals, the data team has prepared a preliminary summary of MODIS data products that includes columns for other MODIS and other Eos data products on which the listed product may depend

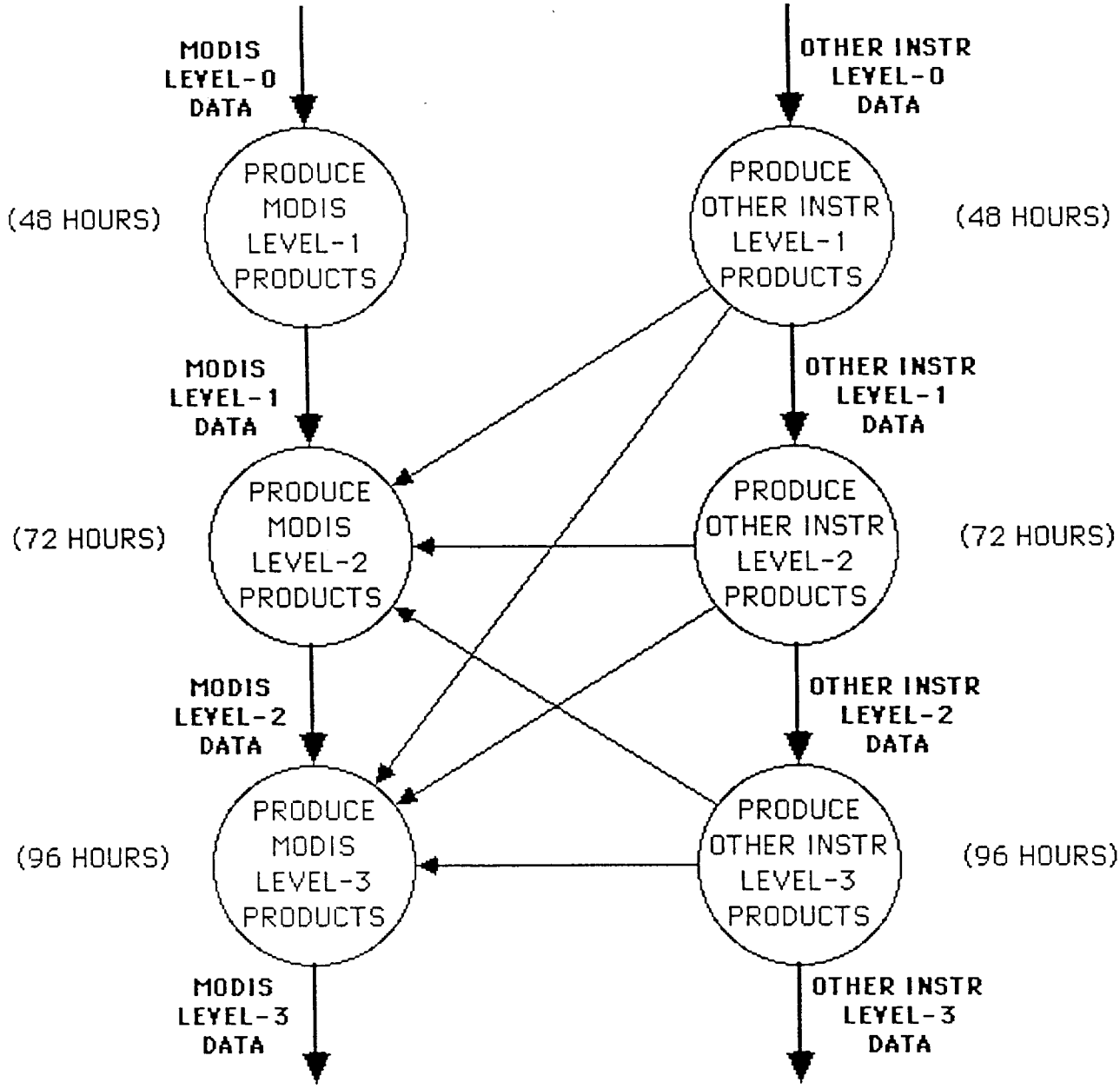
- Please review the information supplied for your products

QUESTIONS:

- Is our listing of your proposed products complete and accurate?

- If your product depends on other Eos data as input, what level of that data product do you expect to use? Who is the principal investigator for that product?

- Do you know of any other instrument Eos products that depend on your products as input?



POTENTIAL INTERDEPENDENCE BETWEEN MODIS AND OTHER INSTRUMENT DATA PRODUCTS

FIELD EXPERIMENT SUPPORT

- Field experiment support imposes several unique requirements on the MIDACS. Since data products may be required in less than the usual processing turn-around time, one issue relates to the required timeliness of supporting data products. Another issue relates to the nature of required support products and the development of any specialized processing algorithms that may be required to meet special requirements. Also, field experiments may require unique data communications facilities to deliver data to required locations. The following questions apply.

QUESTIONS:

- What MODIS data do you require to support projected field experiment activities?
- Will MODIS standard or specialized data products meet your needs?
- Will specialized data processing be required? Can specialized processing be done at your TMCF or will other MIDACS hardware or software support be required?
- Do you require data or data products from other Eos instruments? How quickly after initial data acquisition do you require finished field experiment support products?
- Do you project special data communications requirements for the delivery of field experiment data to required locations?

DATA BLOCK IDENTIFICATION

- In the past it has sometimes been required that all data blocks within a data system be appended with descriptive headers containing complete metadata for the data block in question. This facilitates the accounting process and means that nearly all data, regardless of inadvertance, can be identified and used wherever it is located within the data system. The question of data identification may particularly affect programming and operations at the TMCFs where all EosDIS data will be remotely accessed and a variety of data types and sources will be present at the facility.

QUESTIONS:

- Is such a requirement appropriate for the MIDACS?
- What data would you like to see included in the headers?
- Would identification be required only at data system interfaces where data is transferred from one system component to another, or would such a requirement also apply to the various data blocks as they are processed within the various data processing facilities?

INTERDEPENDENCE OF MODIS AND OTHER INSTRUMENT CONTROL PLANS

- Since some MODIS data products are generated from one or more other Eos instrument products, coordinated operation among the affected instruments may be required to obtain observations for the generation of combined products.

These are some questions which the MODIS Science Team Members should keep in mind when interacting with EosDIS

- Does the appropriate acquisition of data to produce any of your data products require coordinated operation among several Eos instruments?

- Do you know of other instrument Eos products that require coordinated operation from the MODIS instrument?

- Does the MODIS data system need to take account of the needs of other Eos and non-Eos instruments in planning data acquisition operations for "targets of opportunity"?

USE OF EXISTING FACILITIES FOR TMCF FUNCTIONS

- In some cases, the investigator may already possess computational facilities at his home institution that he will use to provide some or all of the MODIS TMCF functions. A number of questions arise concerning the integration of such facilities into the MIDACS and EosDIS.

These are some questions which the MODIS Science Team Members should keep in mind when interacting with EosDIS

- What system hardware do you have?
- What additional data system hardware do you require to perform the MIDACS TMCF function at your facility?
- Do you require additional software to perform this function? What operating environment(s) can you support?
- Do you anticipate that you can provide all routine TMCF functions at your facility? Do you need exceptions in the projected TMCF data flows to accommodate operation at your facility?
- Can you complete algorithm development at your facility, or will you require support from the CDHF for the final stages of algorithm development and implementation? Will you require access to the CDHF for the routine production of some Specialized-Data-Products?

- Do you have sufficient processing capacity to produce some Standard-Data-Products at your facility if it were deemed desirable because of software or other considerations?

- What data communication and distribution media can you support at your facility? What communication and distribution media would you like MODIS to support and use?

PROCESSING AND AVAILABILITY OF INSTRUMENT MONITORING DATA

- The MIDACS, as an EosDIS-unique element, must sustain and maintain the control of the MODIS instrument in support of the coordinated science plan. To satisfy these support requirements, the instrument operations team (IOT) located in the Instrument control Center (ICC) will provide the control and monitoring functions for health and safety. The performance of the instrument data collection will also be monitored. The ICC will receive a percentage of science data from the DHC in a priority mode with minimal time delays from data downlink to reception by the ICC.

These are some questions which the MODIS Science Team Members should keep in mind when interacting with EosDIS

- Does a requirement exist for the near real-time monitoring of science data. In particular, is there a Team Member requirement for the sorting, buffering, selecting of science channels, processing the selected data, and storing the data to be performed only at the ICC?

- Is such a requirement dependent upon where the science data is selection is performed (e.g., ICC versus the DHC)?

- Will the Team Members require that this data be processed as a high level product before display and/or analysis?

- If this is a requirement, what is the expected volume of science data to be monitored on a daily basis by the IOT?

DATA ATTRIBUTES USED FOR DATA SELECTION

- The storage of data products in the DADS necessitates the use of data attributes to support the retrieval of data by the Team Members. These data attributes, called metadata, will be stored at the DADS with a copy sent to the IMC. To retrieve data, the Team Member will access the DADS either directly or through an interface with the IMC. A query language or menu will be used to identify and locate the selected data products based on the archived metadata. After selection, the requested data will be distributed.

These are some questions which the MODIS Science Team Members should keep in mind when interacting with EosDIS

- Are special attributes required for the selection of data which have been placed in active archives?
- Do the Team Members require a specific amount of data selection criteria for data retrieval?
- What specific attributes would Team Members like to have available to them?
- Are there any requirements to retrieve data from the DADS other than the methods stated above?

TIMELINESS OF DADS RESPONSE

- The production and scheduling of catalog query and archive data products is performed by the DADS. A preliminary pole of response time requirements indicates the following. For 90 percent of the time, the first data set requested is currently expected to be retrieved for DADS-resident data (on-line) within 100 seconds. If off-line data is involved, the first data set retrieval may take 30 minutes. Depending on the size of the data set requested and if it is on-line, the complete retrieval process may take up to three days. This is also expected for data retrieved from other EosDIS DADS. Standard orders are processed according to their periodic scheduled execution times, that is, routinely retrieved and distributed.

These are some questions which the MODIS Science Team Members should keep in mind when interacting with EosDIS

- What is the Team Member requirement for the acceptable delay in making routine products available from the DADS?

- Does the Team Member require or anticipate situations where data must be brought on-line and distributed quickly?

REQUIREMENTS AND FUTURE PLANS

- List of Deliverables and Milestones
- Team Member Feedback on Preliminary Data Product Description
  - Data Product Tables
  - Data Product Fact Sheets
- Team Member Feedback on Preliminary Field Experiment Description
  - Field Experiment Tables
  - Field Experiment Fact Sheets

- Information is Required from MODIS Science Team to:
  - Ensure That EosDIS Develops a System That Meets MODIS Team Member Requirements
  - Develop the MODIS Level-1 Processing Software
  - Develop the MODIS Instrument Monitoring and Characterization Software
  - Collect and Integrate Algorithms Developed by the MODIS Team Members

FUTURE DELIVERABLES OF THE MODIS DATA SYSTEM STUDY

PRELIMINARY MODIS DATA REQUIREMENTS DOCUMENT (MARCH 1989)

Purpose: To document the description, path, requirements, attributes, and impacts of all data types required by the MODIS data system to fulfill the requirements of the MODIS science team.

NON-ADVOCACY REVIEW MATERIALS (MARCH 1989)

Purpose: To support the Eos nonadvocacy review in the area of the MODIS data system, science team requirements, and proposed data products.

MODIS DATA SYSTEM SCENARIO FOR SCIENCE TEAM MEMBERS (APRIL 1989)

Purpose: To introduce to the MODIS science team members the present concept of how the MODIS data system will support their proposed activities.

PRELIMINARY TEAM MEMBER SCIENCE DATA PRODUCT SUMMARY (MAY 1989)

Purpose: To summarize, consolidate, and categorize the joint set of MODIS data products proposed by the science team members.

PRELIMINARY INPUT DATA ATTRIBUTES REPORT (JUNE 1989)

Purpose: To identify, quantify, and document the set of attributes for all ancillary and auxiliary input data required to generate the proposed MODIS data products.

PRELIMINARY MODIS DATA PRODUCT ALGORITHM REPORT (JULY 1989)

Purpose: To identify, quantify, and document the set of algorithms required to generate the proposed MODIS data products.

TEAM MEMBER DATA PRODUCT ANALYSIS REPORT (AUGUST 1989)

Purpose: To document the functional and performance requirements on the ground data system.

MODIS SDST REQUIREMENTS DOCUMENT (SEPTEMBER 1989)

Purpose: To document the functional and performance requirements on the Science Data Support Team (SDST) within the MODIS TLCF.