

MODIS DATA SYSTEM STUDY

TEAM PRESENTATION

August 12, 1988

AGENDA

1. Status of the MODIS Phase-B Data System Study
2. Potential Resource Bottlenecks
 - Capacity of the Onboard Local Area Network
 - Space-to-Ground Communications Link
 - Onboard Mass Storage
 - Onboard Processor
3. Action Items

STATUS OF THE MODIS PHASE-B DATA SYSTEM STUDY

1. Documentation Delivered in July

- a. EosDIS Architecture Review**
- b. MIDACC Planning and Scheduling Operations Concept**
- c. Level-1 Data Requirements**
- d. Level-1 Processing Operations Concept**
- e. MIDACC Operations Concept**

2. Documentation to be Delivered in August

- a. Preliminary Operations Concept**
- b. System Performance Requirements**
- c. MIDACC External Interface Report**
- d. Level-2/3 Data Processing Operations Concept**
- e. CDHF Operations Concepts**
- f. Preliminary Functional Requirements Document (August 15)**

MODIS DATA SYSTEM STUDY
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Summary of Deliverables

ORIG. APPUL. 06/24/88
 LAST CHANGE 08/01/88
 STATUS AS OF 08/01/88

MILESTONES	88					89					90					91																	
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M									
01 WBS Study Plans	▼																																
02 Prelim User Data Prod Req'ts		▼																															
03 Preliminary Operations Concept			▼																														
04 Functional Requirements Doc				▼																													
05 Prelim Data Processing Plan					▼																												
06 Prelim Data Requirements Doc						▼																											
07 Prelim System Specification							▼																										
08 Operations Concept								▼																									
09 Conceptual Design Doc									▼																								
10 Draft Calibration Plan										▼																							
11 Draft Data Processing Plan											▼																						
12 Draft Instrument Oper'ns Plan												▼																					
13 Data Requirements Doc													▼																				
14 Database Specification														▼																			
15 System Specification															▼																		
16 Program Specification																▼																	
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Note:

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MBS - 2000

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ORIG. APPUL. 07/01/88
 LAST CHANGE 07/01/88
 STATUS AS OF 08/01/88

MILESTONES		88						89						
		J	J	A	S	O	N	D	J	F	M	A	M	
01	2000 Req'ts Anlysis Study Plan	█	█											
02	2100 User Data Product Req'ts	█	█											
03	2200 MIDACC Operations Concept	█	█											
04	2300 MIDACC Operations Req'ts			▽										
05	2400 System Performance Req'ts			▽										
06	2500 MIDACC Functional Req'ts				▽									
07	2640 Prelim L4 Requirements					▽								
08	2650 Prelim Data Requirements						▽							
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Note: 1 - Required Deliverable

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WBS 3000

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ORIG. APPUL. 07/01/88
 LAST CHANGE 07/01/88
 STATUS AS OF 08/01/88

MILESTONES

		88						89					
		J	J	A	S	O	N	D	J	F	M	A	M
01	3000 Architecture Study Plan	1	1										
02	3100 EosDIS Architecture Rev	1	1										
03	3200 MIDACC External I/F Rep't			1									
04	3300 MIDACC Data Flow Report			1									
05	3420 Configur'n Cost Analysis			1									
06	3450 Arch Trade Study Report			1									
07	3500 Prelim Sys Specification			1									
08													
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Note: 1 - Required Deliverable

MODIS DATA SYSTEM STUDY
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WBS 4000

ORIG. APPUL. 07/01/88
 LAST CHANGE 07/01/88
 STATUS AS OF 08/01/88

MILESTONES	88						89						90																		
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M							
01 4000 Operations Study Plan	▲																														
02 4120 L1 Data Proc Ops Concept	▲	▲																													
03 4120 L2/3 Data Proc Ops Conc	▲	▲	▼																												
04 4300 Prelim Instr Cal'n Plan	▲	▲	▲	▼																											
05 4400 Prelim Data Proc Plan	▲	▲	▲	▲	▼																										
06 4500 Prelim Instr Ops Plan	▲	▲	▲	▲	▲	▼																									
07 4120 L4 Data Proc Ops Concept	▲	▲	▲	▲	▲	▲	▼																								
08 4100 MIDACC Ops Concept			▲	▲	▲	▲	▲	▼																							
09 4250 Data Proc Ops Scenario			▲	▲	▲	▲	▲	▲	▼																						
10 4200 MIDACC Ops Scenarios			▲	▲	▲	▲	▲	▲	▲	▼																					
11 4340 Continuing Instr Cal Plan			▲	▲	▲	▲	▲	▲	▲	▲	▼																				
12 4300 Instrument Cal'n Plan			▲	▲	▲	▲	▲	▲	▲	▲	▲	▼																			
13 4430 Input Data Attributes			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼																		
14 4400 Data Processing Plan			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼																	
15 4530 Operations Procedures			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼																
16 4500 Instrument Operation Plan			▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▼															
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Note:
 2 - Supporting Deliverable

MODIS DATA SYSTEM STUDY
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WBS 5000

ORIG. APPUL. 07/01/88
 LAST CHANGE 07/01/88
 STATUS AS OF 08/01/88

MILESTONES	88				89				90				91											
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
01 5000 Sys Spec Study Plan	▲																							
02 5120 P/S Operations Concepts	▲																							
03 5120 CDHF Operations Concepts			▼																					
04 5120 DADS Operations Concepts				▼																				
05 5120 User Access Ops Concepts					▼																			
06 5120 Instrument Ops Scenarios						▼																		
07 5120 Data Proc Ops Scenarios							▼																	
08 5120 System Requirements Rev								▼																
09 5100 Sys Conceptual Design									▼															
10 5210 Mission Data Requirements										▼														
11 5310 IMC Requirements											▼													
12 5220 Operations Data Req'ts												▼												
13 5320 Database Spec - Internal													▼											
14 5230 Calibration Data Req'ts														▼										
15 5330 Database Spec - External															▼									
16 5240 MIDACC Mst Rep'ting Req't																▼								
17 5200 MIDACC Data Requirements																	▼							
18 5300 MIDACC Database Spec																		▼						
19 5700 Trade Studies Report																			▼					
20 5400 MIDACC System Specific'n																				▼				

Note: 1 - Required Deliverable

P/S - Planning & Scheduling

POTENTIAL RESOURCE BOTTLENECKS

The purpose of this document is to draw attention to potential resource bottlenecks that could affect the operation of the MIDACC. Since design limitations within the flight segment of the system are particularly difficult to rectify, this discussion focuses on potential limitations within this portion of the system. The purpose here is simply to flag potential problems that must be carefully addressed during the system design phase to avoid difficulties later on.

1. Capacity of the Onboard Local Area Network (LAN)

The onboard LAN supports data communications among the platform subsystems and the low and medium-rate payload instruments. Information exchanged includes all commands, low and medium rate science data, engineering subsystem data and ancillary data (attitude, navigation, timing), as well as high-rate instrument data when these instruments are operating in the real time mode. An instrument is classified as a low or medium-rate instrument if its peak data rate is not greater than 10 Mbps or if it can split its output over two separate LAN connections each with output data rate not greater than 10 Mbps.

As presently defined, the LAN operates at a maximum combined throughput of about 20 Mbps. The MODIS-N and MODIS-T instruments alone have a combined data rate of about 20 Mbps. Another medium rate instrument (AMRIR) has a data rate of about 5.5 Mbps (24 hours a day), and will have to share the LAN with the MODIS. The HIRIS instrument data rate is about 3 Mbps in the real time mode. Also, another high-rate instrument (ITIR) may have real time transmission requirements. Therefore the LAN must have an effective throughput exceeding 28.5 Mbps.

Simply stated, the onboard LAN cannot accommodate the data traffic arising from the current instrument configuration. Possible solutions include:

- a. Increase the effective throughput of the LAN to about 30 Mbps.
- b. Reduce the MODIS peak data rate below 11.5 Mbps.

- c. Classify the MODIS-N or MODIS-N and MODIS-T combination as a high-rate instrument, thus diverting MODIS data traffic to the high speed cableway for high rate instruments.

The third suggestion assumes that the cableway can accommodate the combined data rate caused by MODIS-N and MODIS-T, ITIR, and HIRIS. Since the Data Handling Center is presently being designed to handle only 20 Mbps average data rate, modifications in the ground system design are also required to support the first and third options.

2. Space-to-ground Communications Link

All space-to-ground communications are accomplished via the TDRSS. The platform supports the following links:

LINK	DATA RATE	USE
Ku-Band Forward	100 kbps	Command Uplink
Ku-Band Return	300 Mbps	Data Downlink
S-Band MA Forward	1 kbps	Command Uplink
S-Band MA Return	50 kbps	Data Downlink
Emergency Forward	125 bps	Command Uplink
Emergency Return	2 kbps	Data Downlink

The Ku-Band return link is available only up to 30 minutes per orbit, with maximum downlink capacity of 300 Mbps. As currently planned, the MODIS platform (NPOP-1) has two high rate instruments: HIRIS with maximum internal data rate of 512 Mbps and ITIR with maximum data rate of 52.2 Mbps. It is obvious that the K-Band return link can not support these high rate instrument data unless some means is provided to reduce the raw instrument data (e.g., limited duty cycles, subsampling spatially and/or spectrally, reduced quantization levels, or data compression). It is anticipated that user requirements for high-rate instrument data will increase and that there will eventually be heavy competition for space-to-ground communication bandwidth among high-rate and medium-rate instruments.

3. Onboard Mass Storage

A complete list of potential bottlenecks must include onboard data storage. The W-3 Platform will provide about 0.5 Terabits of storage capability, enough to store two orbits of data if the users' appetite for data is limited to the values shown in the "Baseline Report". Additional mass storage would be required to provide selected EOS science data via the NOAA X-band link to users with a Landsat-type receive capability.

4. Onboard Processor

Careful design of the onboard processor system may help alleviate some of the above problems. The processor could be used to:

- a. Reduce the K-Band return link bandwidth (e.g., data compression, averaging, editing).
- b. Provide real-time assessment of payload output (e.g., Level 2 processing on selected samples).
- c. Reduce the end-to-end bit error probability (e.g., coding after compression).
- d. Facilitate ground processing (e.g., data formatting, cloud discrimination).

ACTION ITEMS:

7/8-3 (Han) Review the draft data product questionnaire with members of the MODIS Instrument Team. ** Sent out for comment **

7/15-1 (Han) Confirm the 10 and 20 megabit per second data rates projected for low data-rate instruments and the platform LAN.

7/29-1 (McKay) Fully analyze the scope and implications of the following EosDIS resource bottlenecks with respect to the MODIS data system: communications link between ground and platform, on-board LAN, on-board mass storage, and on-board processor.

7/29-2 (McKay) Describe in detail the differences between real-time, priority playback, and routine data with regards to treatment and priorities in the DHC and DIF. ** Closed **
