

MODIS

STATUS REPORT and EM TEST REPORT

3 May 1995



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TOPICS

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STATUS REPORT

- **Program Summary**
 - **Health chart**
 - **Major events report**
- **Schedule overview**
- **Status report on major assemblies for Protoflight**
- **Top five concerns**

ENGINEERING MODEL TEST RESULTS

- **Data collects from the high-bay**
- **Preliminary data collects during baseline testing**
- **Preliminary data collects during vacuum testing**
- **Some data collects at low temperature**

HEALTH CHART



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PROGRAM TOPICS	MONTHS				↕ →	COMMENTS
	J	F	M	A		
	PROGRAM SUMMARY	Y	Y	Y		
FINANCIAL SUMMARY	Y	Y	Y	Y	→	Living within our means; should finish the FY close, but below, budget cap of \$179M.
EARNED VALUE STATUS	G	R	G	G	→	CPI for Mar was a respectable 0.90; would have been 0.98 without rate increase; 0.89 CPI since re-baseline.
MANPOWER	Y	Y	G	G	→	Manpower losses have slowed, but will continue at low level. Retention incentives an immense help.
PROGRAM SCHEDULE	Y	Y	G	Y	→	SPI a solid 0.93 in Mar; 0.82 since re-baseline. 51% of SV is due to late material liquidations.
MATERIAL STATUS	Y	Y	Y	Y	→	We have permission and sufficient budget authority to buy all flight material.
KEY TECHNICAL PARAMETERS	G	G	G	G	→	Concern for near-field response remains high.
QUALITY OF PRODUCT	G	G	G	G	→	
RISK	Y	Y	Y	Y	→	Cost and schedule
SUPPORT FUNCTIONS	G	G	G	G	↓	Softening
CUSTOMER SATISFACTION	G	G	G	G	→	

STATUS G = Good Y = Concern R = Unsatisfactory

G = $PI > 0.9$; Y = $0.9 < PI > 0.8$; R = $PI < 0.8$.

ALT 5/01/95

MAJOR EVENTS (SINCE LAST MEETING)

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Engineering Model

- **Optical Bench Assembly installed and aligned (Nov)**
- **On-board blackbody delivered and integrated (12 Dec)**
- **DMCF completed acceptance testing (22 Dec)**
- **“Photons-in, digital video out” for VIS and NIR bands (23 Dec)**
- **First data collection from VIS and NIR bands (11 Jan)**
- **First polarization measurements taken (16-18 Jan)**
- **Physically integrated Foward Viewing Analog (FAM) and Cooler Located Analog Module (CLAM) (26 Jan)**
- **Initial end-to-end data collection from all bands (1 Feb)**
- **Thermal blankets checked for fit (7 Feb)**

MAJOR EVENTS (SINCE LAST MEETING)

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- **Physically integrated the MEM (22 Feb)**
- **Completed scatter data collection (17 Mar)**
- **MODIS moved to the MCC and aligned (19 Mar)**
- **Started baseline testing at ambient (22 Mar)**
- **Completed baseline testing at ambient (10 Apr)**
- **Began pump down for thermal vacuum testing (16 Apr)**
- **Cooldown started (20 Apr)**
- **Data collected with CFPAs @ 80°K, MODIS @ 305°K, and BCS @ 295°K (23 Apr)**
- **Data collected with CFPAs @ 85°K, MODIS @ 305°K, and BCS @ 295°K (24 Apr)**

MAJOR EVENTS (SINCE LAST MEETING)



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- **Data collection started with CFPAs @ 85°K, MODIS @ 275°K, and BCS @ 295° and 170°K (27 Apr)**

Protoflight Model

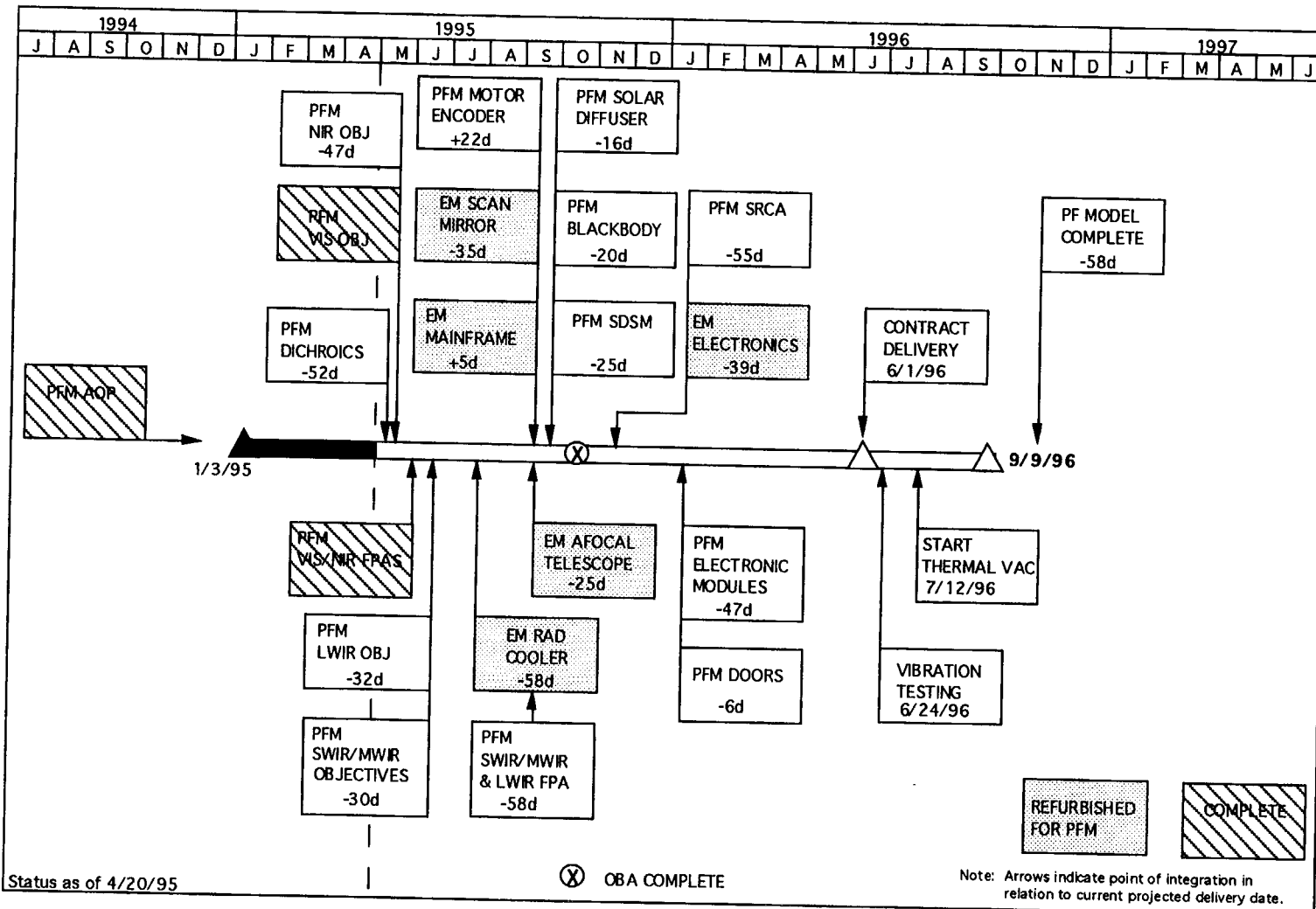
- **NIR Focal Plane Assembly delivered (12 Jan)**
- **VIS Focal Plane Assembly delivered (26 Jan)**
- **Dichroic assemblies for Protoflight completed (9 Feb)**
- **VIS Objective Assembly completed (8 Mar)**
- **SW/MWIR filter bezel assembly delivered (1 May)**
- **Second dichroic assembly completed (this week)**



SCHEDULE OVERVIEW PROTOFLIGHT MODEL



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**PROTOFLIGHT MODEL
CRITICAL PATH**



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<u>Item</u>	<u>Schedule</u>	<u>Float</u>
LWIR Focal Plane Assy	30 May	- 58 days
Rad Cooler refurbishment	28 Jul	- 58 days
SRCA	1 Nov	- 55 days
SW/MWIR Focal Plane Assy	19 May	- 53 days
Electronics Modules	12 Dec	- 47 days
NIR Objective Assy	4 May	- 47 days
EM Disassembly	9 May	- 43 days
Scan Mirror Assy	16 Jan	- 35 days

TOP-FIVE CONCERNS

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- **Cost and budget performance within annual funding caps/
within program funding limit**
- **Loss of key people due to the unintended effect of the
reorganization of Hughes Aircraft**
- **Near-field response of the instrument**
- **Loss of schedule on delivery of Electronics Modules to SI&T**
- **Loss of schedule on delivery of the SRCA to SI&T**



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PFM STATUS

TOPICS

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- **Mechanical**
- **Optical**
- **Focal Planes**
- **Electronics**
- **On-Board Calibrators**
- **Ground Support Equipment**
- **Manufacturing**

MECHANICAL

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Mainframe (top assembly)

- Engineering documents from EM readily transferrable to flight status (minor changes to ten of 52 drawings)
- Procurements started
 - Mainframe procurement placed: FM1 delivery in April 1996

Scan Mirror

- Six flight drawings released; ten remaining have been completed, but require changes
- Motor/encoder procurement
 - Fourteen layer boards twice judged unusable -- now a schedule problem

MECHANICAL (CONT)



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Scan Mirror (cont)

- Procedure for static balance test by Space Electronics has been completed
- Qual motor/encoder now has 2.2 million cycles

Optical Bench

- All (120) flight drawings released
- All housings for objective assemblies have been received
 - Aluminum for VIS and NIR; Invar for SW/MWIR and LWIR

Radiative Cooler

- All (154) flight drawings released, except top assembly
- Vibration testing of dewar brazement successfully completed

MECHANICAL (CONT)



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Door Assemblies

- **All (120) flight drawings released, except screen and seal detail; three top assembly drawings to be released in May**
- **Procurements have begun**
 - **Intec: sunshade and NAD molds complete; frames for SVD complete; change for SDD submitted**
 - **Longest lead part (motor, P/N 405314) has been ordered from Vernitron; delivery in September**
 - **Starsys: pin pullers were completed; failsafe link paced by rod end bearing delivery -- workaround in place; linear failsafe spec in final review**

OPTICS ASSEMBLIES

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- **Dichroic Assembly: second assembly built with lower scatter dichroic**
- **VIS Objective Assembly: ready for integration into next higher assembly**
- **NIR Objective Assembly: paced by delivery of NIR Element 2; assembly to complete by 4 May.**
- **SW/MWIR and LWIR Objective Assemblies: no material shortages; bumped by new dichroic build; to be completed by 2 Jun.**

FILTER ASSEMBLIES

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- **All flight filters, except LWIR, and masks have been received**
 - **LWIR filters expected momentarily**
- **VIS and NIR filter assemblies have been delivered and integrated**
- **Assembly of SW/MWIR filter assembly has begun; delivery planned for this week**
- **LWIR filter assembly will follow; delivery expected in mid May**

FOCAL PLANES PROTOFLIGHT



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- **VIS and NIR assemblies have been delivered**
 - **Back-up SCAs available**
 - **Pedestal/Cable Assembly from SN 105 was salvaged**
- **SW/MWIR FPA has completed pre-filter assembly testing**
 - **Delivery (~19 May) two weeks after receiving filter assembly**
 - **One back-up is available at SCA level**
- **LWIR FPA has also completed pre-filter assembly testing**
 - **Delivery (~30 May) two weeks after receiving filter assembly**
 - **Back-up SCA available**
 - **Back-up Pedestal/Cable Assembly with PC detector mounted is also available**

FOCAL PLANES FM 1 AND FM2



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- **All PC detectors have been delivered**
 - **four (2+2) plus one back-up from the PFM**
- **VIS and NIR screen testing is in progress**
 - **6+6 available to yield 4+4 (5 partially completed)**
- **SW/MWIR probe testing has been completed**
 - **Next three subarray sets have begun pre-hybridization tasks (to be delivered to test as SCAs by 30 May)**
 - **Five sets available as back-up (should cover all flight needs)**
- **LWIR - seven SCA in queue for hybridization**
 - **To be delivered to test as SCAs by 30 May**
- **Cables assemblies and motherboards pose no problems**

ELECTRONICS DOCUMENT RELEASE STATUS



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ELECTRONICS DRAWING SCHEDULE STATUS 5 / 1 / 9 5

		<u>PACK.</u>	<u>ELEC.</u>	<u>TOTAL</u>
MAIN ELECTRONICS MODULE (MEM)	TOTAL	99	73	172
	ACTUAL	56	44	100
	CHECK/SIG.	0 / 0	4 / 6	4 / 6
	% COMP.	57%	60%	58%
ANALOG ELECTRONICS MODULES (SAM, FAM/CLAM)	TOTAL	37	58	95
	ACTUAL	25	21	46
	CHECK/SIG.	0 / 1	6 / 2	6 / 3
	% COMP.	68%	36%	48%
TOTAL	TOTAL	136	131	267
	ACTUAL	81	65	146
	CHECK/SIG.	0 / 1	10 / 8	10 / 9
	% COMP.	60%	50%	55%

TOTAL MEM MECHANICAL DWGs INCLUDE 27 CABLES
TOTAL AEM ELECTRONIC DWGs INCLUDE 17 SDSM/SRCA BOARD DWGs

ELECTRONICS PACKAGING SCHEDULE DRIVERS

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- **Update of PWB layouts completed**
 - **Final (PWB) and master pattern drawings (MPD) have been released**
 - **Purchase Orders for final four PWBs expected to be placed by 10 May (last delivery mid-June)**
- **Update of electronics housing designs completed**
 - **MEM, MEM backplane, SAM, FAM, and CLAM**
 - **Procurement of these assemblies has begun: quotes due for MEM backplane, FAM, and SAM housings on 1 May.**

ELECTRONICS ASSEMBLY SCHEDULE DRIVERS



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- **Circuit Card Assembly drawing status**
 - **Formal release of all CCA drawings, parts lists, and schematic diagrams expected by 30 May**
- **EEE parts**
 - **Harris PROMs - order being finalized; fully qualified parts Eexpected 15 August (15 June pre-qual)**
 - **Analog to Digital Converters - memo discussing radiation issues has been sent to GSFC for concurrence; all parts on order**
- **Mechanical/packaging status**
 - **Last drawing release planned for end of May**

ELECTRONICS

ASSEMBLY SCHEDULE DRIVERS (CONT)



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-
- Problems with EEE parts (cont)**
 - Analog to Digital Converters - working radiation/yield issues with Reliability**
 - BCT logic parts - too many to use place holders**

PROCUREMENT STATUS

EEE PARTS



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<u>Description</u>	<u>Quantity</u>
• Line items	671
• In stock*	568
• On order	21
• In purchasing cycle	57
• In preparation	25

* 524 in stores; 44 in Receiving Inspection; 12 waiting for DPA

ON-BOARD CALIBRATORS

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Spectroradiometric Calibration Assembly (SRCA)

- **Seven subassemblies have been completed (slit/reticle and grating/motor subassemblies)**
- **Casting of the monochromator housing has been completed (received 21 Mar)**
- **Screening of 10w halogen lamps is complete**
 - **Now screening 1we3 lamps**
 - **Assembly procedures in work**
- **Drawings nearing completion**
 - **139 flight drawings: 1 piece part and 14 assy drawings left**
 - **34 tooling/fixture drawings completed**

ON-BOARD CALIBRATORS (CONT)

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Solar Diffuser Stability Monitor (SDSM)

- All (22) mechanical piece parts on order; all (5) optical piece parts on order
- Two assembly drawings yet to be released
- Test Plan incorporated into Rev A of Assy Spec

Solar Diffuser

- All drawings released

Blackbody

- Polishing completed on aluminum V-groove substrate for all flight hardware
- Two drawings left to upgrade for flight hardware (heat plus top assy)
- EM on-board blackbody has worked quite well

GROUND SUPPORT EQUIPMENT



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Software

- OASIS/12 is now operating on STE-1
- Personnel changes have limited progress on STE-1 software
- Substantial support was/is required for SI&T activities

STE & SBS Controllers

- Synchronized data collects based on a selectable Scan Mirror position was implemented. All related drawings have been completed
- Space Background Simulator Controller implementation has been completed; device now in use
- Formal release of STE-1 drawings is in progress

GROUND SUPPORT EQUIPMENT (CONT)



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GSE Fixtures

- **A BCS thermal vacuum mount and alignment fixture is in use**
- **An Air Pallet Transportation System worked well**
- **All Space Background Simulators needed for EM testing are working well**
- **The MODIS T/V gurney and support stand worked as expected**
- **Fixture design and fabrication for a second IAC has been completed**

GROUND SUPPORT EQUIPMENT (CONT)



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MODIS Calibration Chamber

- **The Blackbody Calibration Source was aligned and is working well**
- **The Nadir panel has been permanently installed**
- **The IAC was aligned and is working well**
- **The Spectral Measurement Assembly was aligned and is working well**
- **The fused silica window was tested, fit-checked in the MCC, and is working as advertised**
- **The calcium fluoride window was proof loaded and is working well**
- **The chamber and all fixtures have worked very well during EM testing**

GROUND SUPPORT EQUIPMENT (CONT)

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GSE Stimuli

- **A three-mirror full aperture collimator was received from Tinsley and used as the basis for a second IAC**
- **The PSA was successfully used to measure polarization sensitivity**
- **The SCMA was delivered and used for near-field response measurements**
- **The Spectral Measurement Assembly was completed and delivered to the MCC**
- **Calibration of the 100 cm Spherical Integrating Source was completed and the SIS is workign well**

GROUND SUPPORT EQUIPMENT (CONT)

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GSE Stimulus

- **The SCMA was delivered and used for near-field response measurements**
- **The Spectral Measurement Assembly was completed and delivered to the MCC.**
- **Calibration of the 100 cm Spherical Integrating Source was completed and the SIS was moved to the MCC area**

MANUFACTURING

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Electronics

- **Sixteen PWB kits have been pulled (15 MEM; 1 SAM)**
- **Malco connectors received**
- **Ten more PWBs are on order (1 in insp; 3 need coupon testing; six to be received in May))**
- **Six PWBs in procurement cycle (last ECD 10 May)**
- **Shortage of certified personnel is a concern -- three options under review**

Mechanical

- **Assemblies to be refurbished**

1. Pumpdown
2. Outgass
3. Cool FPAs
4. Elevated Temp 305K
 - a. 85K G&O
 - b. 85K BCS Tests
 - c. SIS Tests
 - d. Spatial
 - e. Thermal Acquis.
5. Low Temp 285K
 - a. Functional
 - b. BCS Test
 - c. SIS Test
 - d. Spatial
 - e. Spectral
 - f. Thermal Acquis.
 - g. MFI-09
6. FPA Temp Cycle
 - a. 83K IAC Test
 - b. 85K IAC Test
 - c. 88K IAC Test
7. STR's
 - a. Fixed Pattern Noise
 - b. Near Field Response
8. Warm-up
9. Return to Ambient

COMPLETE



IN PROGRESS

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**THERMAL
VACUUM TESTING
INCLUDES
COMPREHENSIVE:**

- **SPATIAL**
- **SPECTRAL**
- **RADIOMETRIC**

TESTS

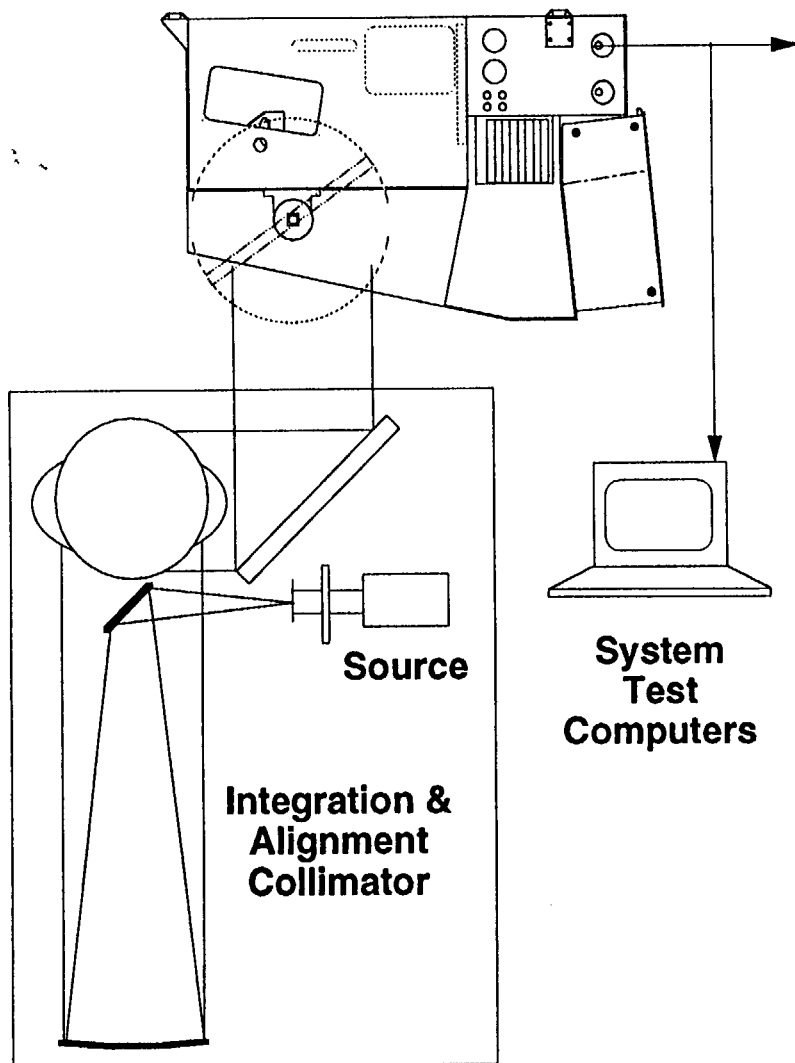




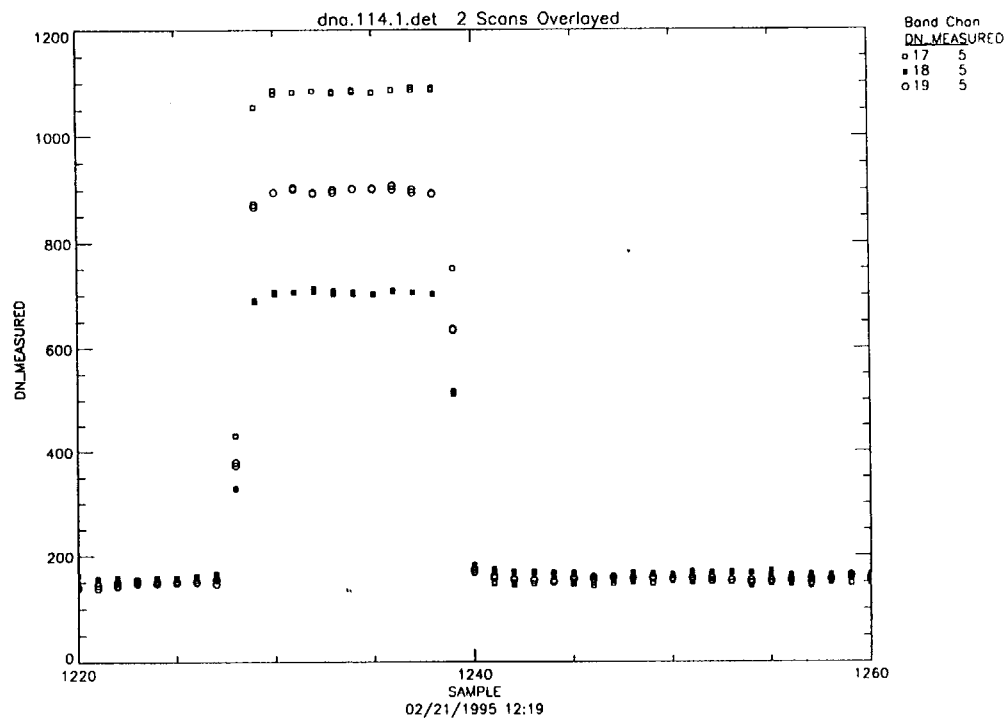
MODIS OPERATIONAL FROM PHOTONS IN TO DATA OUT



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Digital Data from Main Electronics Module



- Excellent Co-Registration
- Low Scan-to-Scan Jitter
- Gains and Offsets Optimized

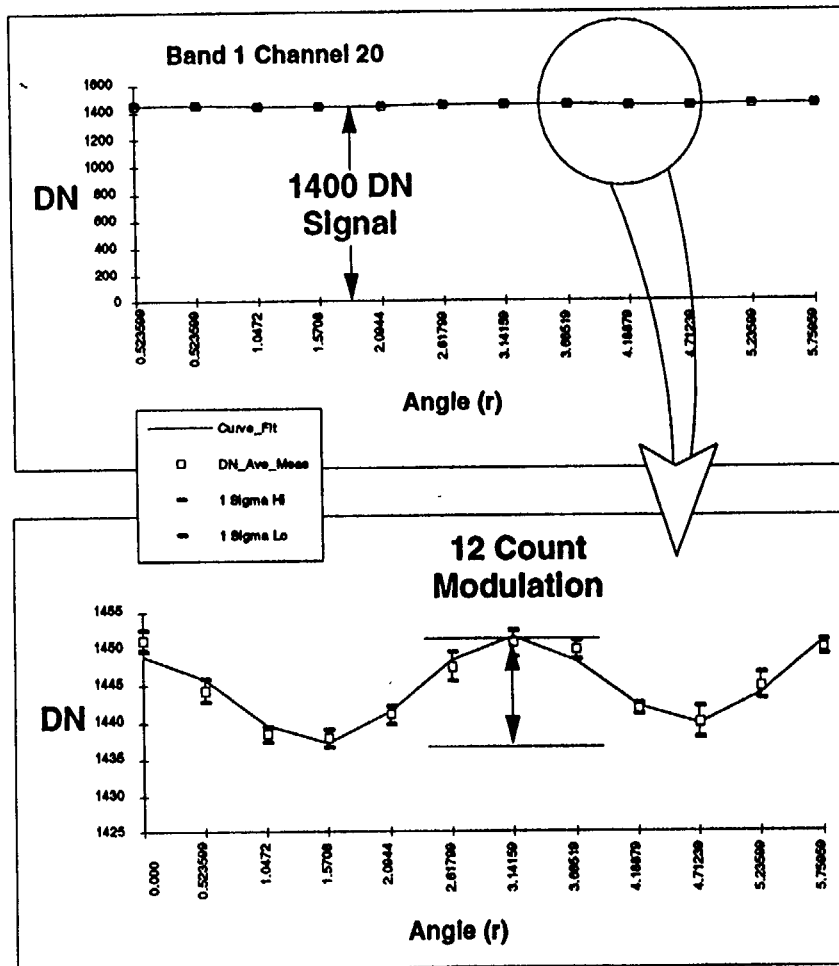


EM POLARIZATION RESULTS MEET MOST REQUIREMENTS

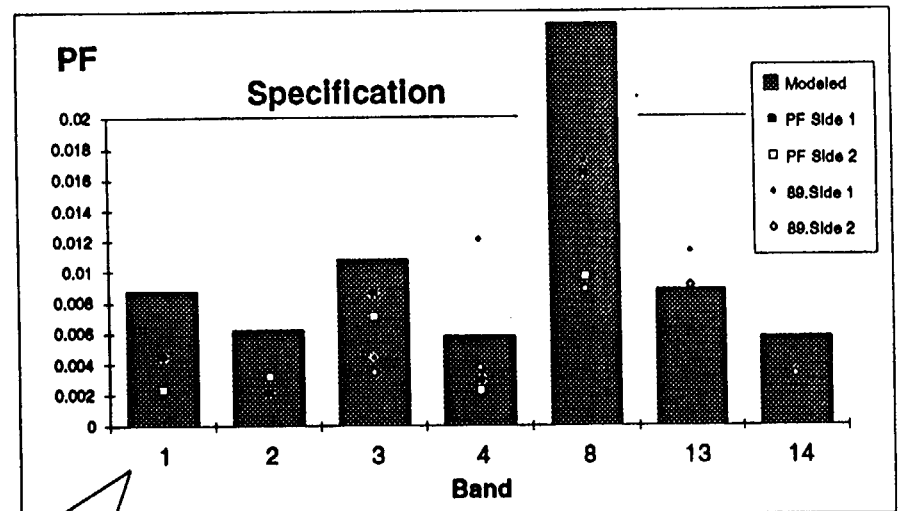


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Raw Data Averaged Over 5 Scans



Polarization for MODIS at 45°



- All bands within limits except Band 3. 2.2% at -45°
- Correlate well with modeled results



EM NEAR FIELD RESPONSE TESTS VERIFY TEST METHODOLOGY



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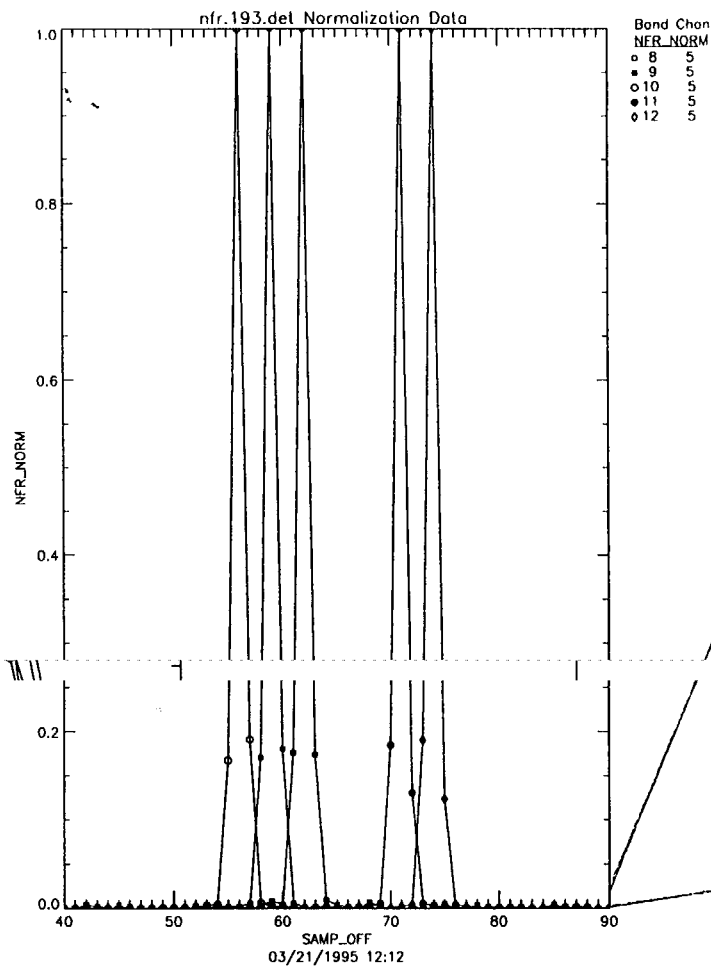
- **ScMA optimized before tests**
 - Mirror surface $<4\text{\AA}$, cleaned before tests
 - Considerable effort expended to minimize return reflections
 - System placed in optimum focus
- **MODIS instrument ready for tests**
 - Electronics noise reduced, phase delay optimized
 - All accessible optics cleaned
 - 50 scans achieved $>1e5$ Extinction Ratio
- **Preliminary data reduction performed**
 - TAC near field response software in place
 - 91 Collects of data acquired: Broadband, Narrowband, Dark
 - 32 of 36 Bands Collected Broadband, 15 Narrowband; all FPAs
 - Data currently under review; to be sent to GSFC by 4/3
- **Preliminary results indicate high dichroic 1 scatter**
 - Alternate vendor part meets requirements

PRELIMINARY VIS DATA SHOWS ABILITY TO CHARACTERIZE NFR



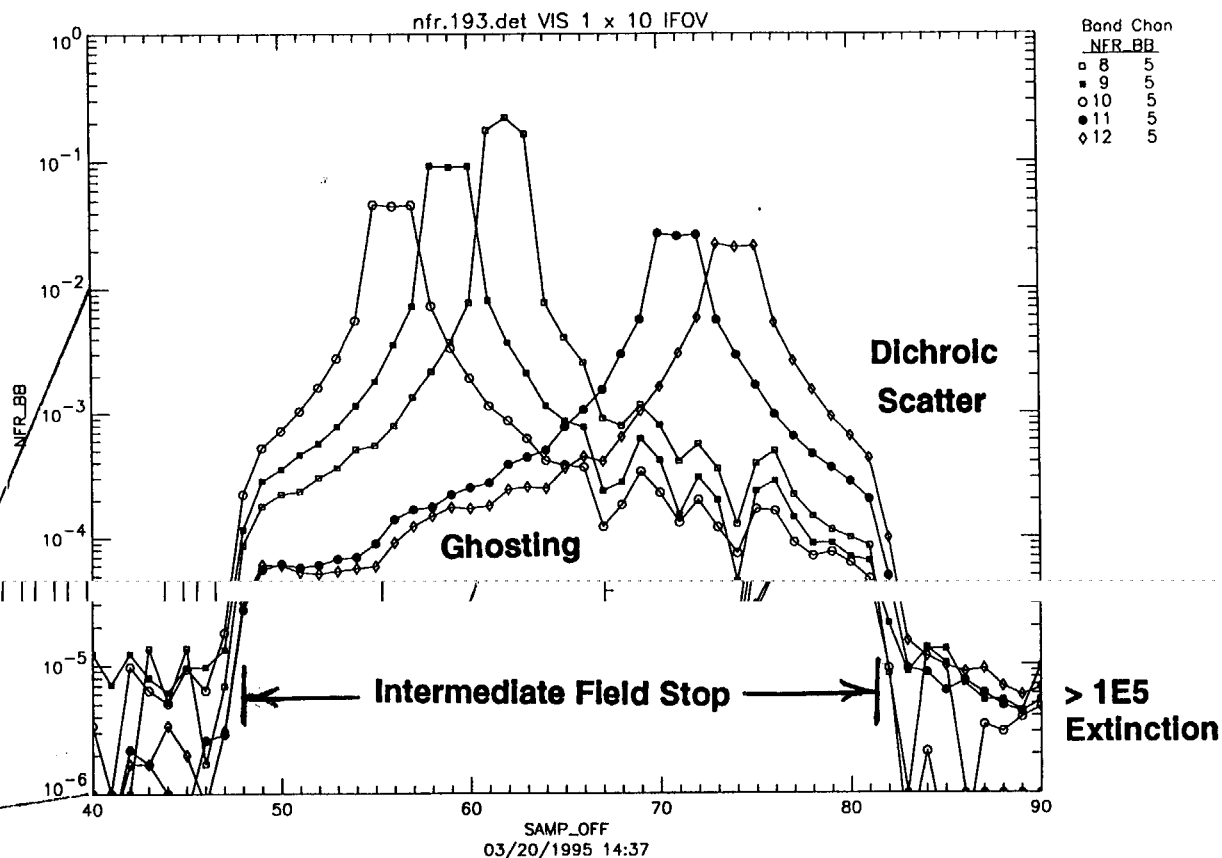
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Linear Scale



5 Scans Averaged

Log Scale



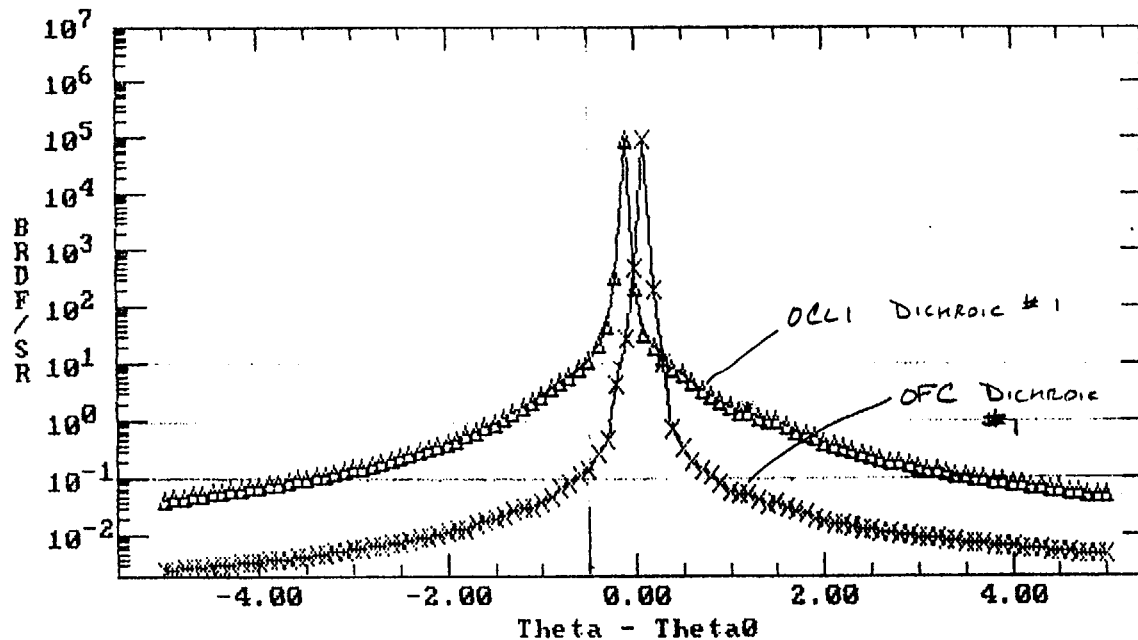
50 Scans Averaged to Minimize Noise



NEAR-FIELD RESPONSE

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- Δ MODIS Dichroic #1 Beamsplitter Lot #5 SN#1, 0.6328 microns, specular = 22.0
- \times MODIS OFC Dichroic #1, 85148-1 Rev.D, SN #5, 0.6328 microns, specular = 22.

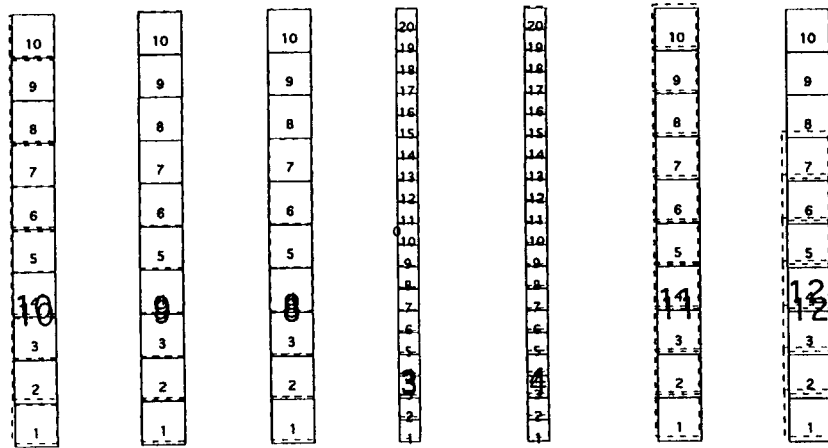


AMBIENT TEST DEMONSTRATES GOOD SPATIAL PERFORMANCE



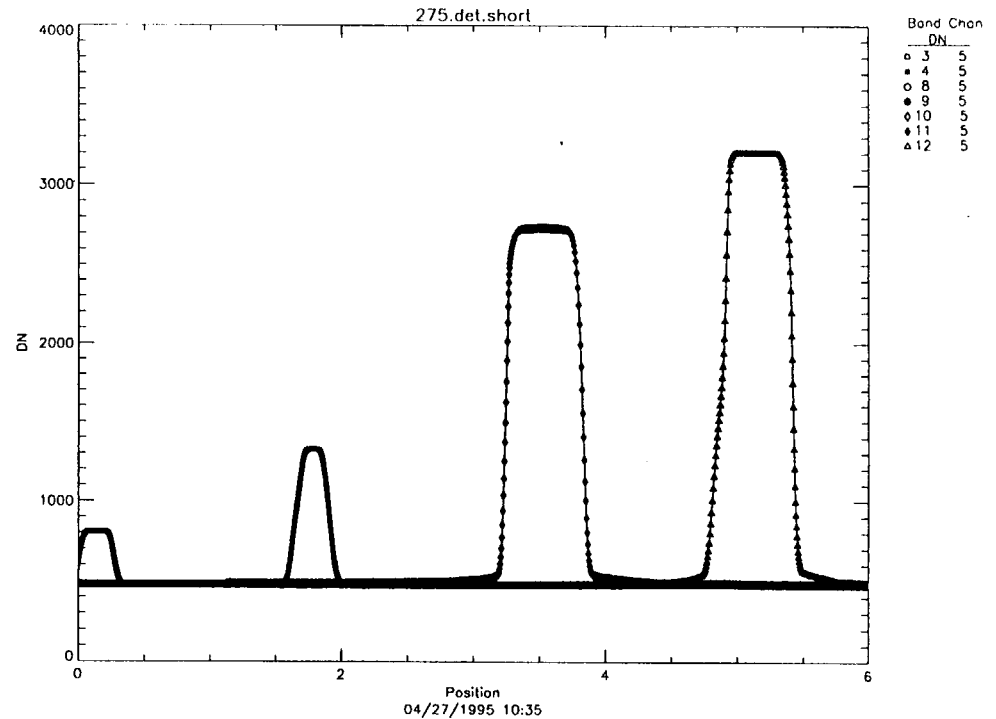
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VIS Detector Layout



————— IDEAL
- - - - - AS MEASURED

VIS Line Spread Functions



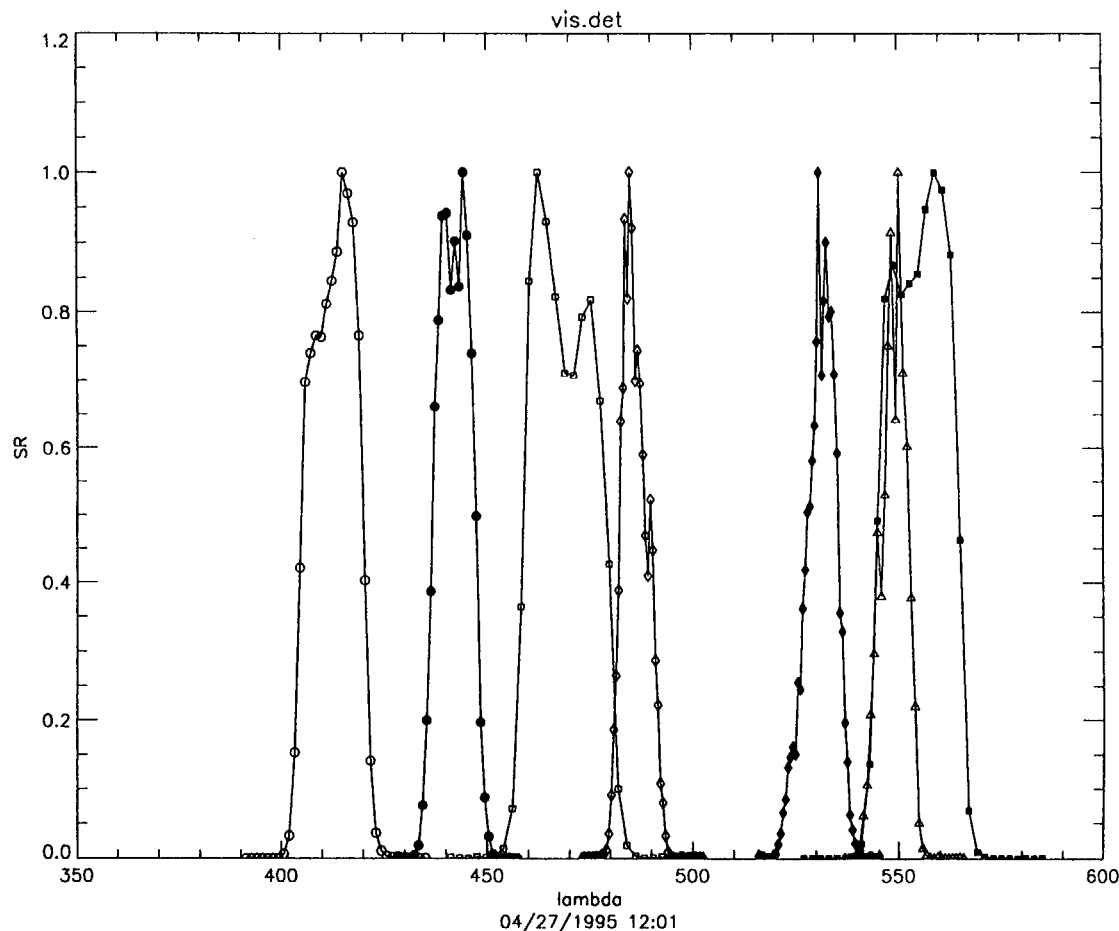


AMBIENT SPECTRAL DATA ACQUIRED FOR ALL BANDS



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VIS Spectral Bands



Measured Parameters

- Center Wavelength
- Bandwidth
- Edge Range
- Out-of-Band

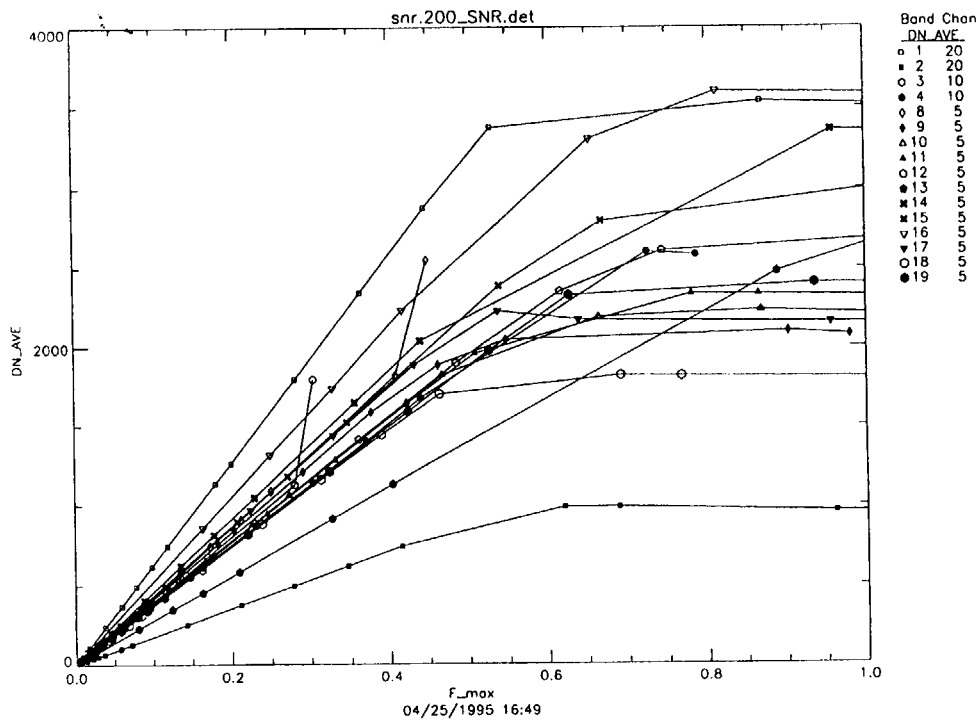


RESPONSE MEASURED TO SATURATION

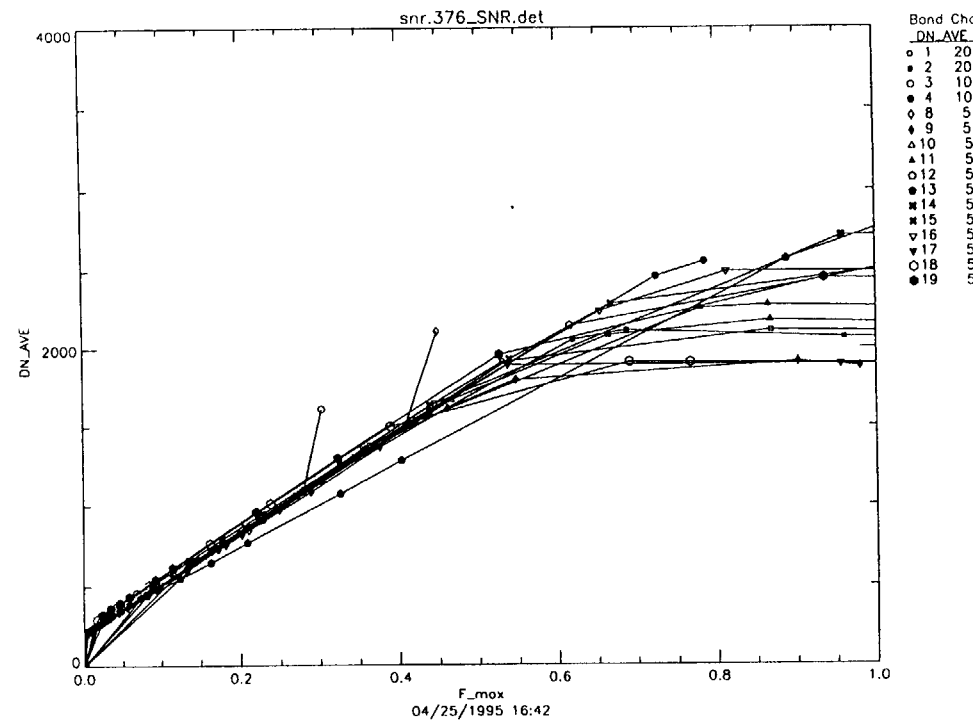


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- VIS Signal vs Radiance is Expressed as a Fraction of Lmax



Before Gain Correction



After Gain Correction

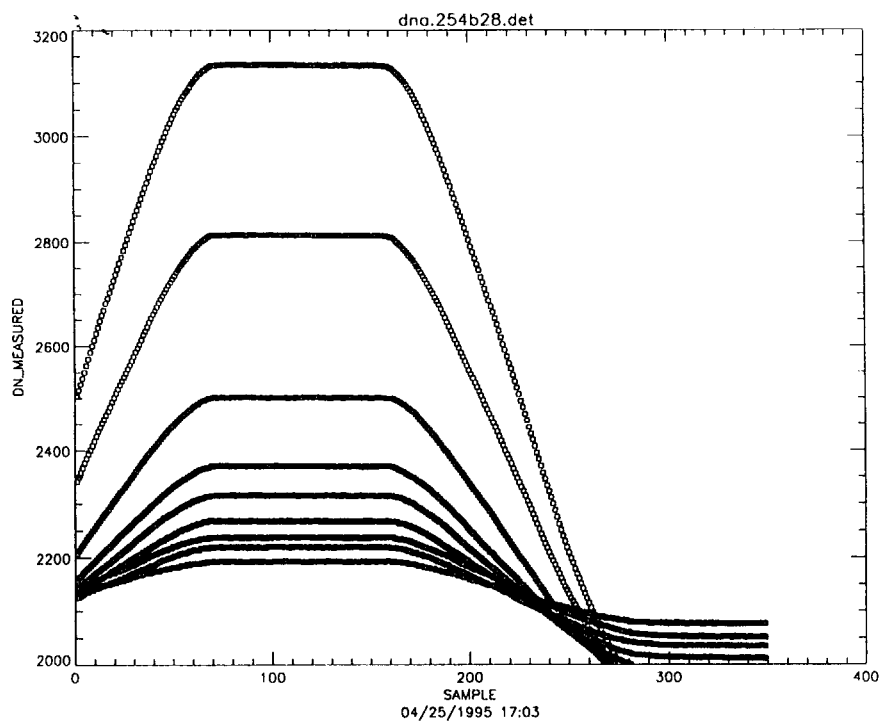


IR BAND PERFORMANCE MEASURED IN VACUUM

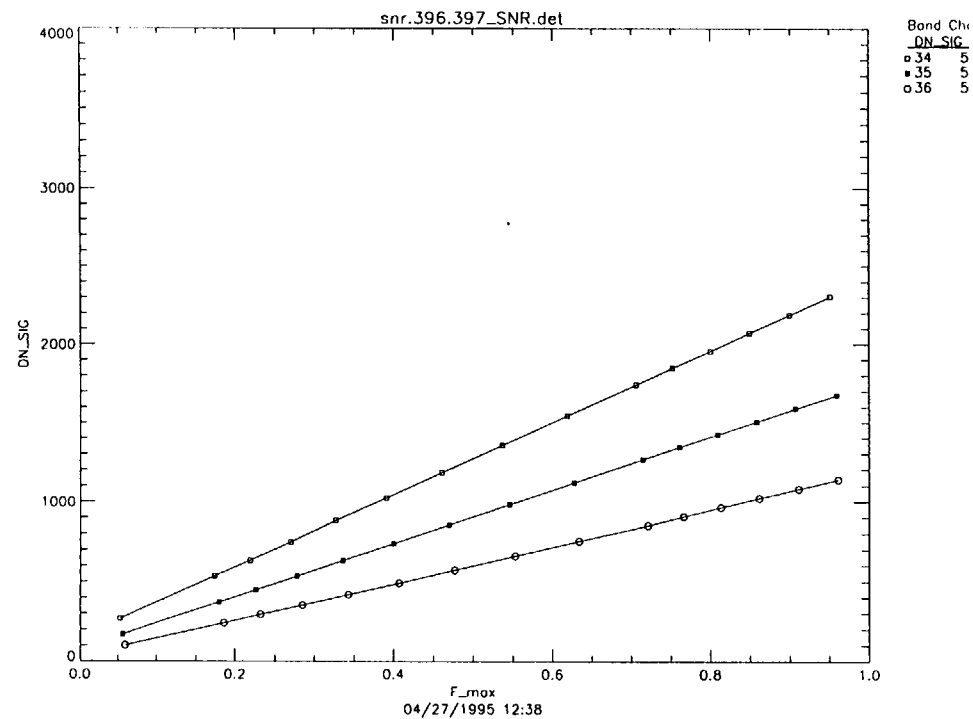


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Response to BCS



Signal Response



• Complete Data Available After T/V Tests



EM Performance Meeting Expectations

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- **EM fully functional**
- **Measured for Spatial, Spectral and Radiometric performance**
- **Measurements conducted in ambient complete**
- **Thermal vacuum tests in progress**
- **Early indications is that the EM performs as expected**
- **Good linearity, high SNRs, low polarization, good registration**
- **Early saturation, high near field response expected on EM
Corrected for PFM**
- **Size, Mass, Power, Data rate meet all specifications**
- **MODIS, GSE, Subsystems, Test Equipment fully demonstrated**