Attachment C

MODIS ENGINEERING MODEL TESTING UPDATE

CALIBRATION WORKING GROUP

J. Young

11 October 1994

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Integration and Alignment Area, Enlarged

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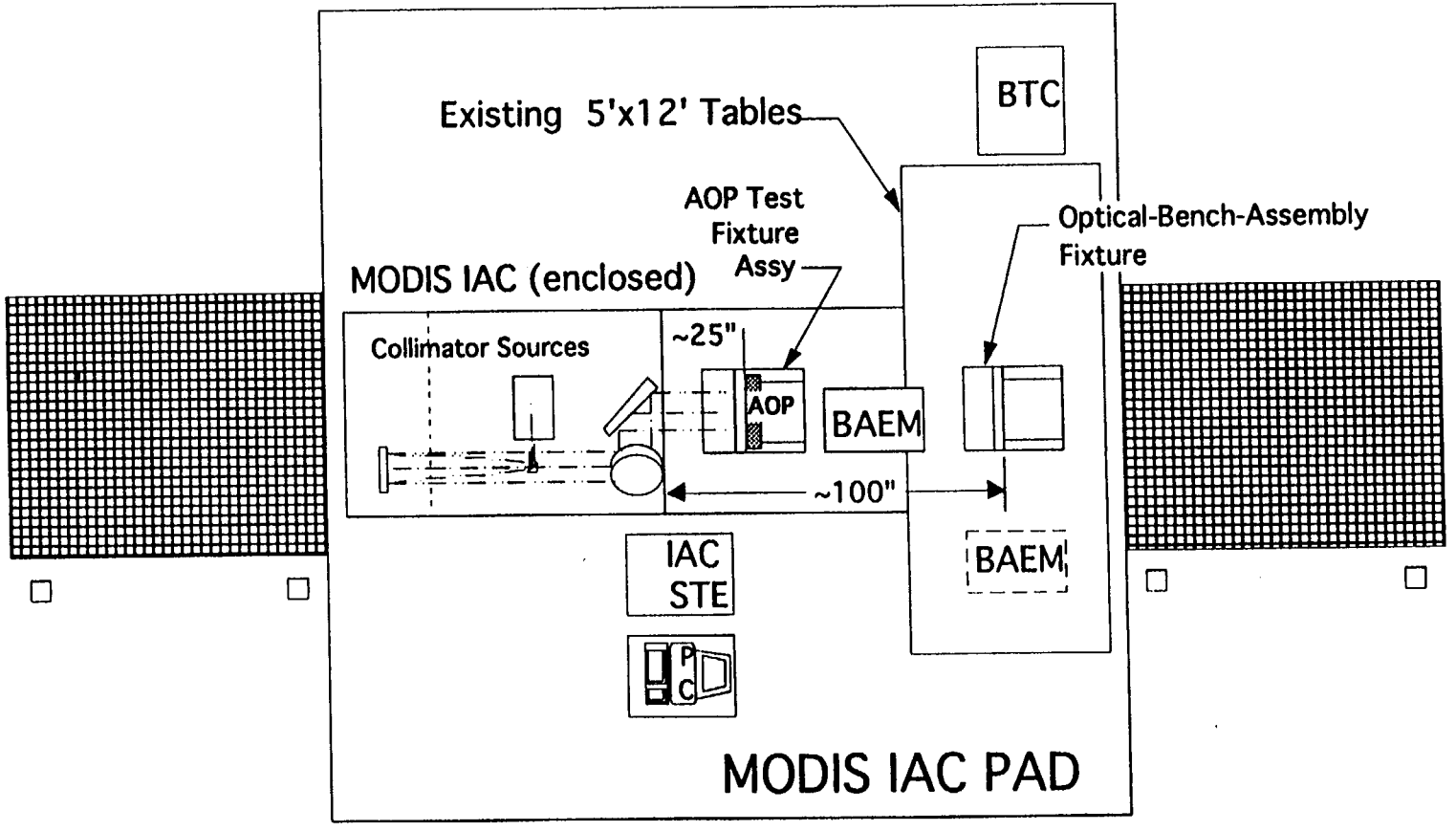

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DMCF Can Accommodate IAC

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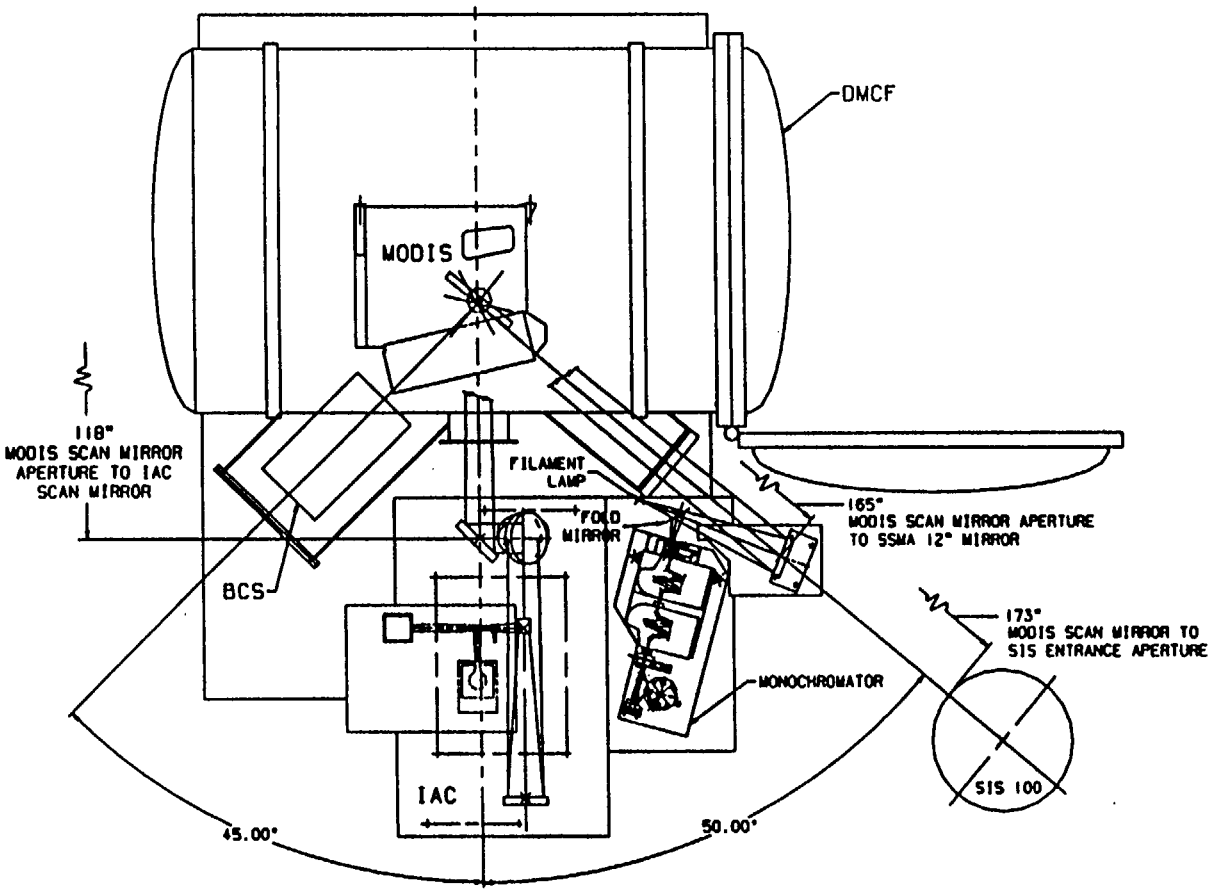

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Calibration Equipment EM TO PF

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TEST	EM	PF
• Radiometric Response SNR, LInearity, Dy. Range, Noise	SIS, BCS	SIS, BCS
• Spectral Response C.W.L., B.W., O.O.B	SpMA	SpMA
• Spatial Response Registration, IFOV, MTF	IAC	IAC
• Near-Field Response Ghosting, Crosstalk, Scatter, Transient	ScMA, IAC	ScMA, IAC
• Stray Light	—	SIS, IAC
• Polarization Response	PSA	PSA

Critical EM Testing Preserved

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TEST	EM	PF
• Radiometric Response SNR, Linearity, Dy. Range, Noise	Ambient T/V	Ambient T/V
• Spectral Response C.W.L., B.W., O.O.B	Ambient T/V*	Ambient T/V*
• Spatial Response Registration, IFOV, MTF	Ambient T/V**	Ambient T/V**
• Near-Field Response Ghosting, Crosstalk, Scatter, Transient	Ambient	Ambient
• Polarization Response	Ambient	Ambient

* No MWIR/LWIR due to window absorption (SiO_2)

** Limited LWIR due to window absorption (CaF_2)

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Planned Instrument Ambient Test Flow

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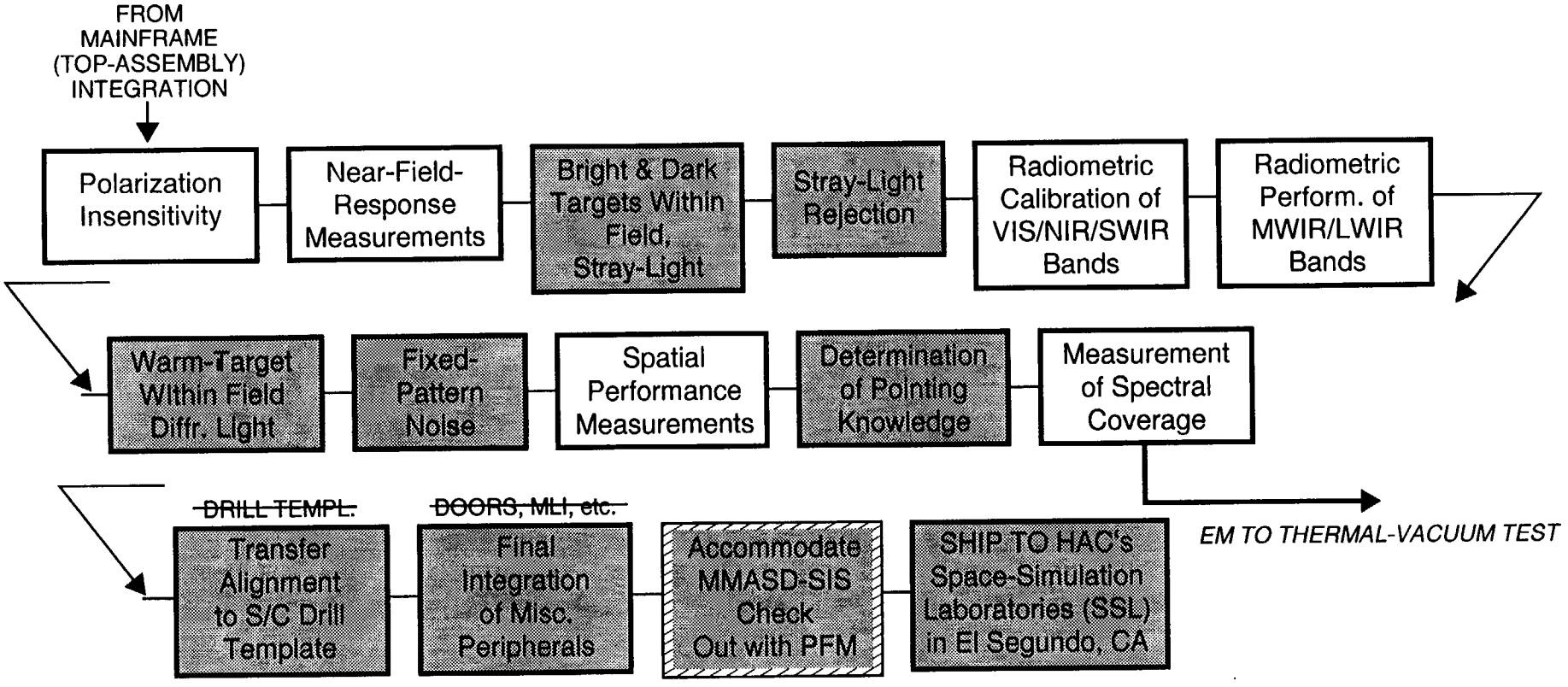

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Radiometric and Performance Characterization Tests (1 of 4)

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TEST	TITLE (151759 REFERENCE PARAGRAPHS)	AMB	T/V	COMMENTS
RC01	Radiometric Performance (VIS/NIR/SWIR)			
(E)	Gain and Offset, Minimum Quantizing Resolution (3.4.3)	X	X	Data acquired using SIS and SVS
	Sensitivity (3.3.4.1)		X	SNR and NEdL
	Dynamic Range (3.4.1)		X	Data acquired from both SIS and IAC
	Relative Radiometric Accuracy (3.4.5.3.1, 3.4.5.3.2, 3.4.5.3.3)	(X)	X	RMS deviation and channel to channel uniformity based on T/V SIS data. Near field response and pattern noise based on ambient data
	System Noise (3.4.5.5)		X	SNR dependence on radiance level
	Absolute Radiometric Accuracy (3.4.5.2)	(X)	(X)	By analysis using the RMM. Includes responsivity and noise measurements in T/V and response vs. scan angle, near field response, spectral response, and stray light in ambient. OBC errors estimated using calibration mgmt. plan
	Short Term Stability (3.4.7.1)	(X)	(X)	By analysis using SIS data in both ambient and T/V
	Long Term Stability (3.4.7.2)	(X)	(X)	By analysis using SIS data in both ambient and T/V
	Band to Band Stability (3.4.7.3)	(X)	(X)	By analysis using SIS data in both ambient and T/V

NOTES:

1. X indicates complete verification test and (X) indicates that data acquired is only a portion of the total data needed for verification or is only for checks or comparisons.
2. All tests indicated will be performed for PFM and FM MODIS instruments. EM tests are limited to those indicated with a (E).

Radiometric and Performance Characterization Tests (2 of 4)

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RC02 (E)	Radiometric Performance (MWIR/LWIR)			
	Gain and Offset, Minimum Quantizing Resolution (3.4.3)	X	X	Preliminary setting performed in ambient using BCS, final settings in T/V. Charge subtraction settings required for ambient
	Sensitivity (3.3.4.1)		X	SNR and NEΔT
	Dynamic Range (3.4.1)		X	Data acquired using BCS
	Relative Radiometric Accuracy (3.4.5.3.1, 3.4.5.3.2, 3.4.5.3.3)	(X)	X	RMS deviation and channel to channel uniformity based on T/V BCS data. Near field response and pattern noise based on ambient data
	System Noise (3.4.5.5)		X	SNR dependence on radiance level
	Absolute Radiometric Accuracy (3.4.5.2)	(X)	(X)	By analysis using RMM. Includes responsivity and noise measurements in T/V and response vs. scan angle, near field response, spectral response, and stray light in ambient. OBC errors estimated using calibration management plan
	Short Term Stability (3.4.7.1)	(X)	(X)	By analysis using BCS data in both ambient and T/V
	Long Term Stability (3.4.7.2)	(X)	(X)	By analysis using BCS data in both ambient and T/V
	Band to Band Stability (3.4.7.3)	(X)	(X)	By analysis using BCS data in both ambient and T/V

NOTES:

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Radiometric and Performance Characterization Tests (3 of 4)

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TEST	TITLE (151759 REFERENCE PARAGRAPHS)	AMB	T/V	COMMENTS
PC02 (E)	System Spatial Performance			
	IFOV and IFOV Uniformity (3.4.5.4)		X	LSF data acquired using IAC
	FOV (3.3.2)	X		Data acquired using SIS while MODIS on rotary table
	MTF (3.4.2)		X	LSF data acquired using IAC
	Spectral Band Registration (3.4.6.3)		X	LSF data acquired using IAC
	Near Field (Transient) Response (3.4.4)	X		Data acquired using SCMA
PC06	Pointing Knowledge and Alignment Changes (3.4.6.1.2)	X	(X)	Data relating all pixel locations to optical axes acquired in T/V. Data acquired using IAC
PC07 (E)	Measurement of Spectral Coverage (3.3.3)	(X)	X	Complete set of ambient data taken, but used only for T/V comparison. Data acquired using SPMA
PC08 (E)	Polarization Insensitivity (3.3.5)	X		Data acquired using PSA

NOTES:

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Radiometric and Performance Characterization Tests (4 of 4)

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PC09	Bright/Dark Target within Field, Stray Light (3.4.8.2, 3.4.8.3)	X		Data acquired using SIS and light trap
PC11	Warm Target within Field, Stray Light (3.4.8.4)	X		Data acquired using IAC
PC12	Stray Light Rejection (3.4.8.1)	X		Data acquired using STS
PC13	S/C Mounting Template Pointing Calibration	X		
PCTBD	In-Flight Calibration Requirements			
	SRCA Registration Operation		X	Compare SRCA data with IAC spectral band registration data
	SRCA Radiometric Mode (3.4.9.1)		X	Compare SRCA data with SIS data
	SRCA Spectral Performance (3.4.9.2)		X	Compare SRCA data with SPMA data
	In-Flight Reflectance Calibration (3.4.9.3)	X		Illuminate solar diffuser. Compare solar diffuser data with SIS data
	In-Flight Lunar Calibration (3.4.9.4)			By Analysis
	In-Flight Electronics Calibration (3.4.9.5)		X	Collect data and compare with theoretical predictions

NOTES:

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2. All tests indicated will be performed for PFM and FM MODIS instruments. EM tests are limited to those indicated with a (E).

MODIS Engineering Model Vacuum Timeline

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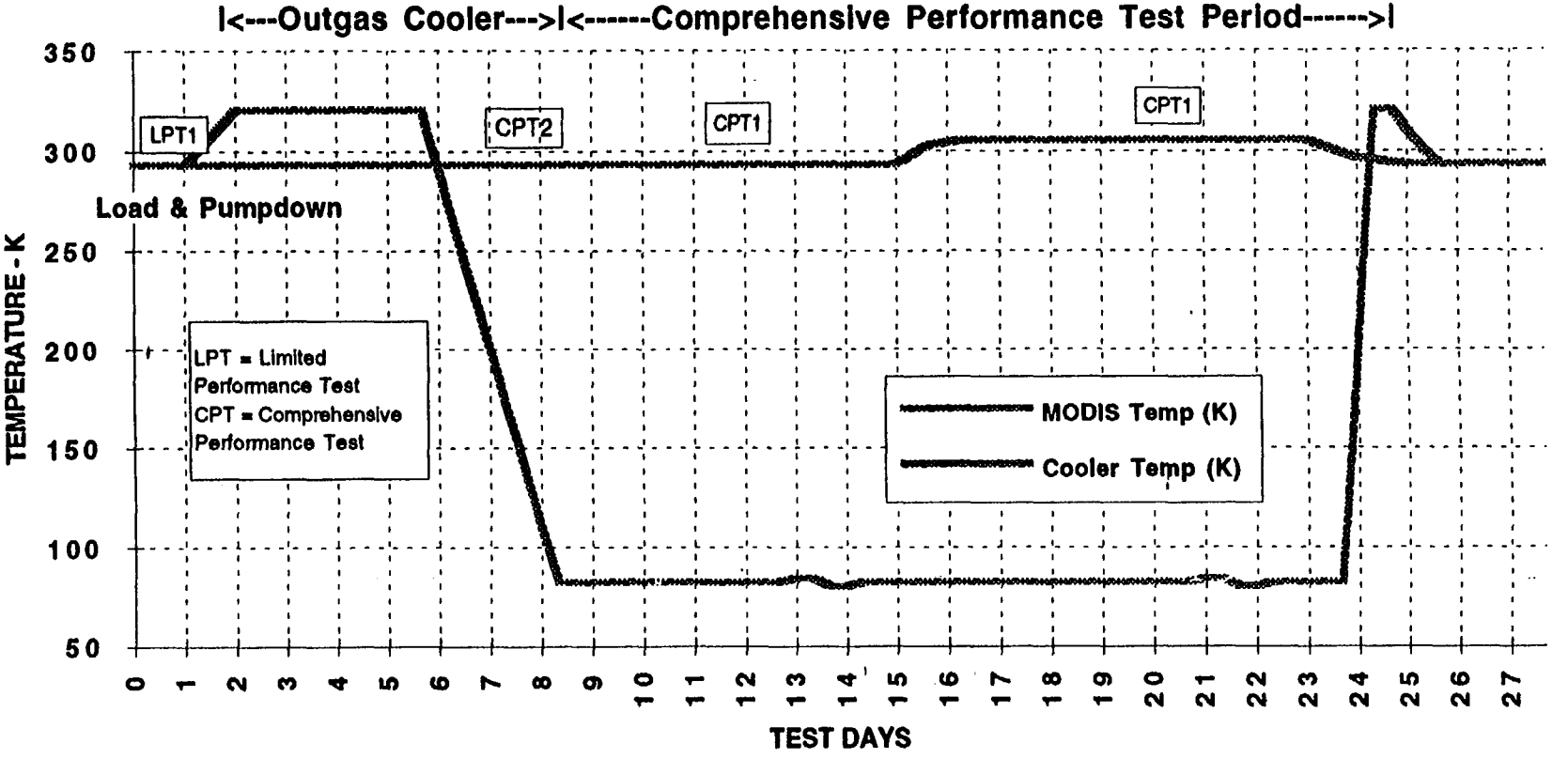

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MODIS Protoflight Model Thermal-Vacuum Timeline

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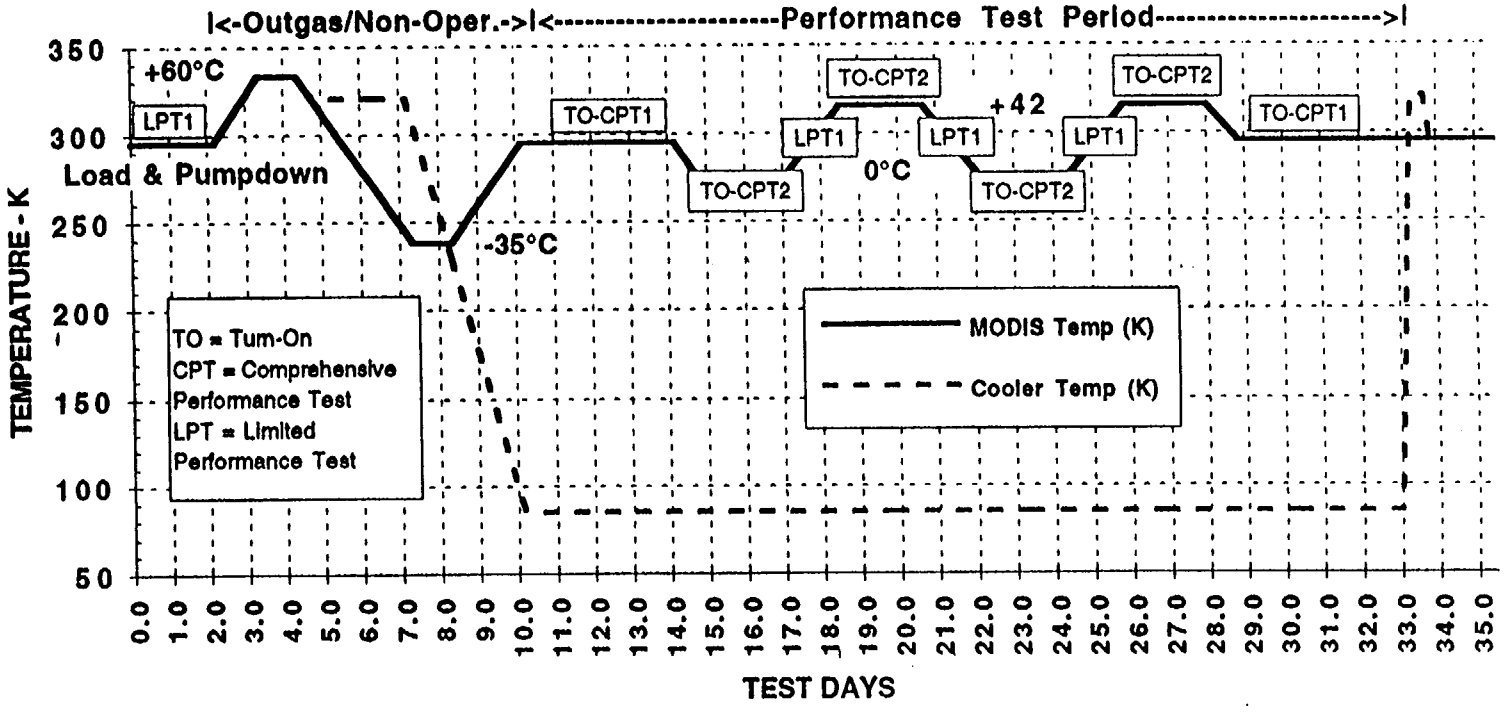

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ScMA
(Scatter Measurement Assembly)

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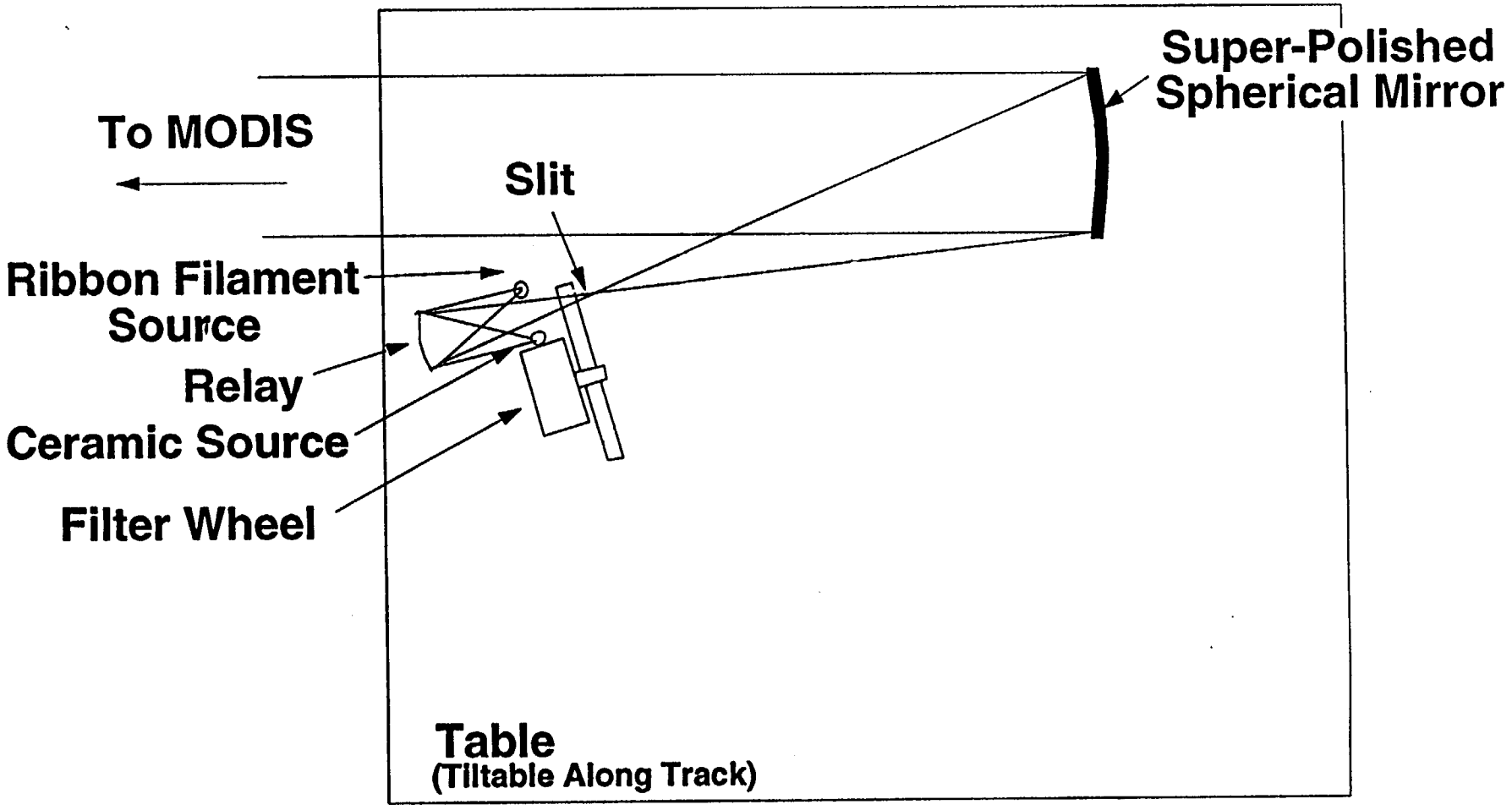

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Scatter Measurement Assembly (ScMA) Nominal Design Parameters

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- SINGLE SMOOTH MIRROR (< 7 Å RMS) COLLIMATOR EFL ≈ 60 INCHES
- RADIANT ENERGY SOURCES - SELECTABLE
  - RIBBON FILAMENT - VARIABLE TEMPERATURE
  - IR CERAMIC - VARIABLE TEMPERATURE
- ILLUMINATED SLIT SIZE: 1X10 PIXEL
- MECHANISM TO HOLD FILTER SETS
  - FILTER MANUALLY INSERTED FOR ENGINEERING MODEL (EM)
  - FILTER WHEEL MAY BE AUTOMATED FOR PROTOFLIGHT MODEL (PFM)
- OPTICAL FILTER FILTER SET
  - SPECTRAL SHAPING FILTERS FOR INTEGRATED MEASUREMENT
  - SELECTED MODIS ENVIRONMENTAL FILTERS FOR EM
  - MODIS ENVIRONMENTAL WITNESS FILTERS FOR PFM (36 TBR)
- ILLUMINATED SOURCE MOTION
  - ALONG SCAN VIA MODIS SCAN MIRROR (EM / PFM)
  - ALONG TRACK VIA TILTABLE SCMA

Measurement of Near-Field Response Matrix

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Performance parameter	Scan	Slit size	Source	Source	Test bed
Crosstalk	No	1x10 pixel	Tungsten ribbon	IR ceramic	ScMA
Ghosting	No	1x10 pixel	Tungsten ribbon	IR ceramic	ScMA
Mirror scatter	No	1x10 pixel	Tungsten ribbon	IR ceramic	ScMA
Transient response	Yes / no	3x12 pixel	SIS	BB	IAC

MODIS Near-Field Response Approaches Technology Limits

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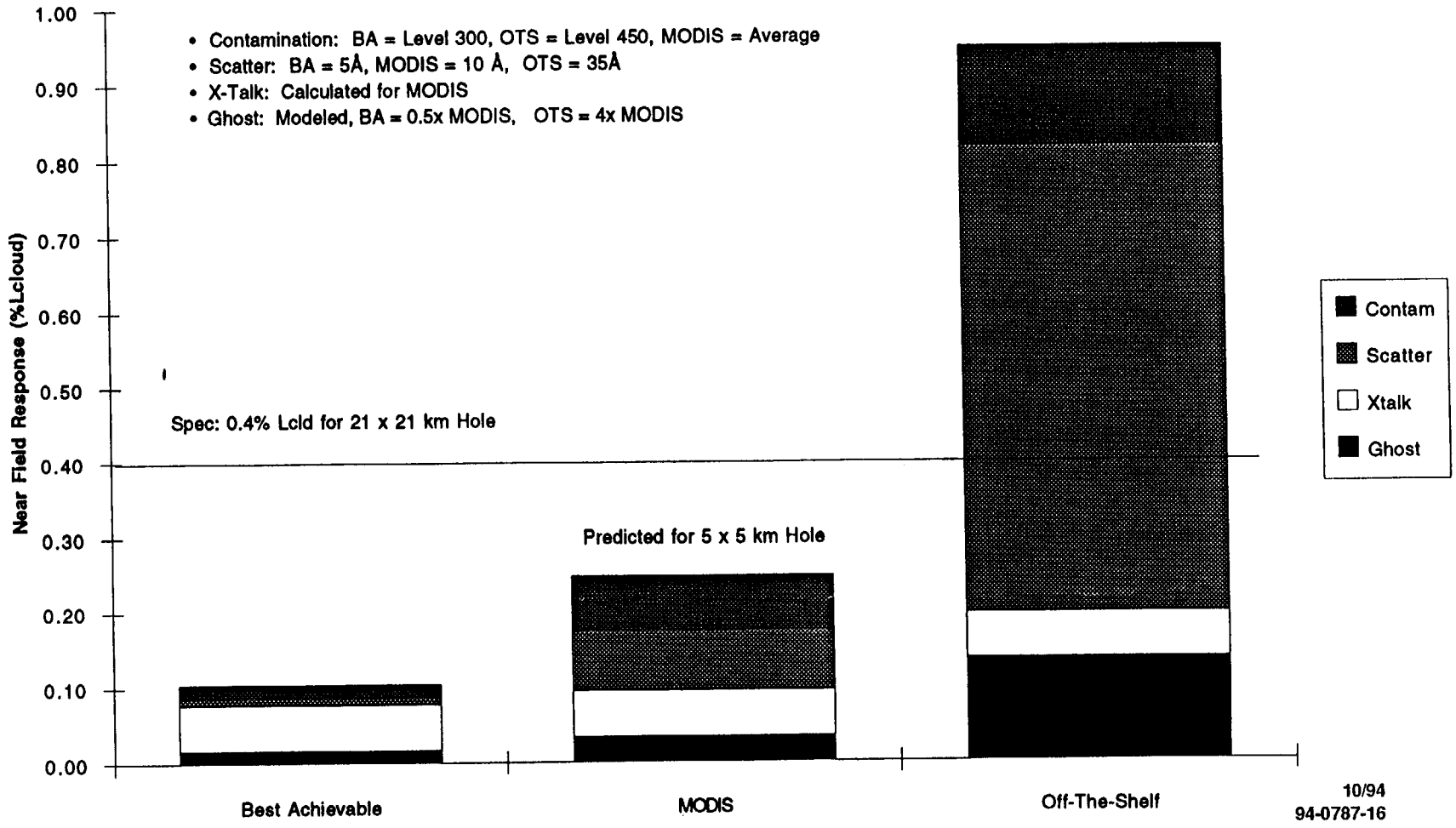

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