W. W. Hansen Experimental Physics Laboratory

STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305 - 4085

Gravity Probe B Relativity Mission

Telescope Readout Electronics Test Readiness Review Completion Certificate

GP-B P0260 Rev A

Mar 10,1999

Prepared by: Sei Chun Date
Systems Engineer

Approved by: Bob Farley Date
Telescope Readout Warm Electronics Responsible Engineer

Approved by: Paul Ehrensberger Date
Telescope Readout Electronics Integrated Product Team Leader

Approved by: John Janicki Date
Safety

Approved by: Rusty Gray Date
Quality Assurance

Approved by: Vince Trujillo Date
DCMC

Approved by: Lim Mar Date
Payload Electronics Team Leader

Approved by: Bob Schultz Date
Chief Systems Engineer

Approved by: S. Buchman Date
Hardware Manager

Telescope Readout Electronics Test Readiness Review

Date & Time: October 23, 1998, 9:00 to 11:00 A.M.
Location: GP-B conference room

Purpose:
To ensure that the flight hardware, test facility, test equipment, and test procedures are ready for testing, data acquisition and reduction.

Scope:
The Telescope Readout Electronics Test Readiness Review (TRR) will encompass all Forward Telescope Readout Electronics flight hardware.

Agenda:
- Requirements Traceability Status
- Procedure Status
- As-built vs. as-designed
- Test Personnel Status
- Test Resources Status
- Test Support Software Status

Review Team:

Sasha Buchman	Hardware Manager
Bob Schultz	Chief Systems Engineer
Lim Mar	Payload Electronics Team Leader
Paul Ehrensberger	TRE Integrated Product Team Leader
Bob Farley	TRE Warm Electronics Engineer
Rusty Gray	Systems Effectiveness
Sei Chun	Systems Engineer
Vince Trujillo	DCMC
John Janicki	Safety

TRR check list:

- Confirm that all specifications and interface control documents are approved and have proper traceability.
- Confirm that the requirement verification matrix has accounted for all of the specification requirements
- Confirm that test procedures approved.
- Confirm that the as-built vs. as-designed is documented.
- Confirm that sufficient and detailed resources are allocated to the test effort.
- Confirm that test support software has been released

Attachments:
A. Test Flow diagram
B. Requirements Verification Matrix
C. Document Status Checklist (AT procedures)
D. As-built vs. as-designed
E. Test Personnel Status Checklist
F. Test Resources Checklists and Test Support Software Checklist
G. Action Items Closure List

A. TRE Test Flow

TRE Digital Board and Analog Board Testing

LMMS TRE-004 Functional Test Procedure for Forward Flight Unit Subassemblies

TRE Acceptance Test

Pre-Environment Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit
Input Voltage Stability Test	LMMS TRE-025 Power and Magnetic Sensitivity Test
Random Vibration Test*	LMMS TRE-019 TRE Proto-Qual Vibration Test Procedure
Post Vibration Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit
Pyroshock Test	LMMS TRE-029 TRE Proto-Qual Pyroshock Test Procedure
T/V Test	LMMS TRE-020 TRE Proto-Qual T/V Test Procedure
Pre-T/V Ambient Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit
Warm Turn-on Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit
Cool Turn-on Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit
Hot turn-on #1 Abbreviated Functional Test	LMMS TRE-017 TRE Abbreviated Functional Test Procedure
Cold turn-on #1 Abbreviated Functional Test	LMMS TRE-017 TRE Abbreviated Functional Test Procedure
Hot turn-on #2& 5 Aliveness Test	LMMS TRE-021 TRE Aliveness Test Procedure
Cold turn-on #2 Aliveness Test	LMMS TRE-021 TRE Aliveness Test Procedure
Roll Rate Stability Test at #4	LMMS TRE-024 TRE Roll Rate Stability Test Procedure
Stability Test during Temp Transition(#6 & 7)	LMMS TRE-018 TRE Stability Test Procedure
Hot turn-on #8 Abbreviated Functional Test	LMMS TRE-017 TRE Abbreviated Functional Test Procedure
Cold turn-on #8 Abbreviated Functional Test	LMMS TRE-017 TRE Abbreviated Functional Test Procedure
Post-T/V Ambient Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit
Burn-in Test	LMMS TRE-016 TRE Burn-in Test Procedure
Pre-Burn-in Abbreviated Functional Test	LMMS TRE-017 TRE Abbreviated Functional Test Procedure
Post-Environment Full Functional Test	LMMS TRE-005 RevA Functional Test Procedure for Fully Assembled Forward Flight Unit

B. Telescope Readout Electronics Verification Matrix

TRE Requirements in T003

#	Title	Requirement	Mtd	Verification Plan	REE
7.2.4	Stability	The linearity and resolution of the telescope system shall be stable to 0.1 marcsec over the year.	A	S0299	M Keiser
7.5	Telescope Noise	The additive telescope readout noise is composed of a slowly changing bias and a continuous noise process. The continuous noise process is white, with a possible 1/f low frequency component, with a level dependent upon the guide star magnitude but sufficient for achieving the pointing requirements (see Section 19). The effective overall noise, including amplifier and photon contributions, shall be <= 10 marcsec/sqrt-Hz (one-sided) after filtering, sampling, and processing. *The specific telescope noise depends upon the guide star selection and amplifier characteristics*	A,T	TRE Acceptance Tests and analysis using assumed telescope performance	P Ehrensberger
7.6	Telescope Signal Processing		N/A		
7.6.1	Description	The telescope readout signals consist of the pointing and light intensity signals, both primary and redundant, for two independent axes (X and Y). *Note: The critical frequencies are the roll frequency (and the modulation of the phase and amplitude of that signal at orbital period, at annual period, and linearly with time), the spacecraft dither frequency (Section 19.5), and the SQUID calibration signal frequency (Section 3.5.3).*	N/A		
7.6.2	Bias Variation (Sensor Noise to unobservable Pointing Error)	The variation in the bias of the telescope pointing signal (including the effects from the telescope, the telescope electronics, and the A/D sampling) has the following requirements:	N/A		
7.6.2.1	Linear Variation	The amplitude of any linear variation in the body-fixed bias signal at roll frequency (linear variation in the inertially-fixed bias), the body-fixed SQUID calibration signal frequency shall be less than 0.1 marcsec for data taken over the course of one year during the time the guide star is valid.	A	Analysis using TRE Acceptance Test data	M Keiser

#	Title	Requirement	Mtd	Verification Plan	REE
7.6.2.2	Annual Variation	The amplitude of any variation at annual rate in the body-fixed bias at roll frequency (annual variation in the inertially-fixed bias) and the body-fixed SQUID calibration signal frequency shall be less than 0.4 marcsec for data taken over the course of one year during the time the guide star is valid.	A	Analysis using TRE Acceptance Test data	M Keiser
7.6.2.3	Orbital Variation	The amplitude of any variation at orbital rate in the body-fixed bias signal at roll frequency (orbital variation in the inertially-fixed bias) and the body-fixed SQUID calibration signal frequency shall be less than 0.1 marcsec for data taken over the course of one year during the time the guide star is valid.	A	Analysis using TRE Acceptance Test data	M Keiser
7.6.2.4	Linear Drift	The linear drift in the body-fixed bias shall be less than 1,000 milliarcseconds in one year for data taken over the course of one year during the time the guide star is valid.	A	Analysis using TRE Acceptance Test data	M Keiser
7.6.2.5	Bias Variation at Other Frequencies	The amplitude of a body-fixed signal at any other frequency not covered in the above requirements shall be less than 1,000 milliarcsec for data taken over the course of one year during the time the guide star is valid.	A	Analysis using TRE Acceptance Test data	M Keiser
7.6.3	Small Angle Scale Factor Variation	The telescope scale factor variation during guide star valid meets the following requirements:	N/A		
7.6.3.1	Orbital frequency scale factor variation	The variation in the small angle telescope scale factor at orbital frequency averaged over one week shall be less than 2%.	A,T	TRE acceptance test and telescope analysis	P Ehrensberger
7.6.3.2	Linear Drift in Telescope Scale Factor	The linear drift in the small angle telescope scale factor shall be less than 2% over any one day period.	A,T	TRE acceptance test and telescope analysis	P Ehrensberger
7.6.4	Phase Shift Variation	The telescope phase shift variation during guide star valid meets the following requirements:	N/A		
7.6.4.1	Orbital Frequency Phase Shift Variation	The variation in the telescope phase shift at orbital frequency averaged over one day shall be less than 0.02 radians.	A,T	TRE acceptance test and Analysis using TRE Acceptance Test data	P Ehrensberger
7.6.4.2	Linear Drift in Phase Shift	The linear drift in telescope phase shift shall be less than 0.02 radians over one day.	A,T	TRE acceptance test Analysis using TRE Acceptance Test data	P Ehrensberger
7.6.5	Timing and Signal Processing	The pointing and light intensity signals shall be sampled at a rate at least 10 times higher than the spacecraft roll frequency (section 21.2) and the spacecraft dither frequency (section 19.5) and shall be time tagged to an accuracy of 0.1 msec.	A	Inspection of design and Analysis using TRE Acceptance Test data	P Ehrensberger

Forward TRE Specification

Para	Title	Requirement Text and *Comment*	Ver Mtd	Verification Plan	REE
3.2	Characteristics		N/A		
3.2.1	Interfaces		N/A		
3.2.1.1	Mechanical Interfaces	The unit shall meet the mechanical interface defined in the Telescope Readout Electronics Interface Control Document 5856152.	I	Inspect per Drawing	Gray
3.2.1.2	Electrical Interfaces	The unit shall meet the electrical interface defined in the Telescope Readout Electronics Interface Control Document 5856152.	I	Inspect per Drawing	Gray
3.2.2	Environments		N/A		
3.2.2.1	Natural & Man-made External EM Environment	The TRE shall meet the EMI requirements in P0149 Paragraph 3.	A	This will be verified at SRE/TRE integration testing.	L Mar
3.2.2.1.1	Natural EM Disturbance Shielding	The TRE design shall reject disturbances at roll-rate due the earth's magnetic field.	A	This will be verified at SRE/TRE integration testing.	L Mar
3.2.2.1.2	EM Pulse Shielding	The TRE design shall meet performance requirement after exposure to EMI pulses up to 50 V/M in the 1-10 GHz range.	A	This will be verified at SRE/TRE integration testing.	L Mar
3.2.2.1.3	Conducted Emissions into Probe	No spurious signal in the frequency range of 1 MHz to 1 GHz on any conductor which connects to the probe shall be larger than 50 microvolts RMS (measured prior to tophat filtering)	T	EMI Test Procedure This will be verified at SRE/TRE EMI test.	L Mar
3.2.2.2	Corpuscular Radiation Environment	The TRE shall operate within specification in the ambient radiation environment of all parts of the GB-B orbit except the South Atlantic Anomaly (SAA). The TRE shall recover from passage through the SAA and shall again operate within specification by the time of the next GI-to-GV transition after an SAA passage.	A	EM # (TBS)	L Mar
3.2.2.2.1	Proton and Electron Instantaneous Flux Disturbances	The TRE design shall be sufficient to reject disturbance due to Proton and Electron Instantaneous Fluxes shown in P0149 to level specified in roll and annual stability specs in its mounted configuration on the payload.	A	EM # (TBS)	L Mar
3.2.2.2.2	Galactic Cosmic Ray Flux Disturbances	The TRE design shall be sufficient to reject disturbance due to Galactic Cosmic Ray Fluxes shown in P0149 to level specified in roll and annual stability specs in its mounted configuration on the payload.	A	EM # (TBS)	L Mar

Para	Title	Requirement Text and *Comment*	Ver Mtd	Verification Plan	REE
3.2.2.2.3	Mission Integrated Proton Fluence Disturbances	The TRE design shall meet performance requirements after exposure to Mission Integrated Proton Fluence shown in P0149 attenuated by shielding due to its mounted configuration and shall meet annual stability specs.	A	EM # (TBS)	L Mar
3.2.2.2.4	Solar Flare X-Ray Instantaneous Flux	The TRE shall meet performance requirements when Solar Flare X-Ray Instantaneous Flux is less than 0.001 W/m^2.	A	EM # (TBS)	L Mar
3.2.2.3	Random Vibration and Pyroshock Testing Environment		N/A		
3.2.2.3.1	Random Vibration Testing Levels	The Telescope Readout Electronics (TRE) shall be capable of performance as specified herein after exposure to the random vibration environments as specified below. The unit shall be subjected to the environment below in each of 3 axes, 1 minute /axis. Test tolerance shall be as listed in Table 1.	T	TRE Random Vibration Test Procedure	L Mar
3.2.2.3.2	Pyroshock Testing Levels	The TRE shall be capable of performance as specified herein after exposure to the protoqual pyroshock environment shown below. For protoqualification testing, the environment shall apply in the normal to mounting plane axis only, in each direction. The test tolerance is ±6 dB. With natural frequencies spaced at 1/6-octave intervals, at least 50 percent of the test spectrum values shall be greater than the nominal test specification. Off-axis (axes in-mounting-plane) test level (SRS) shall be less than the specified environment shown below.	T	TRE Pyroshock Test Procedure	L Mar
3.2.2.4	Temperature Range	The TRE shall meet performance requirements at the operating temperature range from 250 to 320 K.	T	TRE T/V Test procedure	Burns
3.2.3	Electrical Performance		N/A		
3.2.3.1	DMA Support		N/A		
3.2.3.1.1	Reference Voltage (VRG)	The unit shall provide a reference voltage (VRG) of -4.0±0.1 volts for the DMA reference node.	T	TRE Full Functional Test Procedure	Farley
3.2.3.1.2	Drain Supply Voltage (Q1DRN)	The unit shall provide a drain supply voltage (Q1DRN) of 0.5±0.1 volts for the first stage amplifiers of the DMA.	T	TRE Full Functional Test Procedure	Farley
3.2.3.1.3	First Stage Amplifier Current Source	The unit shall provide a current source (SRC1) of -102±4 µA for the first stage amplifiers of the DMA.	T	TRE Full Functional Test Procedure	Farley
3.2.3.1.4	Second Stage Amplifier Current Source	The unit shall provide a current source (SRC2) of -102±4 µA for the second stage amplifiers of the DMA.	T	TRE Full Functional Test Procedure	Farley

Para	Title	Requirement Text and *Comment*	Ver Mtd	Verification Plan	REE
3.2.3.1.5	Temperature Monitoring Current Source	The unit shall provide a current source (SDIA) of 10±0.2 µA to bias a silicon diode in the DMA for temperature monitoring.	T	TRE Full Functional Test Procedure	Farley
3.2.3.1.6	Temperature Monitoring	The unit shall monitor the voltage across the silicon diode temperature sensor in the DMA.	T	TRE Full Functional Test Procedure	Farley
3.2.3.1.7	Reset Clock signal	The unit shall provide a reset clock signal (RJFG) to the reset gates in the DMA.	T	TRE Full Functional Test Procedure	Farley
3.2.3.2	Signal Chain		N/A		
3.2.3.2.1	Input and Output Signal	The unit shall receive differential analog signals from the second stage DMA amplifier drains and provide compensation and a feedback signal to the integrator feedback capacitor located in the DMA.	T	TRE Full Functional Test Procedure	Farley
3.2.3.2.2	Input Line and Transimpedance	The input lines from the drains shall accommodate common mode currents up to 60 µA. The dc transimpedance from the input lines to the feedback capacitor shall be greater than $6x10^6$ volts per amp.	A	Transimpedance will be calculated. TRE Full Functional Test Procedure	Farley
3.2.3.2.3	Input Line Voltage	The voltage of the input lines shall be maintained within 2 millivolts of signal common.	A	Analysis by reviewing the acceptance test data	Farley
3.2.3.2.4	Signal Conditioning	The unit shall low pass filter and amplify the reset integrator output suitable for digitization by an external converter with a 20 volt span centered about zero volts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.2.5	Output Signal	The unit shall provide analog differential output signals to the SRE.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3	Digital Input from SRE	The unit shall receive differential digital signals from the SRE.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1	Parameters Set By Command from SRE	The unit shall provide controllable bias voltages with ranges and levels described below.	N/A		
3.2.3.3.1.1	Reset Clamp Range	The unit shall provide for command control of the RESET CLAMP with a range from 0 to approximately -3.85 volts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.2	Balance Range	The unit shall provide for command control of the BALANCE such that the difference between the Reset voltage and the VRG voltage has a range from approximately –20 to +20 millivolts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.3	Heater Range	The unit shall provide for command control of the HEATER with a range from 0 to 10 volts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.4	Temperature Set Point Range	The unit shall provide for command control of the TEMPERATURE SET POINT with a range from 0 to 10 volts.	T	TRE Full Functional Test Procedure	Farley

Para	Title	Requirement Text and *Comment*	Ver Mtd	Verification Plan	REE
3.2.3.3.1.5	Photo-Cathode Bias Range	The unit shall provide for command control of the PHOTO-CATHODE BIAS with a range from +3 to approximately -10.6 volts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.6	Heater Voltage Control	The unit shall provide an internal temperature control loop based on an externally supplied set-point command, compared to the measured DMA silicon diode voltage to control a heater voltage. The internal loop shall be able to be externally disabled, and the heater voltage set by an external command.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.7	Reset Clamp Resolution	The RESET CLAMP shall have a command step of < 0.03 volts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.8	Balance Resolution	The BALANCE shall have a command step of < 0.2 millivolts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.9	Heater Resolution	The HEATER shall have a command step of < 0.003 volts.	T	TRE Full Functional Test Procedure	Farley
3.2.3.3.1.10	Photo-Cathode Bias Resolution	The PHOTO-CATHODE BIAS shall have a command step of < 0.06 volts.	T	TRE Full Functional Test Procedure	Farley

Para	Title	Requirement Text and *Comment*	Ver Mtd	Verification Plan	REE
3.2.3.4	Engineering Data Channel Signals	The unit shall provide an analog multiplexer to sample the following items and supply a differential output signal to the SRE. Signal Common + Reference TIA voltage + Signal TIA voltage + Direction Clamp voltage + Direction Feedback Point - Reference TIA voltage - Signal TIA voltage - Direction Clamp voltage - Direction Feedback Point Silicon Diode Voltage Box Temperature voltage Heater voltage Temperature Command DAC voltage Temperature Servo error voltage +12V Supply voltage +5V Power voltage Reference -4V voltage Reference -10V voltage -12V Supply voltage Reset Drive Level voltage Reference +0.5 V voltage Diode Bias voltage Reference +5V voltage SRC1V SRC2V	T	TRE Full Functional Test Procedure	Farley
3.2.3.5	Primary Data Chain Performance	Each detector signal is considered as a primary data channel.	N/A		
3.2.3.5.1	Gain Step Size	The unit shall provide for 16 different voltage gain values in the primary data channels. Each step shall be between 1.4 +/- 0.1.	T	TRE Full Functional Test Procedure	Farley
3.2.3.5.2	Gain Range	The gain range shall be from 160 to 200.	T	TRE Full Functional Test Procedure	Farley
3.2.3.5.3	Gain Stability	The differential gain stability between the two detector signal channels of any axis shall change less than 1 part in 5000 per Kelvin.	A,T	TRE Full Functional Test Procedure & Stability Test Analysis of test data	Farley

Para	Title	Requirement Text and *Comment*	Ver Mtd	Verification Plan	REE
3.2.3.5.4	Filter characteristics	The primary data filter shall have the characteristic of a second-order butterworth approximation with a 500 Hertz corner frequency. The deviation from this approximation over the range from 5 to 2500 Hertz shall be less than +/- 0.5 dB.	T	TRE Full Functional Test Procedure	Farley
3.2.4	TRE Mechanical Specifications (per box)		N/A		
3.2.4.1	Forward Box Maximum Dimensions	The unit dimension shall be 17"L X 9.7" W X 3.5" H per the drawing 5856128.	I	Inspect the unit per drawing	Rusty
3.2.4.2	Mass/Unit	The unit mass shall be less than or equal to 6.4 Kg.	I	Check measurement	Rusty
3.2.4.3	Power, Max per Unit	The power consumption per unit, averaged over any orbit shall be less than or equal to 6 Watts.	T	TRE Full Functional Test Procedure	Farley
3.2.4.3.1	Load Shedding	During periods of low power availability, one of the two TREs might be turned off to save power. The TRE shall survive being turned off for up to one year.	A	EM # (TBS)	Farley

C. Telescope Readout Electronics Requirements Verification Documents Checklist

TRE Test Procedures

Document	Revision Date	Author	Title	Written	Approval Status
LMMS/ TRE-004	2/09/98	Bob Farley	Functional Test Procedure for Fwd Flight Unit Subassembly	✓	Approved
LMMS/ TRE-005 A	9/2/98	Bob Farley	Full Functional Test Procedure for Fully assembled Fwd Flight Unit	✓	Approved
LMMS/TRE-016	11/9/98	Bob Farley	TRE Burn-In Procedure For Forward Flight Units	✓	Approved
LMMS/TRE-017	11/9/98	Bob Farley	TRE Abbreviated Functional Test Procedure	✓	Approved
LMMS/TRE-018	11/9/98	Bob Farley	TRE Stability Test Procedure	✓	Approved
LMMS/TRE-019	11/9/98	Lim Mar	TRE Proto-Qual Random Vibration Test Procedure	✓	Approved
LMMS/TRE-020	11/17/98	Lim Mar	TRE Proto-Qual Thermal/Vacuum Test Procedure	✓	Approved
LMMS/TRE-021	11/9/98	Bob Farley	TRE Aliveness Test Procedure	✓	Approved
LMMS/TRE-024	11/22/98	Bob Farley	TRE Roll Rate Stability Test Procedure	✓	Approved
LMMS/TRE-025	11/9/98	Bob Farley	TRE Input Voltage Stability Test Procedure	✓	Approved
LMMS/TRE-029	3/9/99	Mike Gate	TRE Proto-Qual Pyroshock Test Procedure		

Additional Documents

	Date	Author	Title	Approval Status
T003	10/27/98	S. Chun	System Design and Performance Requirements	Approved
P480135	10/29/98	P. Ehrensberger	TRE Forward Electronics Specification	Approved
EMPLE201	11/9/98	Lim Mar	TRE Acceptance Test Plan	Approved
P086822	7/25/97	C. Chivatero	Spacecraft Contamination Control Plan	Approved
8A00918A	10/12/98	C. Mulberg	TRE Electronics Assembly Drawing	Approved
8A00614A	11/17/97	R. Farley	TRE Analog Board	Approved
8A00615A	11/15/97	R. Farley	TRE Digital Board	Approved
8A00851A	11/17/97	R. Farley	TRE schematic-Analog	Approved
8A00852A	11/18/97	R. Farley	TRE schematic-Digital	Approved
5856152 Rev A	11/13/98	R. Taylor	TRE Interface Control Document	Approved

D. TRE As-built vs. as-designed

Assembly #	PART/DOCUMENT	DESIGNED AS REVISION	BUILT AS REVISION	DESCRIPTION
8A00918-101				TRE Final Assembly
	8A00851	B	B	Schematic, TRE Analog Board
	8A00614	A	A	PWB, TRE Analog
	8A00842	E	E	PWA, TRE Analog
	8A00852	A	A	Schematic, TRE Digital Board
	8A00615	A	A	PWB, TRE Digital
	8A00843	D	D	PWA, TRE Analog
	5856128	A	A	Enclosure
	5856129	A	A	Cover, Top
	5856130	A	A	Cover, Bottom
	8A00626	A	A	Internal Cable, WTRE-002
	8A00627	B	B	Internal Cable, WTRE-001
	8A00845	N/C	N/C	Vent Clamp

E. Telescope Readout Electronics Test Personnel Status Checklist

Test Director / QA

The test director is Bob Farley (Backup: Paul Ehrensberger).

The QA personnel is Rusty Gray (Back-up: Mike Sisley).

F. Telescope Readout Electronics Test Resources Checklists

Instruments Requiring Calibration

Item Description	ID / Serial Number
Oscilloscope	Tektronix TD540A
Multimeter	Fluke 87 True RMS Multimeter
Multimeter	HP3457A
Waveform Generator	HP 33120A
Three output laboratory power supply	Systron-Donner TL8-3 or equivalent
Power Test Cable	LMCO 8A01602GSE-101

Test Equipment Certification

Item Description	Certification Procedure
Electrical Ground Support Equipment	P0396 QA Test Procedure for TRE EGSE rack
TRE Test Stimulator	TRE-008 Certification Procedure for TRE Test Stimulator
Digital Board Test Breakout Box	TRE-006 Certification Procedure for Digital Board Test Breakout Box
Power Insert Box	TRE-007 Certification Procedure for Power Insert Box
Knobpot Test Box	TRE-009 Certification Procedure for Knobpot Test Box
TRE 2-Axis Differential Modulator	TRE-012 Certification Procedure for the TRE 2-Axis Differential Modulator
TRE Differential Amplifier Test Box	TRE-013 Certification Procedure for TRE Differential Amplifier Test Box
TRE Burn-in Temperature Controller	TRE-027 Certification Procedure for TRE Burn-in Temperature Controller

Test Support Software

Software Product	Version	Controlled	Demonstrated
Sqd360.exe	V3.6	✓	✓

G. Action Item Closure Status

Action Items	Assignee	ECD	Status
1. Add as-built vs. as-designed information to the TRE TRR package. Confirm that board-level is appropriate.	Bob Farley Mike Sisley	10/9/98	Closed
2. Complete all the test procedure and obtain approval signature. Note that each test procedure should identify the names of the individuals responsible for the tests. Approvals required are: QA (Mike Sisley or Rusty Gray), REE (Bob Farley), and Lead (Lim Mar). LMMS/TRE-017 TRE Abbreviated Functional Test Procedure(Bob Farley) Sign-off by 10/27 LMMS/TRE-018 TRE Stability Test Procedure (Bob Farley) Sign-off by 10/27 LMMS/TRE-000 TRE Voltage Sensitivity Test Procedure (Bob Farley) Sign-off by 10/29 LMMS/TRE-00 TRE Roll Rate Stability Test Procedure (Bob Farley) Sign-off by 11/3 LMMS/TRE-016 TRE Burn-In Procedure For Forward Flight Units (Bob Farley) Sign-off by 11/3 LMMS/TRE-021 TRE Aliveness Test Procedure (Bob Farley) Sign-off by 10/27 LMMS/TRE-019 TRE Proto-Qual Random Vibration Test Procedure (Lim Mar) Sign-off by 10/27 LMMS/TRE-020 TRE Proto-Qual Thermal/Vacuum Test Procedure (Lim Mar) Sign-off by 10/28	Bob Farley Lim Mar	10/30/98 11/9 11/9/98 11/9/98 11/9/98 11/9/98 11/9/98	Closed
*3. Summarize the parameters to trend for functional tests. Not required for TRE TRR.	Sasha Buchman	10/27/98	Closed
4. Establish software version control. Provide a copy of version controlled software to Mae Sato and Mike Sisley	Bob Farley / Mike Sisley	10/9/98	Closed Reassigned to #14
5. Determine method to perform EMI test at TRE box level. Use SC box procedure as a template.	Lim Mar, Paul Ehrensberger, Jim Lockhart	10/12/98	Closed
6. Write a procedure to perform magnetics testing.	Lim Mar/ Jim Lockhart	10/13/98	Closed
7. Add functional tests and move the burn-in test after TV test.	Lim Mar/ Sei Chun	10/9/98	Closed
8. Update the calibration/certification instrumentation lists.	Sei Chun	10/9/98	Closed
9. Release the TRE specification, including the section 4. The following should sign the specification: Paul Ehrensberger, Bob Farley, Lim Mar, Bob Schultz, Ben Taller, LMMS QA (Rusty or Mike). PCB the new release and have Jim Lockhart and Barry Muhlfelder sign the PCB.	Paul Ehrensberger/ Sei Chun	10/29/98	Closed PCB approval 10/29/98
10. Complete the TRE verification plan matrix.	Paul Ehrensberger / Sei Chun	10/29/98	Closed
11. Add red-lines to TRR presentation package.	Sei Chun	10/9/98	Closed
12. Group the TRE TRR objectives by resources, procedures, and requirements.	Sei Chun	10/9/98	Closed
*13. Define the pyroshock tests for aft payload electronics units. Assignee:	Ken Shaul/ Lim Mar	10/23/98	Closed

Action Items	Assignee	ECD	Status
14. Write a TRE test SW Version Description Document and include in the data package. Originator: Rusty Gray	Bob Farley	10/26/98	Closed
15. Develop EMI test for the integrated SRE/TRE test. Originator: Gaylord Green	Jim Lockhart	10/27/98	Closed. Will be completed prior to SRE TRR
16. Include TRE magnetic and magnetic sensitivity test as a pert of SRE/TRE integration test. Originator: Sasha Buchman ECD:	Jim Lockhart	10/27/98	Closed. Will be completed prior to SRE TRR
17. Investigate whether the pyroshock testing is needed for Fwd Electronic boxes. Assignee: Originator: Sasha Buchman	Gaylord Green	10/27/98	Closed. Recommended no pyroshock testing. PCB to update spec if needed.
18. Identify any additional test equipment required for new added testing Originator: Lim Mar ECD:	Bob Farley	10/27/98	Closed.

*All the action items except the number # 3 & # 13 need to be closed before the testing.