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1.0		**SCIENCE REQUIREMENTS**														
1.1	**MAG Science Requirements**	Noise Level < 0.05nT	MRD - 4.7(K) and solar wind characteristics. IPF - 3.1			T					Operation in laboratory 4-layer magnetic shield with B<0.25 nT. Computation of noise spectrum from test data				GSFC / Acuna	
1.2		Absolute Accuracy < +/- 0.1nT	MRD - 4.7(K) IPF - 3.1			T					Calibration against proton precession standard at GSFC Test Site – Electronics adjustments during electrical testing				GSFC / Acuna	
1.3		Range = +/-512nT	MRD - 4.7(K) IPF - 3.1			T					Operation in laboratory coil system and MAG Test Site – Calibration against proton precession standard				GSFC / Acuna	
1.4		Drift < +/- 0.2 nT/yr	MRD 4.6.2.6.1 and Absolute Accuracy IPF - 3.1			S,T					Short term test only – analytical verification from prior missions				GSFC / Acuna	
1.5		Time Resolution = 1 second	MRD - 4.7(K) IPF - 3.1					T			Boom suite tests shall verify telemetry throughput				UCB / Curtis	
1.6	**SWEA Science Requirements**	FOV = 360 X 60 degrees	MRD - 4.7(H,I,J) IPF - 3.2			T					Calibration with electron gun at CESR				CESR	
1.7		Resolution = 45 degrees	MRD - 4.7(H,I,J) IPF - 3.2			T					Calibration with electron gun at CESR				CESR	
1.8		Energy = 20 to 1000eV	MRD - 4.7(H,I,J) IPF - 3.2			T, A					Calibration with electron gun at CESR over a limited energy range; extrapolated analytically to lower energies				CESR	
1.9		Energy Resolution (Telemetry) < 100%	MRD - 4.7(H,I,J) and solar wind characteristics IPF - 3.2			T					Calibration with electron gun at CESR shall verify instrument resolution (~10%); IDPU software acceptance test shall verify averaging for telemetry into bins with resolution better than 100%				CESR	
1.10		Geometric Factor > 0.001 cm^2 ster E(eV)	MRD - 4.7(H,I,J) and solar wind characteristics IPF - 3.2			T					Calibration with electron gun at CESR				CESR	
1.11		Max Count Rate (per 22.5 degree sector) > 1E5 counts/sec	MRD - 4.7(H,I,J) and solar wind characteristics IPF - 3.2			T					Calibration with electron gun at CESR				CESR	
1.12		Time Resolution = 1 minute	MRD - 4.7(H,I,J)					T			Boom Suite testing shall verify end-to-end throughput				UCB / Curtis	
1.13	**STE Science Requirements**	FOV = 60 x 60 degree	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3			T, A					Geometrical analysis of STE instrument together with spot checking during calibrations with an electron gun				UCB	
1.14		Resolution = 60 x 20 degrees	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3			T, A					Geometrical analysis of STE instrument together with spot checking during calibrations with an electron gun				UCB	
1.15		Energy = 5 - 100 keV	MRD - 4.7(F,G) IPF - 3.3			T					Calibrations with an electron gun and sources				UCB	
1.16		Energy Resolution (Telemetry) < 100%	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3			T					IDPU software acceptance test shall verify STE energy resolution in telemetry better than 100%				UCB	
1.17		Energy Resolution (Electronic) < 2keV	IPF - 3.3			T					Calibrations with an electron gun and sources				UCB	

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1.18		Geometric Factor > 0.1 cm^2 ster	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3			T					Calibrations with an electron gun and sources				UCB	
1.19		Background < 30c/s /detector	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3			T					No-source background measurements				UCB	
1.20		Max Count Rate (per detector) > 10,000 counts/sec	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3			T					Calibrations with an electron gun and sources				UCB	
1.21		Time Resolution = 1 minute	MRD - 4.7(F,G) IPF - 3.3					T			Boom Suite testing shall verify end-to-end throughput				UCB	
1.22	**SIT Science Requirements**	FOV = 17 x 44 degrees	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			A					Geometrical analysis of SIT telescope, thin foil and solid state detector size.				UMd	
1.23		Energy = 30-2,000 keV/nuc He-Fe	MRD - 4.7(F,G) IPF - 3.4			A, T					Analysis of thin foil thickness (from manufacturer's specification), solid state detector threshold, and dynamic range of solid state detector energy amplifier and time-of-flight system. Spot-checks of performance done with radioactive alpha-sources, and ion beam calibration at Brookhaven Tandem Van de Graaff.				UMd	
1.24		Mass Resolution = 0.85 AMU (^{4}He at 1MeV/Nuc)	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			T					Laboratory calibration with radioactive alpha sources (energy approx 1 MeV/nucleon)				UMd	
1.25		Energy Resolution - 35keV FWHM @ 22C	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			T					Pulser calibration of energy system, along with calibration using radioactive alpha sources.				UMd	
1.26		Geometric Factor - 0.4 cm^2 ster	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			A					Geometrical analysis of SIT telescope, thin foil and solid state detector size.				UMd	
1.27		Background = 10^{-2} events/sec during vac test	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			T					Observe background event rate during lab vacuum tests without source.				UMd	
1.28		Max Event Rate = 1000 events/sec	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			T					Pulser calibration of instrument, and calibration at tandem Van de Graaff at Brookhaven National Lab.				UMd	
1.29		Time Resolution = 15 minutes	MRD - 4.7(F,G) and CME characteristics IPF - 3.4				T				SEP Suite testing shall verify end-to-end throughput				CIT	
1.30	**SEPT Science Requirements**	FOV = 2 sets for electrons and protons, each with: 2 oppositely directed view cones in-ecliptic, 2 oppositely directed view cones off-ecliptic, 45 degree full opening angle.	MRD - 4.7(F,G) and CME characteristics IPF - 3.5			A					Geometrical analysis of SEPT telescope, collimator aperture, magnet air gap, thin foil, and solid state detector size.				Keil	

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1.31		Energy = 30-400 keV, electrons 60-2000 keV, protons	MRD - 4.7(F,G) IPF - 3.5			A, T					Analysis of vector field of magnetic remanence with point charge model approach. Spot-checks to verify analytical calculations.Measurement of foil thickness with alpha-spectrometer (50 nm resolution).Mathematical model of SEPT telescope (GEANT Monte-Carlo-Simuation). Verification of model with ion-source (up to 300 keV) at HMI, Tandem Van de Graaff (up to 7 MeV) at HMI, conversion electrons (up to 1 MeV) with radioactive sources				Keil	
1.32		Energy Resolution (Telemetry) = 30% electrons, 30% protons	MRD - 4.7(F,G) and CME characteristics IPF - 3.5			T					Measurement with cosmic ray muons, radioactive sources, proton beam, pulser calibration.				Keil	
1.33		Geometric Factor > 0.4 cm^2 ster, electrons 0.4 cm^2 ster, protons	MRD - 4.7(F,G) and CME characteristics IPF - 3.5			A					Geometrical analysis of SEPT telescope, collimator aperture, magnet air gap, thin foil, and solid state detector size. Monte-Carlo-Simulation to determine telescope response as function of energy and incidence angle.				Keil	
1.34		Background < 2 counts/s on ground, 20 degrees C	MRD - 4.7(F,G) and CME characteristics IPF - 3.5			T					Measurement of background event rate during lab vacuum tests without source.				Keil	
1.35		Max Event Rate > 25,000 counts/s at 2.2 MeV 250,000 counts/s at 55 keV	MRD - 4.7(F,G) and CME characteristics IPF - 3.5			T					Pulser calibration of instrument, calibration at tandem Van de Graaff at HMI (Hahn-Meitner-Institut, Berlin).				Keil	
1.36		Time Resolution = 60 seconds	MRD - 4.7(F,G) and CME characteristics IPF - 3.5				T				SEP Suite testing shall verify end-to-end throughput				CIT	
1.37	**LET Science Requirements**	FOV = 2 oppositely directed 100 x 30 degree fans	MRD - 4.7(F,G) and CME characteristics IPF - 3.6	T		A					Geometrical analysis of LET instrument coupled with laboratorymapping of solid state detector areas.				CIT	
1.38		Energy Range (MeV/nucleon) = H: 1.5 - 3 He: 1.5 - 13 O: 3 -25 Fe: 3 - 25	MRD - 4.7(F,G) IPF - 3.6	T							detector thickness measurements				CIT	
						T, A					Pulser and alpha-particle calibrations and heavy-ion range-energy relations.				CIT	
						T					Verification at particle accelerator.				CIT	
1.39		Geometric Factor cm^2 ster = H, He: 0.5 6=Z=26: 2	MRD - 4.7(F,G) and CME characteristics IPF - 3.6	T		A					Geometrical analysis of LET instrument coupled with laboratorymapping of solid state detector areas.				CIT	
1.40		Element Resolution = Resolve H, He, C, N, O, Ne, Mg, Si, Fe	MRD - 4.7(F,G) and CME characteristics IPF - 3.6	T		A					Alpha-particle measurement of detector thickness uniformity coupled with Monte Carlo simulations.				CIT	
						T					Final verification at particle accelerator.				CIT	
1.41		^{4}He Mass Resolution = 0.35 AMU	MRD - 4.7(F,G) and CME characteristics IPF - 3.6			T, A					Calibrations with alpha particle source and electronic pulser aided by analysis.				CIT	
1.42		Max Event Rate = 1000 events/sec	MRD - 4.7(F,G) and CME characteristics IPF - 3.6			T					Bench tests with pulser;				CIT	
						T					verification at particle accelerator.				CIT	

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1.43		Energy Binning = 6 intervals per species for Z=2=3 intervals for H	MRD - 4.7(F,G) and CME characteristics IPF - 3.6			**T, A**					Pulser and alpha-particle calibrations supplemented by Monte-Carlo simulations.				CIT	
						T					Verification at particle accelerator.				CIT	
1.44		Species Binning = H, ^{3}He, ^{4}He, C, N, O, Ne, Mg, Si, Fe	Derived from element resolution above IPF - 3.6			**T, A**					Pulser and alpha-particle calibrations supplemented by Monte-Carlo simulations.				CIT	
						T					Verification at particle accelerator.				CIT	
1.45		Time Resolution = 15 minutes, 1 prioritized event/sec	MRD - 4.7(F,G) and CME characteristics IPF - 3.6				**T**				SEP Suite testing shall verify end-to-end throughput				CIT	
1.46		Beacon Telemetry = 1 minute for H, He, 6=Z=26	MRD - 6.7.1 and CME characteristics IPF - 3.6				**T**				SEP Suite testing shall verify end-to-end throughput				CIT	
1.47	**HET Science Requirements**	FOV (full angle) = 50 degree cone	MRD - 4.7(F,G) and CME characteristics IPF - 3.7												GSFC / Tycho	
1.48		Energy Range (MeV/nucleon) = e: 1 - 6 H, He: 13 - 40 3He: 16 - 40 ~30 to 80 for 6 = Z= 14	MRD - 4.7(F,G) IPF - 3.7												GSFC / Tycho	
1.49		Geometric Factor, cm^2 ster = 0.5	MRD - 4.7(F,G) and CME characteristics IPF - 3.7												GSFC / Tycho	
1.50		Element Resolution, dZ (rms), for stopping particles = 0.2 for 1 = Z = 14	MRD - 4.7(F,G) and CME characteristics IPF - 3.7												GSFC / Tycho	
1.51		^{4}He Mass Resolution = 0.25 amu	MRD - 4.7(F,G) and CME characteristics IPF - 3.7												GSFC / Tycho	
1.52		Max Event Rate = 1000 events/sec	MRD - 4.7(F,G) and CME characteristics IPF - 3.7												GSFC / Tycho	
1.53		Energy Binning = Six intervals per species	MRD - 4.7(F,G) and CME characteristics IPF - 3.7												GSFC / Tycho	
1.54		Species Binning = H, ^{3}He, ^{4}He, 6 = Z = 14, Electrons	Derived from Element resolution above IPF - 3.7												GSFC / Tycho	

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1.55		Time Resolution = 15 minutes, 0.3 prioritized event/sec	MRD - 4.7(F,G) and CME characteristics IPF - 3.7				T				SEP Suite testing shall verify end-to-end throughput				CIT	
1.56		Beacon Telemetry = 1 minute H, He, e	MRD - 6.7.1 and CME characteristics IPF - 3.7				T				SEP Suite testing shall verify end-to-end throughput				CIT	
1.57	**BOOM Science Requirements**	Magnetic field = < 1nT static, 0.05 nT dynamic at the MAG sensor	MRD - 4.7(K) IPF - 4.1			A, T					Materials analysis suplemented by part-level measurements for items close to the MAG sensor and assembly measurement for the rest				UCB	
1.58		MAG distance from spacecraft > 3m	MRD - 4.7(K) and typical spacecraft magnetic characeristics IPF - 4.1			I					Inspection of drawings, final assembly				UCB / JM	
1.59		MAG distance from other boom mounted instruments > 1m	MRD - 4.7(K) and recent experience with SWEA-like instrument IPF - 4.1			I					Inspection of drawings, final assembly				UCB / JM	
1.60		MAG distance from boom harness = 20 cm	MRD - 4.7(K) and expected harness currents IPF - 4.1			I					Inspection of drawings, final assembly				UCB / JM	
1.61		MAG mounting bracket material = non-metallic	MRD - 4.7(K) and thermal current issues IPF - 4.1			I, T					Inspection and Magnetics test of completed MAG bracket				UCB / JM	
1.62		Instrument Alignment (includes <0.25 degree spacecraft allocation for mounting, attitude knowledge, etc., leaving 0.75 degrees for MAG sensor mounting, boom deployment repeatability, etc.) = +/- 1 degree knowledge	MRD - 4.7(K) IPF - 4.1 ICD 2.1.3/6.2.2			T					Repeated deployment tests followed by alignment measurements on the qual model				UCB / JM	
						T					Deploy and measure alignment on flight units				UCB / JM	
1.63		SWEA FOV = > 80 % clear	MRD - 4.7 (H, I, J) IPF - 4.1			A					FOV analysis				APL	
1.64		SWEA FOV = No sunlight in aperture during science modes	MRD - 4.7 (H, I, J), detector sensitivity to UV IPF - 4.1			A					Analysis to demonstarte SWEA in shadow when science mode pointing achieved				UCB / JM	
1.65		Boom surface conductivity = <10K ohms bulk, <10E8 ohms/square	MRD - 4.7 (H,I, J), electrostatics IPF - 4.1			T					Spot resistance measurements at numerous locations along a deployed boom				UCB / JM	
1.66		STE FOV = clear	MRD - 4.7 (F,G), scattered light sensitivity IPF - 4.1			I					FOV analysis				APL	
1.67		STE FOV = 2-bounce system to detectors	MRD 4.7 (H,I,J), detector sensitivity to UV IPF - 4.1			A					stray light analysis				UCB / PT	

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1.68		STE Thermal = < 0C	MRD - 4.7 (F,G), STE detector noise IPF - 4.1			A,T					thermal analysis, thermal balance tests				UCB / PT	
1.69	Boom Stiffness	The IMPACT Boom, in its deployed configuration, shall be designed such that the first flexible body mode has a frequency above 0.5 Hz.	ENV - 3.4.1.2 ICD - 6.4.2.1 IPF - 4.2			T		T			Part of boom deployment test proceedure				UCB / JM	
1.70	**Overall Timing Accuracy**	The S/WAVES and IMPACT instruments and spacecraft shall be designed to allow science data to be time-tagged with a relative timing accuracy of <1ms between the S/WAVES and IMPACT instruments.	MRD - 6.2.3							T	Preliminary verification made with SWAVES, IMPACT and the Spacecraft ETUs, 10/2003. Final verification to be made during Observatory tests. Tests involve stimulating the MAG and SWAVES instruments with a common signal from the SWAVES GSE and then verifying the time tags on the data match to the required accuracy.				UCB / UMn / APL	
2.0		**THERMAL REQUIREMENTS**														
2.1	**Instrument Subsystem Thermal Design Environments/ Requirements**	Instruments shall design for solar distances detailed in Table 3.3.1-0 in order to cover a launch opportunity during any month of the year (except Dec 2005 and Dec 2006). 1. Instruments shall assume worst case solar flux values ranging from ~1653.8 W/m2 to ~1152.3 W/m2 in its thermal models/analyses. 2. Instruments shall assume for its thermal models/analyses that the maximum off pointing referenced to the probe-sun line is 5 degrees during anomalous operations (Earth Aquisition Mode), 5 arc-min during normal operation and up to 45 degrees off-pointing (maximum duration of 105 minutes) for transient operation. 3. Instrument thermal analyses shall use the temperature limits on the S/C side of the mounting interface to define the conduction and radiation boundary condition. Mounting temperature limits shall be no wider than -13C to +45C (predicted maximum range) during operational modes and no wider than -18C to +50C during S/C survival mode. 4. Survival heaters shall be sized for 100% duty cycle at 25V. Operational heaters shall be sized for 75% duty cycle at 30.5V 5.Isolated IMPACT subsystems shall demonstrate, through analysis and test, a total thermal interface resistance (conductive and radiative) of at least 20C/W from mounting surface to S/C. 6. Thermally coupled IMPACT subsystems shall be designed such that the heat density at their mounting	ENV - 3.3.1 ICD - 5.11/5.15/5.1.3.2/ 5.15/5.2.1/3.2.2	SEP			A			A	SEP suite Thermal Analysis (Observatory Analysis by APL)				GSFC / Hawk	
				BOOM				A			Boom suite thermal analysis (Observator analysis by APL)				UCB / Seivold	
				SEPT		T					Thermal Vac at Keil				Kiel	
				SIT		T					Thermal Vac at GSFC (Tycho's facility)				UMd	

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2.2	**Instrument Thermal VacuumTesting**	5	ENV - 3.3.2/3.3.2.1 ICD - 5.3/5.15	SEPC			T			T	SEP Central / HET / LET Thermal vac at JPL				CIT	
				IDPU		T					Thermal vac at UCB.				UCB	
				Boom				T			Boom/MAG/STE-U assembly thermal vac @ UCB				UCB	
				SWEA		T					Thermal vac at UCB				UCB	
2.3	**Instrument Thermal Balance Testing**	Each instrument must udergo thermal vacuum balance testing to correlate its thermal performance to thermal model predictions. The test must simulate spacecraft conductive and radiative interace temperatures, space radiation couplings, and environmental heat inputs. The instrument thermal control system must demonstrate the ability to maintain temperatures within survival while in operational mode and within operational limits while in operating mode.	ENV - 3.3.2/3.3.2.1 ICD - 5.3/5.15	SEPT		T				T	Thermal Balance at GSFC (Tycho's facility)				Kiel	
				SIT		T					Thermal Balance at GSFC (Tycho's facility)				UMd	
				SEPC		T					SEP Central / HET / LET Thermal balance at JPL				CIT	
				IDPU							No thermal balance (inside spacecraft bus)				UCB	
				Boom		T					Boom qual unit thermal balance tests., 10/2002, "STEREO/IMPACT Boom Thermal Balance Test Plan"			Pass	UCB	
				MAG		H					MAG thermal balance based on previous missions with identical sensors.			Pass	GSFC / Acuna	
				STE-U		T					Thermal Balance at UCB				UCB	
				SWEA		T					Thermal Balance at UCB				UCB	
3.0		**STRUCTURAL/MECHANICAL REQUIREMENTS**														
3.1	**Instrument Structrual Design Requirements**	The instruments shall meet the following design reqts. **Quasi Static Load Factors:** Component weight --> Limit Load <4.5 kg --> 30g 4.5 kg to 22.7 kg --> 25g 22.7 kg to 45 kg --> 20g >45 kg --> 16g **Factors of Safety:** Material Yield - Design >= 1.3 x limit load factors, Sine Vibration - 1.4 x max expected level Material Ultimate - >+1.4 x limit load factors, Acoustic and Random Vibration - Max level +3db. Buckling - >= 2.0 x limit load factors Composites - >= 2.0 x limit load factors **Margin of Safety for Instruments:** Instrument strength and analysis must show a positive margin of safety (MS) Margins of safety for yield strength (Y) and ultimate strength (U) are defined as follows: MSY = Margin of Safety on Yield Strength = Material Yield Strength - 1.0 > 0 1.3 x Applied Stress MSU - Margin of Safety on Ultimate Strength = Material Ultimate Strength - 1.0 > 0 1.4 x Applied Stress	ENV - 3.4.1	SEPT		A									Kiel	
				SIT		A									GSFC / SS	
				SEPC			A				SEP Central / HET / LET				GSFC / SS	
				IDPU		A									UCB	
				Boom		A					Including STE & SWEA pedestal				UCB	
				MAG		A									GSFC / Acuna	
				SWEA		A					Analyzer				CESR	

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3.2	**Instrument Stiffness**	Instruments shall be designed such that primary structural vibration modes are above 50 Hz. The IMPACT Boom, in its deployed configuration, shall be designed such that the first flexible body mode has a frequency above 0.5 Hz.	ENV - 3.4.1.2 ICD - 6.1.3.2/6.4.2.1 IPF - 4.2	SEPT		**A**									Kiel	
				SIT		**A**									GSFC / SS	
				SEPC			**A**				SEP Central / HET / LET				GSFC / SS	
				IDPU		**A**									UCB	
				Boom		**A/T**			**T**		Including STE & SWEA pedestal. Part of boom deployment test proceedure.				UCB/ JM	
				MAG		**A**									GSFC / Acuna	
				SWEA		**A**					Analyzer				CESR	
3.3	**Instrument Venting Requirements**	Instruments shall be designed and analyzed to provide relief ports or otherwise withstand a maximum pressure rate change of 1.0 psi/sec. Pressure profile testing is considered optional.	ENV - 3.4.1.3 ICD - 6.1.3.2	SEPT		**A**									Kiel	
				SIT		**A**									GSFC / SS	
				SEPC			**A**				SEP Central / HET / LET				GSFC / SS	
				IDPU		**A**									UCB / HB	
				Boom		**A**									UCB / JM	
				STE		**A**									UCB / PT	
				MAG		**A**									GSFC / Acuna	
				SWEA		**A**									UCB / PT	
3.4	**Instrument Shock Design and Test**	Self-induced shock shall be considered in the design of instruments with deployables. If actuation of the device is used, this test shall be performed twice.	ENV - 3.4.1.4 ICD - 6.1.3.2	Boom				**T**			Boom deploy test (once with instruments; see waiver)				UCB	
				SWEA		**T**					SWEA door open test part of the SWEA functional				CESR	
				SIT		**T**					SIT door open test part of the SIT functional				UMd	
				SEPT		**T**					SEPT door open test part of the SEPT functional				Kiel	

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3.5	**Instrument Dynamic Test Requirements**	Instruments shall be vibrated as given in sections 3.4.2.1 and 3.4.2.2. The test requirements are for protoflight hardware, that is qualification levels (max expected level +3dB for acceptance duration). The test requirements matrix is given in Appendix B. During testing, all hardware shall be flight configured, power shall be applied to those circuits that are powered at launch, otherwise, powered vibration is a goal. Functional testing shall be conducted prior to and after each axis-of-vibration test to verify proper operation of the component. Instrumentation shall be installed to identify fundamental mode frequencies of the instrument. Prior to and after the vibration testing required by this section, a survey as give in Table 3.4.2-1 shall be performed for all axes to ensure no structural degradation has occurred during the protoflight testing.	ENV - 3.4.2 ICD - 6.1.3.2			T					These requirements shall be built into the test proceedures for 3.6, 3.7, and 3.8 as appropriate. Note that there is a waiver in the system to allow SEPT vibration without it's thermal hardware attached, which should otherwize be powered per this requirement.					
3.6	**Instrument Sine Sweep Vibration Tests**	Instruments shall be subjected to the following sinusoidal vibration levels listed in section 3.4.2.1. These shall be applied to 3 orthogonal axes. Sinusoidal vibration levels should be maintained within +10% of nominal test levels over the test frequency range. Reference Req't #3.8 - Instrument Dynamic Test Requirements	ENV - 3.4.2.1 ICD - 6.1.3.2	SEPT		T					SEPT Vib (-E and -NS)				Kiel	
				SIT		T					SIT Vib				UMd	
				SEPC			T				SEP Central / HET / LET Vib				CIT	
				Boom				T			Boom suite vib, less SWEA				UCB	
				SWEA		T					SWEA Vib (levels envelope Qual boom measurements)				UCB	
				IDPU		T					IDPU Vib				UCB	
3.7	**Random Vibration Level for Instruments**	All instruments shall be subjected to the following random vibration levels referenced in section 3.4.2.2. These shall be applied in each of three orthogonal axes, one of which is parallel to the thrust axis. Random vibration levels should be maintained within 3dB of nominal test levels over the test frequency range. Overall amplitude shall be kept within +/-1.5 dB. Any request to modify the specified random vibration test through methods such as force limiting, input notching or response limiting will be addressed on a case by case basis. For these cases, test plans/procedures must be approved by the STEREO Spacecraft Lead Structural Engineer prior to instrument testing.	ENV - 3.4.2.2 ICD - 6.1.3.2	SEPT		T					SEPT Vib (-E and -NS)				Kiel	
				SIT		T					SIT Vib				UMd	
				SEPC			T				SEP Central / HET / LET Vib				CIT	
				Boom				T			Boom suite vib, less SWEA				UCB	
				SWEA		T					SWEA Vib (levels envelope Qual boom measurements)				UCB	

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		Reference Req't #3.8 - Instrument Dynamic Test Requirements		IDPU		T					IDPU Vib				UCB	
3.8	**Instrument Acoustic Test**	Acoustic test levels for observatory level testing are given in table 3.4.3-1. Instruments that are susceptible to acoustic energy (e.g.: have thin foils) shall verify their capability to withstand the observatory level testing. Reference appendix B, Environmental Test Matrix and figure 3.4.3-1. Reference Req't #3.8 - Instrument Dynamic Test Requirements	ENV - 3.4.3 ICD 6.1.3.2	SEPT		T					SEPT ETU Accoustics				Kiel	
				SIT	T						SIT Prototype Foils test				Umd	
				HETd	T						HET Flight Detectors				CIT	
				LETw	T						LET prototype windows				CIT	
				LETd	T						LET Flight Detectors				CIT	
				LET		T					LET Flight Instrument Accoustic				CIT	
	Instrument Mass Properties															
3.9	Mass	Instruments shall be weighed to an accuracy of 0.2% or 0.5 kg., whichever is less.	ENV - 3.4.4.1 ICD - 6.3.1.1	SEPT		T									Kiel	
				SIT		T									UMd	
				SEPC			T								CIT	
				BOOM				T							UCB	
				IDPU		T									UCB	
3.10	Center of Mass	Component center of mass shall be established to an accuracy of +/-0.25 inches.	ENV - 3.4.4.2 ICD - 6.3.1.2	SEPT		T									Kiel	
				SIT		T									UMd	
				SEPC			T								CIT	
				BOOM				T							UCB	
				IDPU		T									UCB	
3.11	Moments of Inertia	Instrument moment of inertia calculations shall have 10% accuracy as a goal.	ENV - 3.4.4.3 ICD - 6.3.1.3	SEPT		A									Kiel	
				SIT		A									UMd	
				SEPC			A								CIT	
				BOOM				A							UCB	
				IDPU		A									UCB	
	Mechanical I/F Req.															
3.12	Instrument Mounting Repeatability	All instruments that need to be removed and replaced after optical axis alignment shall provide means of preserving alignment on repeated mountings. IMPACT boxes (except IDPU) require +/-1 degree alignment and +/-1 degree knowledge.	ICD - 6.2.2			A									Kiel	Alignment requirements can be met by mounting hole tolerance without need of alignment
						A									UMd	
							A								CIT	
								A							UCB	
						A									UCB	
3.13	Payload Instrument Mounting Surface	Instrument components shall provide a planar surface for mounting to the S/C. The surface shall be flat to less than 0.010 inches across the longest span of the instrument. The average surface roughness height rating shall not exceed 125 micro inches along the instrument's longest dimension.	ICD - 6.2.6	SEPT		I									Kiel	
				SIT		I									UMd	
				SEPC			I								CIT	
				BOOM		I									UCB	
				IDPU		I									UCB	

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3.14	Structural Model Test and Verification	IMPACT shall perform test and verification of the finite element model.	ICD - 6.4.2.3	BOOM		T					Boom post-deployment stiffness tests verify the FEM				UCB	
3.15	Payload Instrument Identification and Marking	IMPACT shall be marked with appropriate (AXXX) identification. The markings shall be permanent, resistant to chipping and located away from points of physical wear.	ICD - 6.5.4	SEPT		I									Kiel	
				SIT		I									UMd	
				SEPC			I								CIT	
				BOOM		I									UCB	
				IDPU		I									UCB	
3.16	**Instrument Leakage**	Leakage testing shall be conducted at the instrument level to demonstrate that leakage rates of sealed hardware are within the prescribed mission limits. Leakage rates need to be checked before and after stress-inducing portions of the verification program to disclose anomalies caused by the stress.	ENV - 3.4.5						I		N/A; no hermetically sealed units					
4.0		**ELECTRICAL**														
4.1	**Instrument Component Magnetic Objectives**	GSFC supplied 'sniffing' hardware will be used to map the magnetic emiisions of selected instrument components (prior to integration) which are expected to contribute to the magenetic field.	ENV - 3.5	SEPT		T					Possibly arrange for group screening during the SEP suite I&T prior to EMC?				Kiel	
				SIT		T									UMd	
				SEPC			T								CIT	
				SWEA		T					Tested separately due to its proximity to MAG				UCB	
				BOOM	T			T			Boom piece-parts close to MAG to be individually screened				UCB	
				IDPU		T									UCB	
	Instrument Component Design Radiation Requirements															
4.2	Total Ionizing Dose	All parts used for the spacecraft are required to survive a total ionizing dose of 8 krads (Si) without part failure. If it is necessary to use a part having a susceptibility of less than 8krads (Si), the part may be used if the criteria noted in the Environmental Spec are met.	MRD - 4.6.9.1.1 ENV - 3.9.1	**A,T**							All EEE parts verified to meet the radiation requirement by analysis or test. Results documented on the parts lists. SIT DTOF is a special case that was radiation tested at the board level				UCB	
4.3	Displacement Damage	Components shall withstand displacement damage associated with the proton fluence levels shown in figure 3.9.2-1.	ENV - 3.9.2	**A,T**							All EEE parts verified to meet the radiation requirement by analysis or test. Results documented on the parts lists.			Pass	UCB	
	Single Event Effects															
4.4	Single Event Latch-up	Parts susceptible to single event latch-up with linear energy transfer thershold less than 80 MeV-cm^2/mg shall not be used in spacecraft components without latch-up mitigation techniques. Analysis and mitigation are subject to approval through the GSFC STEREO Project Office. The single event environment is shown in figure 3.9.3-1.	ENV - 3.9.3.1	**A, T**							All EEE parts verified to meet the radiation requirement by analysis or test. In some cases latchup protection circuitry is used. Results documented on the parts lists.			pass	UCB	
4.5	Single Event Upsets	Single event upsets (SEU) shall not cause mission-ciritcal failures, compromise spacecraft health or mission performance. System level SEU effects shall be considered, such that upsets do not cause uncorrectable errors that impact system performance. All parts must be reviewed for SEU, along with any mitigation schemes needed to meet the system-level performance requirements.	MRD - 4.6.9.1.2 ENV - 3.9.3.2	**A, T**							All EEE parts verified to meet the radiation requirement by analysis or test. In some cases latchup protection circuitry is used. Results documented on the parts lists.			Pass	UCB	

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4.6	Single Event Upsets due to Heavy Ions	Calculation of upset rates due to heavy ions is required. If the part falls below a threshold of 15 MeV-cm^2/mg then guidance given in section 3.9.3.4 shall be followed.	ENV - 3.9.3.3	**A, T**							All EEE parts verified to meet the radiation requirement by analysis or test. Results documented on the parts lists.			Pass	UCB	
4.7	Single Event Upset due to Protons	Parts with heavy ion upset thresholds below 15 MeV-cm^2/mg are considered susceptible to upsets due to protons. If such parts are used in components, proton testing and proton upset rate calculations shall be performed and summed with the upset rate due to heavy ions (section 3.9.3.3).	ENV - 3.9.3.4	**A, T**							All EEE parts verified to meet the radiation requirement by analysis or test. Results documented on the parts lists.			Pass	UCB	
4.8	Upset Rates: Maximum Values	If it is necessary to use a part which has a high probability of experiencing upset during the mission time frame, component-level sigle event upset mitigation techniques shall be used with these parts.	ENV - 3.9.3.5	**A, T**							All EEE parts verified to meet the radiation requirement by analysis or test. Results documented on the parts lists.			Pass	UCB	
4.9	**EMC Design Rules and Requirements**															
4.10	Primary Power Bus I/F	Primary power input lines and all heater circuits shall be electrically isolated within IMPACT by at least 1 Mohms from: 1) each other (unless internally switched or controlled) 2) chassis ground 3) all secondary circuits IMPACT shall be designed to support the voltage	EMC - 3.2.1.1 ICD - 3.2.2 (Table 3-2)	SEP			**T**				Ground Isolation Test at SEP Suite I&T				CIT	
				IDPU		**T**					IDPU/MAG/STE-U Ground Isolation Test				UCB	
				SWEA		**T**					SWEA/STE-D Ground Isolation Test				UCB	
4.11	Primary Power Bus I/F	Components bridging this isolation I/F shall, as a minimum, be sized to withstand a potential difference of 100Vdc.	EMC - 3.2.1.1						**A**		LVPS design				UCB	
4.12	Primary Power Bus I/F Power Turn-On Transients	Primary power turn-On input current transients @28Vdc input from a source impedance of less than 200 mOhms shall not exceed 2.5 times the nominal current experienced in the highest power operating mode at 28Vdc (but excluding heater current) or, 2.5 amperes peak, whichever is greater. All components shall test to the limits discussed in section 3.10.2 and section 3.10.3 of the Environmental Spec. IMPACT shall conduct a turn-on/off transient tests to demonstrate compliance with primary power bus interface load transient requirements so as not to stress S/C power switching components, fuses, or interfere with S/C performance. A) The test power source must have a low transient impedance (to be achieved with a 10,000 uf or	ENV - 3.10.2/3.10.3 EMC - 3.2.1.3/4.11 ICD - 3.2.2.3	SEP			**T**				Primary Power Test at SEP Suite I&T				CIT	
				IDPU		**T**					IDPU/MAG/STE-U Primary Power Test				UCB	

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		impedance (to be achieved with a 10,000 uF or greater capacitor) B) A power switch exhibiting less than 20 mOhms insertion resistance together with bounceless closure characteristics and no transient limiting properties is to be used for turn-on measurements. C) A power switch incorporating no voltage limiting or any type of transient limiting characteristics is to be used for turn-off measurements.		SWEA		T					SWEA/STE-D Primary Power Test				UCB	
4.13	Primary Power Bus I/F	In all cases, the input current shall settle to within 10% of nominal current within 200 milliseconds after turn-on.	ENV - 3.10.2/3.10.3 EMC - 3.2.1.3 ICD - 3.2.2.3			T					Included in Primary Power test, 4.12					
4.14	Primary Power Bus I/F Power Turn-Off Transients	Primary power turn-OFF voltage transients appearing across IMPACT's power input terminals shall not exceed the range from +56 to -2 volts (absolute).	ENV - 3.10.4 EMC 3.2.1.4			T					Included in Primary Power test, 4.12					
4.15	Primary Power Bus I/F Ripple and Transient Currents	Infrequent and short-term Ripple and transient currents appearing at the primary power I/F as a consequence of motor operation, mode changes, or other operating characteristics, shall not exceed a peak-to-peak value of a) 0.7 times the nominal operating current, or b) 0.5 amperes, whichever is greater, as observed in the time domain using a bandwidth of at least 50MHz	ENV - 3.10.3 EMC - 3.2.1.5			T					Included in Primary Power test, 4.12					
4.16	Primary Power Bus I/F	IMPACT shall be capable of surviving any primary power input voltage between 0 and +40Vdc, applied in any sequence, for an indefinite time.	EMC - 3..2.1.6			T					Included in Primary Power test, 4.12					
4.17	Primary Power Bus I/F	IMPACT shall be capable of surviving a hard short circuit (for a duration of 10 msec) across the primary power input lines applied during operation. (possible reverse input current). Components shall provide assurance tha the stored charge of their instrument (I.e., the outrush current) will not blow fuses in the event of a hard short on the power bus.	ENV - 3.10.7 EMC - 3.2.1.7			T					Included in Primary Power test, 4.12					
4.18	Primary Power Bus I/F	All primary power input lines are to self-discharge to less than 5Vdc within 2 seconds after power removal.	EMC - 3.2.1.8			T					Included in Primary Power test, 4.12					
4.19	Primary Power Bus I/F	DC/DC power converters throughout the S/C shall be operated at 50KHz, or harmonic thereof, with a frequency tolerance of 100ppm over all environmental conditions.	EMC - 3.2.1.10	SEP	T						Measured in SEP LVPS functional test				UCB	
				IDPU	T						Measured in IDPU LVPS functional test				UCB	
				SWEA	T						Measured in SWEA LVPS functional test				UCB	
				SIT	T						Measured in SIT HVPS functional test	Dec-03			UCB	
				SWEA	T						Measured in SWEA HVPS functional test	Sep-03	Oct-03		CESR	
4.20	**Removal of Instrument Power**	The Instruments shall handle a warning message from the S/C prior to instrument safing/shutdown. IMPACT shall be designed to safe itself within 90 seconds after receiving a power shutdown warning message over the 1553 bus.	MRD - 4.6.8 ICD - 3.2.2.9	IDPU		T					IDPU software acceptance tests and IDPU functional tests shall verify correct handling of 1553 shutdown messages.				UCB	
				Suite					T		Suite level testing will verify correct actions are taken at the instrument level.				UCB	
	Instantaneous Removal of	The Instruments shall be designed to withstand an	MRD - 4.6.8	IDPU				T			IDPU Functional (with MAG & STE-U Instruments)				UCB	

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4.21	[illegible] Instrument Power	instantaneous removal of power without a warning message from the S/C.	MRD - [illegible] ICD - 3.2.2.9	SEP			T				SEP Suite Functional				CIT	
				SWEA		T					SWEA/STE-D Functional				UCB	
4.22	One-Time Activation Electrical Characteristics	IMPACT doors and Boom release actuators shall be designed to receive a 100ms, +28V pulse, off unregulated power. All SMAs shall have auto-cutoff capability. IMPACT shall be designed to receive only 1 command service from the S/C for each of the redundant door unit circuits for SIT, SEPT-E(2x) and SEPT-NS(2x). Both sets of wires provided by the S/C shall be wired to the primary firing circuit for these actuators.	ICD - 3.2.3.1/3.2.3.2	SEPT		I, T									Kiel	Test actuation time at worst case voltage, auto-cutoff, wire redundancy
				SIT		I, T									UMd	
				Boom		I, T									UCB	
4.23	Electrical Bonding	Mounting surfaces of each unit shall be clean and free of paint or other insulating material and shall be capable of providing a DC bond resistance of no greater than 2.5mOhms when mounted to the next larger assembly structure. DC resistance measurements between any two adjacent exterior case parts shall not exceed 2.5 mOhms.	EMC - 3.2.3.1/3.2.3.2 ICD - 6.2.4	SEP			T				Bonding measurements at SEP I&T				CIT	
				IDPU		T					Bonding measurements				UCB	
				Boom			T				Bonding measurements ate Boom Suite I&T				UCB	
4.24	Electrical Bonding/ Surface Conductivity	Multi-layer thermal blankets shall have all conductive layers electrically bonded together and to chassis ground with a resistance not to exceed 10 ohms Outside layers need to be conductive to meet the < 1v potential differential measurable at any twop points on this external surface	EMC - 3.2.3.3/3.2.6.10.4 ICD - 5.2.6							T	APL to build and verify thermal blankets				APL	
4.25	Electrical Bonding/ Blanket Grounding	A mimimum of 2 ground wires is required for each blanket. A ground connection is required within 1 meter of any location on each blanket. The measured resistance between each pair of adjacent ground wires is not to exceed 10 ohms prior to connection to the S/C.	EMC - 3.2.3.3/2.3.6.10.4 ICD - 6.2.4							T	APL to build and verify thermal blankets				APL	
4.26	Electrical Bonding	Doors and other hinged or shafted devices that have an exterior exposure shall have a ground strap, wire, or conductive spring across the hinge or shaft to provide a reliable bond resistance not exceeding 100 ohms to assure a drain path for electrostatic charge.	EMC - 3.2.3.4 ICD - 6.2.4	SIT		T					SIT door ground test				UMd / SS	
				STE		T					STE door ground test				UCB / PT	
				SEPT		T					SEPT door ground test				Kiel	
4.27	Electrical Harness Configuration and Fabrication	Harnesses are to be measured during fab to assure that connector-to-shield bond resistance is no greater than 2.5 mOhms and to confirm continuity between each end is less than 1 ohm.	MRD - 4.6.9.3 EMC - 3.2.5.5	SEP	T						SEP suite harness test				CIT	
				Boom	T						Boom suite harness test				UCB	
	[illegible]	The maximum variation in surface potential between [illegible]	[illegible]	SEPT		T									Kiel	Test excludes surfaces to be covered with thermal blankets (which
				SIT		T									Umd	

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4.28	Electrostatic Charging/ Surface Resistivity	any 2 points on the external surface of the Instrument shall not exceed 1V. The resistivity of the surface materials shall not exceed 10^8 Ohms/sq.	MRD - 4.6.9.3 EMC - 3.2.6.2	SEPC			T								CIT	are not considered external surfaces). Test measures surface or bulk resistance only.
				BOOM				T							UCB	
				IDPU		T									UCB	
4.29	CE-01 Conducted Emissions, 100 Hz to 15KHz	IMPACT shall conduct a CE-01 test to demonstrate that the levels of low frequency conducted current emissions on input power and interface lines do not exceed the specified limits: (figure 4.1&2) E) Differential mode test limits are 80dBmicroamps from 100 Hz to 3KHz then decreasing to 50dBmicroA at 15kHz. F) Common mode test limits are 60dBmicroamps from 100 Hz to 10KHz then decreasing to 50dBmicroA at 15kHz.	EMC - 4.1						T		Suite EMC test at UCB subcontractor				UCB	
4.30	CE-01 Conducted Emissions, 100 Hz to 15KHz	IMPACT shall measure differential and common mode currents for the CE-01 test as follows: A) Differential currents are to be measured on the following lines: 1) Power input 2)Power input return 3)True differential current on power, only if 1) or 2) exceeds specification limit. B) Common mode currents are to be measured on the following lines: 1) +28V Power input 2) All other interface lines collectively at each connector. C) Narrowband measurement are to be made with an effective bandwidth not exceeding 120 Hz.	EMC - 4.1						T		Suite EMC test at UCB subcontractor				UCB	
4.31	CE-03 Conducted Emissions, 15KHz to 50MHz	IMPACT shall conduct a CE-03 test to demonstrate that the levels of high frequency conducted current emissions on input power and interface lines do not exceed the specified limits: (figure 4.1&2) B) Differential mode narrowband test limits are 50dBmicroamps from 15kHz decreasing to 20dBmicroA at 2MHz from which it continues at that level to 50MHz. C) Common mode narrowband test limits are 50dBmicroamps from 15kHz decreasing to 20dBmicroA at 2MHz from which it continues at that level to 50MHz.	EMC - 4.2						T		Suite EMC test at UCB subcontractor				UCB	
4.32	CE-03 Conducted Emissions, 15KHz to 50MHz	IMPACT shall measure differential and common mode currents for the CE-03 test as follows: A) Differential currents are to be measured on the following lines: 1) Power input 2)Power input return 3)True differential current on power, only if 1) or 2) exceeds specification limit. B) Common mode currents are to be measured on the following lines: 1) +28V Power input 2) All other interface lines collectively at each connector. C) Narrowband measurement are to be made with an effective bandwidth not exceeding 120 Hz.	EMC - 4.2						T		Suite EMC test at UCB subcontractor				UCB	
4.33	CE-07 Ripple and Spike Emissions, Time Domain	IMPACT shall conduct a CE-07 test to demonstrate that the broadband levels of conducted ripple and spikes (both voltage and current) on input power and interface lines do not exceed the specified limits as follows: B) Time domain conducted voltage ripple shall not exceed 700 mV p-p fro differential measurements. Common mode voltage shall not exceed 500 mV p-p. C) Time domain conducted current ripple shall not exceed 200 mA p-p fro differential measurements and 50mA p-p for common mode measurements.	EMC - 4.4						T		Suite EMC test at UCB subcontractor				UCB	

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4.34	CE-07 Ripple and Spike Emissions, Time Domain	IMPACT shall measure differential and common mode currents and voltages for the CE-07 test as follows: A) Common and Differential mode currents shall be measured on the power lines as described in section 4.1, and the bulk common mode current shall be measured on all interfaces. Differential voltage measurements are to be made between +28V input and return. Common mode voltage measurements are to be made between a) +28V input and chassis, and b)	EMC - 4.4						T		Suite EMC test at UCB subcontractor				UCB	
4.35	CS-01 Conducted Susceptibility, 30 Hz to 51 KHz	IMPACT shall conduct a CS-01 test to demonstrate that the performance is not adversely degraded by the presence of low frequency sinusoidal ripple on the primary input power lines. Applicable test parameters are as follows: A) AC sinusoidal ripple shall be applied to the 28V primary power input lines to produce a differntial input voltage of 1.0V p-p. B) Ripple current injected into the UUT shall be limited to 5A p-p. C) Ripple frequency shall be swept over the indicated range while monitoring the subsystem for susceptibility. The sweep shall be paused at appropriate intervals to exercise the subsystem and record performance. E) Specific criteria for determining susceptibility shall be documented and approved by the EMC committee prior to	EMC - 4.5						T		Suite EMC test at UCB subcontractor				UCB	
4.36	CS-02 Conducted Susceptibility, 49kHz to 400MHz	IMPACT shall conduct a CS-02 test to demonstrate that the performance is not adversely degraded by the presence of high frequency sinusoidal ripple on the primary input power lines. Applicable test parameters are as follows: A) AC sinusoidal ripple shall be applied to the 28V primary power input lines to produce a differntial input voltage of 1.0V p-p. B) All test frequencies shall be pulse modulated at 1kHz with 50% duty factor. C) Ripple frequency shall be swept over the indicated range while monitoring the subsystem for susceptibility. The sweep shall be paused at appropriate intervals to exercise the subsystem and record performance. E) Specific criteria for determining susceptibility shall be documented and approved by the EMC committee prior to testing.	EMC - 4.6						T		Suite EMC test at UCB subcontractor				UCB	

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4.37	CS-06 Conducted Susceptibility, Spikes	IMPACT shall conduct a CS-06 test to demonstrate that the performance is not adversely degraded by the presence of transient spikes on the primary input power lines. Applicable test parameters are as follows: A) Peak transient voltage, relative to nominal line voltage, for MIL-STD-461B spike #1(slow) and spike #2(fast) shall be 20V differential, 10V return-to-chassis or .... B) Both positive and negative spikes are to be applied. C) These spikes are to be applied a) differentially to the primary power input lines and b) between primary power input return and chassis. D) Spikes shall be applied at a variable rate from 1 to 5 spikes per second for a duration of at least 2 minutes while monitoring the subsystem for susceptibility. E) Specific criteria for determining susceptibility shall be documented and approved by the EMC committee prior to testing.	EMC - 4.7						T		Suite EMC test at UCB subcontractor				UCB	
4.38	RE-01 Radiated Emissions, Magnetic Field, 100Hz to 49 kHz	IMPACT shall conduct a RE-01 test to demonstrate that the levels of low frequency radiated magnetic field emissions from the operating subsystem do not exceed the specified limits: A) Emission limits are 120dB pT (1000 gamma) starting at 100 Hz then decreasing to 20dB pT (10 milligamma) at 32 kHz from which it continues at the same level to 49 kHz. Data will be acquired to 51kHz. B) The subsystem is to be scanned on all sides to determine maximum emission levels.	EMC - 4.8						T		Suite EMC test at UCB subcontractor				UCB	
4.39	RE-02 Radiated Emissions, Electric Field, 14 kHz to 10 GHz	IMPACT shall conduct a RE-02 test to demonstrate that the levels of low frequency radiated electric field emissions from the operating subsystem do not exceed the specified limits: B) Narrowband emission limits are 110 dB microV/m from 14 kHz to 20 MHz then increasing to 70dBmicroV/m at 10GHz. Also, in the band 7180 +/- 25MHz the limit is 15dB microV/m. C) Broadband emission linits are 110 dB microV/m/MHz at 14 kHz decreasing to 65 dBmicroV/m/MHz at 200 MHz then increasing to 80 dB microV/m/MHz at 1.0 GHz.	EMC - 4.9						T		Suite EMC test at UCB subcontractor				UCB	
4.40	RE-02 Radiated Emissions, Electric Field, 14 kHz to 10 GHz	1) IMPACT is required to record data, in addition to the above, over the frequency range from 2 kHz to 14 kHz… 2) Instrument covers must be open during radiated emission and susceptibility testing. RF transparent covers must be supplied to prevent contamination.	EMC - 4.9						T		Suite EMC test at UCB subcontractor				UCB	

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4.41	RS-03 Radiated Susceptibility, 14 kHz to 15 GHz	IMPACT shall conduct a RS-03 test to demonstrate that the performance of the subsystem is not adversely degraded by the presence of high frequency radiated electric fields. Applicable test parameters are as follows: A) Over the frequency range from 14 kHz to 1.0 GHz, the subsystem shall be irradiated with an electric field intensity of 10 V/m. B) Over the frequency range from 1.0 GHz to 15 GHz, the subsystem shall be irradiated with an electric field intensity of 20 V/m. C) In the bands 2.2 to 2.3 GHz, 5.5 to 5.9 GHz, and 8.4 to 8.5 GHz tha applied field shall be 40 V/m. D) Test frequencies at and above 100MHz shall be pulse modulated at 1kHz with a 50% duty factor. Lower frequencies shall be CW. E) Frequency shall be manually swept over the indicated range while monitoring the subsystem for susceptibility. The sweep shall be paused at appropriate intervals to exercise the subsystem and record performance. F) If susceptibility is encountered, then threshold levels are to be determined and recorded. G) Specific criteria for determining susceptibility shall be documented and approved by the EMC committee prior to testin	EMC - 4.10						T		Suite EMC test at UCB subcontractor				UCB	
4.42	Acceptance Tests	Certification tests require that 1 item from every Instrument set to be tested. Second instruments are to be tested for Conducted Emissions as described below. Testing will consist of narrowband common mode and differential mode conducted emissions on power and power return lines from 15 kHz to 40 MHz using the same linits specified in section 4.2.	EMC - 8.1	SEP			T				SEP Suite FM2 EMC test @ CIT				CIT / UCB	
				IDPU		T					IDPU / MAG / STE-U FM2 EMC test @ UCB				UCB	
				SWEA		T					SWEA/STE-D FM2 EMC Test @ UCB				UCB	
5.0		**C&DH I/F REQUIREMENTS**														
	C&DH I/F Requirements															
5.1	Distribution of S/C Time and Status	The IMPACT/PLASTIC IDPU shall be designed to accept a 1553 message once per second on subaddress R-1. This message will contain the following data: S/C UTC time, S/C status, Imminent HGA motion, Observatory fine pointing, Off Pointing, SSR Partition %Full. Table 4-7 shows the format of this message. The IMPACT/PLASTIC IDPU shall be designed to accept the "synch with data word" mode code and compute UTC.	ICD - 4.4.2.1 Table 4-7	IDPU		T					IDPU CPT				UCB	
5.2	Collection of Instrument Status	The IMPACT/PLASTIC IDPU shall be designed to have the S/C collect an "Instrument Status" message once per second using subaddress T-1. Table 4-8 shows the format of this message.	ICD - 4.4.2.2 Table 4-8	IDPU		T					IDPU CPT				UCB	

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5.3	Distribution of Instrument Command Packets	1.The IMPACT/PLASTIC IDPU shall receive commands from the C&DH in the form of CCSDS telecommand packets. Maximum telecommand packet length, including the header, is 1088 bytes. 2 The IMPACT/PLASTIC IDPU shall be able to process CCSDS telecommand packets broken up into fixed length portions, known as Fixed-Length Transfer Containers (FLTCs). 3.The IMPACT/PLASTIC IDPU shall be able to retrieve FLTCs from subaddress R-3. 4. The IMPACT/PLASTIC IDPU shall be able to process an FLTC according to the format in table 4-9. Each FLTC will be 64 bytes long. 5.The IMPACT/PLASTIC IDPU shall be able to process telecommands that span multiple FLTCs. 6. The IMPACT/PLASTIC IDPU shall be able to process FLTCs that contain one or more complete or partial CCSDS TC packets. 7. The IMPACT/PLASTIC IDPU shall be able to process FLTCs that contain fill data at the end of an FLTC. 8. The IMPACT/PLASTIC IDPU shall be able to process idle FLTCs that contain only fill data. 12. The IMPACT/PLASTIC IDPU shall be able to process FLTCs that contain an invalid APID (all ones) as fill data. 13. The IMPACT/PLASTIC IDPU shall be able to proc	ICD - 4.4.2.3 Table 4-9			T					IDPU CPT				UCB	

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5.4	Collection of Instrument Telemetry Packets	1. The IMPACT/PLASTIC IDPU shall send tlm data to the (S/C) C&DH computer in the form of CCSDS packets. In addition to the required CCSDS header, each (telemetry) packet shall contain a 5-byte secondary header containing a UTC time value representing the collection time of the data in the packet. The length of each CCSDS telemetry packet, including headers, shall be 272 bytes. 2. IMPACT/PLASTIC IDPU shall maintain a counter in subaddress T-2 to indicate when new data has been written to the buffer. The IDPU shall increment this counter (Telemetry Packet Data Available Counter) by 1 every time it writes a new telemetry packet to the buffer. 3. IMPACT/PLASTIC IDPU shall ensure that the telemetry buffer contains valid data before incrementing the TBDAC 4. IMPACT/PLASTIC IDPU shall not change the TBDAC, nor change the data in the buffer until the (S/C) C&DH has read the data. 5.IMPACT/PLASTIC IDPU shall store 64 bytes of the telemetry packet in subaddresses T-3 thru T-7, and the remainder 16 bytes in T-8. 6.IMPACT/PLASTIC IDPU shall write a new (tlm) packet and a new TBDAC value to the (T-2 thru T-7 subaddress) 1553 space no later than 10msec (ideall	ICD - 4.4.2.4			T					IDPU CPT				UCB	
5.5	Mode Codes for 1553 Bus Diagnostics	The IMPACT/PLASTIC IDPU shall support the Mode Code transcations defined in table 4-10	ICD - 4.4.2.5.1 Table 4-10			T					IDPU CPT				UCB	
6.0		**CONTAMINATION REQUIREMENTS**														
6.1	Surface Cleanliness Requirement	Unless stated in Table 3.2-1, external surfaces of all IMPACT components that are mounted externally on the spacecraft, shall meet a surface cleanliness level of 300 A (or equivalent PAC) per MIL-STD-1246. with Integration activities at UCB shall take place in Class 10,000 cleanroom environment, and purge shall be maintained at all times except when interruptions are explicitly permitted. The IDPU and any other items which will be located inside the STEREO spacecraft shall meet the STEREO spacecraft requirement of level 300 A (or equivalent PAC) per MIL-STD-1246. Thermal Control surfaces shall not exceed Level B per MIL-STD-1246 at End-of-Life.	CC - 4.1 ICD - 7.2.1	SEPT		T					Unit surface cleanliness shall be verified by inspection at APL. Ensuring the units meet the cleanliness requirements and cleaning as needed are indicated under "Responsible Organization"				Kiel	
				SIT		T									UMd	
				SEPC			T								CIT	
				BOOM				T							UCB	
				IDPU		T									UCB	
		It is required by the IMPACT project that a material list be provided for each subsystem for approval by UCB prior to fabrication. The list is to include material name, description, manufacturer, and usage. The characteristics of total mass loss and condensable volatile condensable materials are also	CC - 8.1	SEPT		X								Pass	Kiel	Preliminary lists provided at PDR. "Final" lists provided at CDR;
				SIT		X								Pass	UMd	
				HET		X					One waiver approved			Pass	GSFC	

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6.2	Materials List	to be included on this list. NASA Reference Publication 1124 or MAPTIS will be consulted to determine that all non-metallic materials have a Total Mass Loss (TML) of 1.0% or less and Collected Volatile Condensable Material (CVCM) of 0.1% or less. Acceptability of materials for flammability and odor will be determined from document ASTM E595.	CC - 8.1 ICD - 7.2.2	SEPC		X					Sep Central / LET list			Pass	CIT	Preliminary lists provided at PDR, Final lists provided at CDR, updated lists as required
				BOOM		X					Boom / IDPU / STE / LVPS List. One Waiver approved			Pass	UCB	
				MAG		X								Pass	GSFC	
				SWEA		X								Pass	CESR	
6.3	Outgassing Certification	Prior to acceptance to being integrated on STEREO, all payload components shall undergo a thermal vacuum certification with a Quartz Crystal Microbalance (QCM). This certification may be performed with on separate components of IMPACT or on all the components as an assembly. It shall be performed in accordance with paragraph 6.3.2.	CC - 8.3.4 ICD - 7.2.2	SEPT		T									Kiel	
				SIT		T									UMd	
				SEPC			T								CIT	
				BOOM				T							UCB	
				IDPU		T									UCB	
		SOFTWARE REQUIREMENTS														
7.0	Software	Each instrument and the IMPACT/PLASTIC IDPU must verify the requirements as described in their Software Requirements Documents and Software Deveopment Plans.	IPF ICD	SEPC			T				SEP Central Software Acceptance Test				CIT	
				LET		T					LET Software Acceptance Test				CIT	
				HET		T					HET Software Acceptance Test				GSFC	
				SIT		T					SIT Software Acceptance Test				GSFC	
				IDPU		T					IDPU Boot Software Acceptance Test	14-Oct-03		Pass	UCB	Repeated subsections at Spacecraft ETU Interface test, 2003-10-28
				IDPU		T					IDPU Instrument Software Acceptance Test				UCB	