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Req#	Parameter/ Req Title Section	Requirement	Document	Subassembly	Instrument	SEP Suite	Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization Notes / Comments
1.0		SCIENCE REQUIREMENTS												
1 1 N	IAG Science equirements	Noise Level < 0.05nT	MRD - 4.7(K) and solar wind characteristics. IPF - 3.1		т				C	Operation in laboratory 4-layer magnetic shield with B<0.25 nT. Computation of noise spectrum from test data	Apr-04	May-04	Pass	GSFC / Acuna
1.2		Absolute Accuracy < +/- 0.1nT	MRD - 4.7(K) IPF - 3.1		S,T					Calibration against proton precession standard at GSFC Test Site – Electronics adjustments during electrical testing	Apr-04	May-04	Pass	GSFC / Acuna
1.3		Range = +/-512nT	MRD - 4.7(K) IPF - 3.1		т				(Operation in laboratory coil system and MAG Test Site – Calibration against proton precession standard	Apr-04	May-04	Pass	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	Apr-04	May-04	Pass	GSFC / Acuna
1.5		Time Resolution = 1 second	MRD - 4.7(K) IPF - 3.1				т		E	Boom suite tests shall verify telemetry throughput	May-04	Aug-04	Pass	UCB / Curtis Bench test of FM1/2 IDPU with ETU LVPS, ETU harness
	WEA Science equirements	FOV = 360 X 60 degrees	MRD - 4.7(H,I,J) IPF - 3.2		т				C	Calibration with electron gun at CESR	Nov-03	May-04	Pass	CESR
1.7		Resolution = 45 degrees	MRD - 4.7(H,I,J) IPF - 3.2		т					Calibration with electron gun at CESR	Nov-03	May-04	Pass	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	Nov-03	May-04	Pass	CESR
1.9		Energy Resolution (Telemetry) < 100%	MRD - 4.7(H,I,J) and solar wind characteristics IPF - 3.2		т				(Calibration with electron gun at CESR shall verify instrument resolution (~10%); IDPU software acceptance test shall verify averaging for elemetry into bins with resolution better than 100%	Nov-03	May-04	Pass	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		т				C	Calibration with electron gun at CESR	Nov-03	May-04	Pass	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		т				C	Calibration with electron gun at CESR	Nov-03	May-04	Pass	CESR
1.12		Time Resolution = 1 minute	MRD - 4.7(H,I,J)				т		E	Boom Suite testing shall verify end-to-end throughput	Oct-04	Feb-05	Pass	UCB / Curtis
	TE Science equirements	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	Apr-04	Aug-04	Pass	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	Apr-04	Aug-04	Pass	UCB
1.15		Energy = 5 - 100 keV	MRD - 4.7(F,G) IPF - 3.3		Т				(Calibrations with an electron gun and sources	Apr-04	Aug-04	Pass	UCB
1.16		Energy Resolution (Telemetry) < 100%	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3		т					DPU software acceptance test shall verify STE energy resolution in elemetry better than 100%	Jun-04	Aug-04	Pass	UCB STE-U Thermal Vac tests
1.17		Energy Resolution (Electronic) < 2keV	IPF - 3.3		Т		7		(Calibrations with an electron gun and sources	Apr-04	Aug-04	Pass	UCB
1.18		Geometric Factor > 0.1 cm ² ster	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3		T,A				C	Calibrations with an electron gun and sources	Apr-04	Aug-04	Pass	UCB Use door source to verify geometric calculations
1.19		Background < 30c/s /detector	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3		т				1	No-source background measurements	Apr-04	Aug-04	Pass	UCB
1.20		Max Count Rate (per detector) > 10,000 counts/sec	MRD - 4.7(F,G) and solar wind characteristics IPF - 3.3		т				(Calibrations with an electron gun and sources	Apr-04	Aug-04	Pass	ИСВ
1.21		Time Resolution = 1 minute	MRD - 4.7(F,G) IPF - 3.3				т		E	Boom Suite testing shall verify end-to-end throughput	Apr-04	Aug-04	Pass	UCB STE-U FM1 Thermal balance, STE-U FM2 Thermal Vac

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		MRD - 4.7(F,G)												
1.22 SIT Science Requirements	FOV = 17 x 44 degrees	and CME characteristics IPF - 3.4		A					size.	scope, thin foil and solid state detector				UMd
1.23	Energy = 30-2,000 keV/nuc He-Fe	MRD - 4.7(F,G) IPF - 3.4		A,	т				state detector threshold, and dyr energy amplifier and time-of-flight	ive alpha-sources, and ion beam				UMd
1.24	Mass Resolution = 0.85 AMU (⁴ He at 1MeV/Nuc)	MRD - 4.7(F,G) and CME characteristics IPF - 3.4		т					Laboratory calibration with radio MeV/nucleon)	active alpha sources (energy approx 1				UMd
1.25	Energy Resolution - 35keV FWHM @ 22C	MRD - 4.7(F,G) and CME characteristics IPF - 3.4		Т					Pulser calibration of energy systeradioactive alpha sources.	em, along with calibration using				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 telessize.	scope, thin foil and solid state detector				UMd
1.27	Background = 10 ⁻² events/sec during vac test	MRD - 4.7(F,G) and CME characteristics IPF - 3.4		т					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		т					Pulser calibration of instrument, Graaff at Brookhaven National L	and calibration at tandem Van de .ab.				UMd
1.29	Time Resolution = 15 minutes	MRD - 4.7(F,G) and CME characteristics IPF - 3.4			т				SEP Suite testing shall verify end	d-to-end throughput				СІТ
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 to air gap, thin foil, and solid state of	elescope, collimator aperture, magnet detector size.	Feb-04	Feb-04	Pass	Kiel
1.31	Energy = 30-400 keV, electrons 60-2000 keV, protons	MRD - 4.7(F,G) IPF - 3.5		A,	т				approach. Spot-checks to verify foil thickness with alpha-spectror model of SEPT telescope (GEAI Verification of model with ion-so	etic remanence with point charge model analytical calculations. Measurement of meter (50 nm resolution). Mathematical NT Monte-Carlo-Simuation). surce (up to 300 keV) at HMI, Tandem HMI, conversion electrons (up to 1	Feb-04	Feb-04	Pass	Kiel Ion-source and Tandem van de Graaf only with flight spare later in 2004
1.32	Energy Resolution (Telemetry) = 30% electrons, 30% protons	MRD - 4.7(F,G) and CME characteristics IPF - 3.5		т					Measurement with cosmic ray m beam, pulser calibration.	nuons, radioactive sources, proton				Kiel
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					air gap, thin foil, and solid state of	elescope, collimator aperture, magnet detector size. Monte-Carlo-Simulation e as function of energy and incidence	Feb-04	Feb-04	Pass	Kiel
1.34	Background < 2 counts/s on ground, 20 degrees C	MRD - 4.7(F,G) and CME characteristics IPF - 3.5		т						ent rate during lab vacuum tests without	Mar 04	Mar 04		Background rate at lowest energy threshold (20 KeV) > 2 counts/s, Kiel threshold will be adjusted (by upload) to allow scientifically meaningful measurement. 2 counts/s is not a strict requirement.
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		т					Pulser calibration of instrument, HMI (Hahn-Meitner-Institut, Berli	calibration at tandem Van de Graaff at in).				Kiel
1.36	Time Resolution = 60 seconds	MRD - 4.7(F,G) and CME characteristics IPF - 3.5			т				SEP Suite testing shall verify end	d-to-end throughput				СІТ

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			MRD - 4.7(F,G)											
1.37 LET	Science Requirements	FOV = 2 oppositely directed 100 x 30 degree fans	and CME characteristics IPF - 3.6	Т	A					Geometrical analysis of LET instrument coupled with laboratorymapping of solid state detector areas.				CIT
		Energy Range (MeV/nucleon) = H: 1.5 - 3		Т						detector thickness measurements				CIT
1.38		He: 1.5 - 13	MRD - 4.7(F,G) IPF - 3.6		Т, А	Δ.				Pulser and alpha-particle calibrations and heavy-ion range-energy relations.				CIT
		O: 3 -25 Fe: 3 - 25	111 - 3.0		т					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	т	А					Geometrical analysis of LET instrument coupled with laboratorymapping of solid state detector areas.				СІТ
1.40		Element Resolution = Resolve H, He, C, N, O, Ne, Mg, Si, Fe	MRD - 4.7(F,G) and CME characteristics	Т	А					Alpha-particle measurement of detector thickness uniformity coupled with Monte Carlo simulations.				CIT
		ivig, Si, Fe	IPF - 3.6		Т					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		т, А	A				Calibrations with alpha particle source and electronic pulser aided by analysis.				СІТ
			MRD - 4.7(F,G) and CME		т					Bench tests with pulser;				CIT
1.42		Max Event Rate = 1000 events/sec	characteristics IPF - 3.6		т					verification at particle accelerator.				СІТ
1.43		Energy Binning = 6 intervals per species for Z=2=3	MRD - 4.7(F,G) and CME		Т, А	Δ.				Pulser and alpha-particle calibrations supplemented by Monte-Carlo simulations.				СІТ
1.40		intervals for H	characteristics IPF - 3.6		т					Verification at particle accelerator.				CIT
1.44		Species Binning = H, ³ He, ⁴ He, C, N, O, Ne, Mg, Si,	Derived from element resolution		Т, А	Δ.				Pulser and alpha-particle calibrations supplemented by Monte-Carlo simulations.				CIT
		Fe	above IPF - 3.6		т					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			т				SEP Suite testing shall verify end-to-end throughput				СІТ
1.46		Beacon Telemetry = 1 minute for H, He, 6=Z=26	MRD - 6.7.1 and CME characteristics IPF - 3.6			т				SEP Suite testing shall verify end-to-end throughput				СІТ
	Juirements	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

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		MRD - 4.7(F,G)						-					
1.52	Max Event Rate = 1000 events/sec	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
1.55	Time Resolution = 15 minutes, 0.3 prioritized event/sec	MRD - 4.7(F,G) and CME characteristics IPF - 3.7			т			;	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			т			÷	SEP Suite testing shall verify end-to-end throughput				СІТ
1.57 BOOM Science Requirements	Magnetic field = < 1nT static, 0.05 nT dynamic at the MAG sensor	MRD - 4.7(K) IPF - 4.1		Α,	Т				Materials analysis suplemented by part-level measurements for items close to the MAG sensor and assembly measurement for the rest	Feb-04	Feb-04	Pass	UCB
1.58	MAG distance from spacecraft > 3m	MRD - 4.7(K) and typical spacecraft magnetic characeristics IPF - 4.1		1				ı	Inspection of drawings, final assembly	Mar-04	Mar-04	Pass	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		1				1	Inspection of drawings, final assembly	Mar-04	Mar-04	Pass	UCB / JM
1.60	MAG distance from boom harness = 20 cm	MRD - 4.7(K) and expected harness currents IPF - 4.1		1				ı	Inspection of drawings, final assembly	Mar-04	Mar-04	Pass	UCB / JM
1.61	MAG mounting bracket material = non-metallic	MRD - 4.7(K) and thermal current issues IPF - 4.1		1, 1	-			ı	Inspection and Magnetics test of completed MAG bracket	Feb-04	Feb-04	Pass	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,	MRD - 4.7(K) IPF - 4.1		т					Repeated deployment tests followed by alignment measurements on the qual model	Oct-03		Pass	UCB / JM
	boom deployment repeatability, etc.) = +/- 1 degree knowledge	ICD 2.1.3/6.2.2		т				ļ	Deploy and measure alignment on flight units	Jun-04	Aug-04	Pass	UCB / JM
1.63	SWEA FOV = > 80 % clear	MRD - 4.7 (H, I, J) IPF - 4.1		А				I	FOV analysis	Aug-03	Aug-03	Pass	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		А					Analysis to demonstarte SWEA in shadow when science mode pointin achieved	g Aug-03		Pass	UCB / JM
1.65	Boom surface conductivity = <10K ohms bulk, <10E8 ohms/square	MRD - 4.7 (H,I, J), electrostatics IPF - 4.1		т					Spot resistance measurements at numerous locations along a deploye boom	d Jun-04	Aug-04	Pass	UCB / JM
1.66	STE FOV = clear	MRD - 4.7 (F,G), scattered light sensitivity IPF - 4.1		1				ı	FOV analysis	CDR		Pass	APL
1.67	STE FOV = 2-bounce system to detectors	MRD 4.7 (H,I,J), detector sensitivity to UV IPF - 4.1		А				:	stray light analysis	Aug-03		Pass	UCB / PT

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		MRD - 4.7 (F,G),											
1.68	STE Thermal = < 0C	STE detector noise IPF - 4.1		A,T				t	thermal analysis, thermal balance tests	Apr-04		Pass	UCB / PT STE-U FM1 thermal balance, Al Seivold's analysis
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		т		т		F	Part of boom deployment test proceedure	Jun-04	Aug-04	Pass	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 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												
Instrument Subsystem Thermal Design Environments/ Requirements	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 Aquistion Mode). 5 arcmin 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 -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 Sloaleted IMPACT subsystems shall demonstrate,	ENV - 3.3.1 ICD - 5.11/5.15/5.1.3.2/ 5.15/5.2.1/3.2.2	SEP		A	A		A -	SEP suite Thermal Analysis (Observatory Analysis by APL)	CDR		Pass	GSFC / Hawk
	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 surfaces does not exceed 465 W/m2.		SEPT	т				-	Thermal Vac at ESTEC	Mar 04	Mar 04	Fail	Kiel to be repeated after rework
	Instruments are expected to undergo a successful							ŀ		War 04	War 04	raii	
	thermal vacuum cycle flight qualification test program. 1) The test cycles include 6 operational & 1 survival.		SIT	т				ŀ	Thermal Vac at GSFC (Tycho's facility)				UMd
Instrument Thermal	Chamber pressure is <1 X 10^5 torr. Desired transition rates of 3 to 50 C per minute. Each operational cycles must include electrical	ENV - 3.3.2/3.3.2.1	SEPC		Т			ŀ	SEP Central / HET / LET Thermal vac at JPL				СІТ
VacuumTesting	performance testing at the plateaus. 5) Instruments must demonstrate the ability to turn on at the palteaus of the first and last operational cycles.	ICD - 5.3/5.15	IDPU	Т				Т :	Thermal vac at UCB.	Jan-05	Feb-05	Pass	UCB 4 additional cycles after rework, Feb-05
	Flight predictions must demonstrate at least 10 degrees C margin within the operational or survival		Boom			т		E	Boom/MAG assembly thermal vac @ UCB	Jun-04	Aug-05	Pass	UCB
	design limits, as appropriate, with the exception that for active heater control, 5 degree C of temperature margin is acceptable at the lower design limit.		STE-U	Т				ŀ	Thermal vac at UCB	Jun-04	Aug-04	Pass	UCB
			SWEA	т					Thermal vac at UCB	Feb-05		Pass	UCB

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			SEPT	7					Thermal Balance at GSFC (Tycho's facility)				Kiel
			SIT	1	_				Thermal Balance at GSFC (Tycho's facility)				UMd
	Each instrument must udergo thermal vacuum balance testing to correlate its thermal performance to		SEPC	1	_			4	SEP Central / HET / LET Thermal balance at JPL				CIT
	thermal model predictions. The test must simulate spacecraft conductive and radiative interace		IDPU						No thermal balance (inside spacecraft bus)				UCB
2.3 Instrument Thermal Balance Testing	environmental heat inputs. The instrument thermal	ENV - 3.3.2/3.3.2.1 ICD - 5.3/5.15	Boom	1	-			т	Boom qual unit thermal balance tests., 10/2002, "STEREO/IMPACT			Pass	UCB
	control system must demonstrate the ability to maintain temperatures within survival while in								Boom Thermal Balance Test Plan* MAG thermal balance based on previous missions with identical				GSFC /
	operational mode and within operational limits while in operating mode.		MAG	1	_				sensors.			Pass	Acuna
			STE-U	_	-				Thermal Balance at UCB	Apr-04		Pass	UCB
			SWEA	Т					Thermal Balance at UCB	Jan-05		Pass	UCB After rework
3.0	STRUCTURAL/MECHANICAL REQUIREMENTS												
	The instruments shall meet the following design reqts. Quasi Static Load Factors: Component weight> Limit Load		SEPT	A	١.					Jan-03		Pass	Kiel SEPT Structural Analysis Doc.No. TOS-MCS/2002/721/ln
	<4.5 kg> 30g 4.5 kg to 22.7 kg> 25g 22.7 kg to 45 kg> 20g >45 kg> 16g		SIT	A	4					CDR		Pass	GSFC / SS
	Factors of Safety: Material Yield - Design >= 1.3 x limit load factors, Sine Vibration - 1.4 x max expected level		SEPC		А				SEP Central / HET / LET	CDR		Pass	GSFC / SS
3.1 Instrument Structrual Design Requirements	Material Ultimate - >+1.4 x limit load factors, Acoustic and Random Vibration - Max level +3db. Buckling - >= 2.0 x limit load factors	ENV - 3.4.1	IDPU	A	4					CDR		Pass	UCB
	Composites - >= 2.0 x limit load factors Margin of Safety for Instruments: Instrument strength and analysis must show a positive		Boom	A	١.				Including STE & SWEA pedestal	CDR		Pass	UCB
	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		MAG	A	١.					CDR		Pass	GSFC / Acuna
	MSU - Margin of Safety on Ultimate Strength = Material Ultimate Strength - 1.0 > 0 1.4 x Applied Stress		SWEA	A	4				Analyzer	Nov-02		Pass	CESR Structural Analysis, COMAT (CESR) doc 6032-TN-RL-001
			SEPT	A	١.					Jan-03		Pass	Kiel SEPT Structural Analysis Doc.No. TOS-MCS/2002/721/ln
			SIT	A	١.					CDR		Pass	GSFC / SS
	Instruments shall be designed such that primary structural vibration modes are above 50 Hz.	ENV - 3.4.1.2	SEPC		А				SEP Central / HET / LET	CDR		Pass	GSFC / SS
3.2 Instrument Stiffness	The IMPACT Boom, in its deployed configuration, shall be designed such that the first flexible body mode has a	ICD - 6.1.3.2/6.4.2.1 IPF - 4.2	IDPU	4	١.					CDR		Pass	UCB
	frequency above 0.5 Hz.		Boom	A	/Τ		т		Including STE & SWEA pedestal. Part of boom deployment test proceedure.	May-04	Aug-04	Pass	UCB/ Analysis backed by post-deployment "twang" test; uses mass dummies for instruments
			MAG	A	١.					CDR		Pass	GSFC / Heritage for MAG sensor
			SWEA	4	١.				Analyzer	Nov-02		Pass	CESR Structural Analysis, COMAT (CESR) doc 6032-TN-RL-001
			SEPT	4	4					Feb-04		Pass	Kiel

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Req# Parameter/ Req Title Section	Requirement	Document	Subassembly	Instrument	SEP Suite	Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization Notes / Comments
													GSFC /
			SIT	Α						CDR		Pass	SS
			SEPC		Α			ş	SEP Central / HET / LET	CDR		Pass	GSFC / SS
3.3 Instrument Venting	Instruments shall be designed and analyzed to provide relief ports or otherwise withstand a maximum pressure	ENV - 3.4.1.3	IDPU	A						CDR		Pass	UCB / HB
Requirements	rate change of 1.0 psi/sec. Pressure profile testing is considered optional.	ICD - 6.1.3.2	Boom	Α						CDR		Pass	UCB / JM
			STE	А						CDR		Pass	UCB / PT
			MAG	А						CDR		Pass	GSFC / Acuna Heritage for MAG sensor
			SWEA	А						CDR		Pass	UCB / PT
Instrument Shock Design	Self-induced shock shall be considered in the design	ENV - 3.4.1.4	Boom SWEA	_		Т			Boom deploy test (once with instruments; see waiver)	0-4.01	l== 05	D	UCB Done & measured for Qual mode boom; done for MAG and STE-U, but not SWEA. To be done on FM booms at S/C EMC deploy
and Test	of instruments with deployables. If actuation of the device is used, this test shall be performed twice.	ICD - 6.1.3.2	SWEA	T					SWEA door open test part of the SWEA functional SIT door open test part of the SIT functional	Oct-04	Jan-05	Pass	UCB UMd
	.,		SEPT	T					SEPT door open test part of the SEPT functional	Jan-04	Jan-04	Pass	Kiel
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 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		т				ā	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.				
	Instruments shall be subjected to the following		SEPT	Т					SEPT Vib (-E and -NS)	Feb-04	Feb-04	Fail	Kiel to be repeated after rework
	sinusoidal vibration levels listed in section 3.4.2.1. These shall be applied to 3 orthogonal axes.		SIT	т					SIT Vib				UMd
3.6 Instrument Sine Sweep	Sinusoidal vibration levels should be maintained within +10% of nominal test levels over the test frequency	ENV - 3.4.2.1	SEPC		Т				SEP Central / HET / LET Vib				CIT
Vibration Tests	range.	ICD - 6.1.3.2	Boom			Т		E	Boom suite vib, less SWEA	May-04	Aug-04	Pass	UCB
	Reference Req't #3.8 - Instrument Dynamic Test		SWEA	Т					SWEA Vib (levels envelope Qual boom measurements)	Jan-05		Pass	UCB
	Requirements		IDPU	т				ı	IDPU Vib	Nov-05	Dec-05	Pass	UCB
	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		SEPT	т					SEPT Vib (-E and -NS)	Feb-04	Feb-04	Fail	Kiel to be repeated after rework
	Random vibration levels should be maintained within 3dB of nominal test levels over the test frequency		SIT	т				\$	SIT Vib				UMd

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Req# Parameter/ Req Title Section	Requirement	Document	>		SEP Suite		ø.	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Res ponsible Organization Notes / Comments
Random Vibration Level for Instruments	range. Overall amplitude shall be kept within +/-1.5 dB. Any request to modify the specified random vibration test	ENV - 3.4.2.2 ICD - 6.1.3.2	SEPC		т				SEP Central / HET / LET Vib				СІТ
	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		Boom			Т			Boom suite vib, less SWEA	May-04	Aug-04	Pass	UCB
	must be approved by the STEREO Spacecraft Lead Structural Engineer prior to instrument testing. Reference Req't #3.8 - Instrument Dynamic Test		SWEA	т					SWEA Vib (levels envelope Qual boom measurements)	Jan-05		Pass	UCB
	Requirements		IDPU	т					IDPU Vib	Nov-05	Dec-05	Pass	UCB Workmanship vib Feb-05 after rework
	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	5 107 - : -	SEPT	т					SEPT ETU Acoustics, IBAG report No B-TR60-0221			Pass	Kiel ETU Test, 2003-Nov-11
3.8 Instrument Acoustic Test	testing. Reference appendix B, Environmental Test Matrix and figure 3.4.3-1.	ENV - 3.4.3 ICD 6.1.3.2	SIT	Т					SIT Prototype Foils test				Umd
Instrument Mass	Reference Req't #3.8 - Instrument Dynamic Test Requirements		SEPC		Т				SEP Central/HET/LET Accoustic test				CIT
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 SIT SEPC BOOM	T	_	т				Apr-04 Jan-05	Apr-04	Pass	Kiel to be repeated after rework UMd CIT UCB
			IDPU SEPT SIT	T T		_				Jan-05		Pass	UCB Kiel UMd
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	SEPC BOOM IDPU	т	Т	т							UCB 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 SIT SEPC BOOM	A		A						Pass	Kiel UMd CIT UCB
Mechanical I/F Req.			IDPU	Α								Pass	UCB
Mechanical //F Req.				А								Pass	Kiel
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.	ICD - 6.2.2		A	_							Pass Pass	UMd GSFC Alignment requirements can be met by mounting hole tolerance without need of alignment
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	IMPACT boxes (except IDPU) require +/-1 degree alignment and +/-1 degree knowledge.			А		A						Pass Pass	UCB UCB
Payload Instrument Mounting	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		SEPT	1									Kiel UMd
Surface	instrument. The average surface roughness height rating shall not exceed 125 micro inches along the instrument's longest dimension.	ICD - 6.2.6	BOOM IDPU	1	_							Pass	UCB UCB Per fabrication spec
3.14 Structural Model Test and	IMPACT shall perform test and verification of the finite	ICD - 6.4.2.3	ВООМ	Т	+				Poom post doployment stiffeees tests verify the FEM	May-04	Aug 04	Pass	UCB Per fabrication spec UCB
Verification	element model.	ICD - 6.4.2.3	SEPT	1	+-	\vdash			Boom post-deployment stiffness tests verify the FEM	way-u4	Aug-04	Pass	Kiel
	IMPACT shall be marked with appropriate (AXXX)		SEPT	1	1		_						UMd
3.15 Payload Instrument Identification and Marking	identification. The markings shall be permanent, resistant to chipping and located away from points of	ICD - 6.5.4	SEPC		ı								GSFC

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Req# Parameter/ Req Title Section	Requirement	Document	Subassembly	Instrument	SEP Suite	Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Organization Notes / Comments
	, , , , , , , , , , , , , , , , , , ,												
	physical wear.		воом	ı						Jan-05	Jan-05	Pass	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	IDPU	1			ı		N/A; no hermetically sealed units	Jan-05	Jan-05	Pass	UCB
4.0	ELECTRICAL		SEPT	т									Kiel
4.1 Instrument Component Magnetic Objectives	GSFC supplied 'sniffing' hardware will be used to map the magnetic emissions of selected instrument components (prior to integration) which are expected to contribute to the magenetic field.	ENV - 3.5	SIT SEPC SWEA	T T	т	т			Possibly arrange for group screening during the SEP suite I&T prior to EMC? Tested separately due to its proximity to MAG Boom piece-parts close to MAG to be individually screened	Jun-04 Feb-05	Jun-04	Pass Pass	UMd CIT GSFC (Acuna) to provide test setup and conduct tests at instrument UCB UCB
Instrument Component Design Radiation Requirements													
4.2 Total lonizing 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			Pass	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-cm²/mg shall not be used in spacecraft components without latch-up miligation techniques. Analysis and miligation 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	А, Т						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
4.6 Single Event Upsets due to Heavy lons	Calculation of upset rates due to heavy ions is required. If the part falls below a threshold of 15 MeV-cm²/mg then guidance given in section 3.9.3.4 shall be followed.	ENV - 3.9.3.3	А, Т						All EEE parts verified to meet the radiation requirement by analysis or test. Results documented on the parts lists.			Pass	исв
4.7 Single Event Upset due to Protons	Parts with heavy ion upset thresholds below 15 MeV- cm²/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	А, Т						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													

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	Frimary power input lines and all neater circuits shall												
	be electrically isolated within IMPACT by at least 1 Mohms from: 1) each other (unless internally switched or controlled)	EMC - 3.2.1.1	SEP		Т				Ground Isolation Test at SEP Suite I&T				CIT
4.10 Primary Power Bus I/F	chassis ground 3) all secondary circuits IMPACT shall be designed to support the voltage	ICD - 3.2.2 (Table 3-2)	IDPU	Т					IDPU/MAG/STE-U Ground Isolation Test	Oct-04	Jan-05	Pass	UCB
	ranges specified in table 3-2 in the ICD (Power Bus Interface). Components bridging this isolation I/F shall, as a		SWEA	Т					SWEA/STE-D Ground Isolation Test	Jan-05		Pass	UCB
4.11 Primary Power Bus I/F	minimum, be sized to withstand a potential difference of 100Vdc.	EMC - 3.2.1.1					Α		LVPS design	Oct-04		Pass	UCB
	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 ex		SEP		т				Primary Power Test at SEP Suite I&T				CIT UCB can provide support for this test to CIT
4.12 Primary Power Bus I/F Power Turn-On Transients	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 greater	ENV - 3.10.2/3.10.3 EMC - 3.2.1.3/4.11 ICD - 3.2.2.3	IDPU	т					IDPU/MAG/STE-U Primary Power Test	Oct-04		Pass	UCB
	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	т					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 turnon.	ENV - 3.10.2/3.10.3 EMC - 3.2.1.3 ICD - 3.2.2.3		т					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		т					Included in Primary Power test, 4.12				
Primary Power Bus I/F 4.15 Ripple and Transient Currents	Infrequent and short-term Ripple and transient currents appearing at the primary power UF 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		т					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 - 32.1.6		т					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 that 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		т					Included in Primary Power test, 4.12				

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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		Т				I	Included in Primary Power test, 4.12					
			SEP T	•				I	Measured in SEP LVPS functional test	Jun-04	Jul-04	Pass	UCB	
	DC/DC power converters throughout the S/C shall be operated at 50KHz, or harmonic thereof, with a		IDPU T	•				I	Measured in IDPU LVPS functional test	Jul-04	Aug-04	Pass	UCB	
4.19 Primary Power Bus I/F	frequency tolerance of 100ppm over all environmental	EMC - 3.2.1.10	SWEA T	•				I	Measured in SWEA LVPS functional test	Jul-04	Aug-04	Pass	UCB	
	conditions.		SIT T					I	Measured in SIT HVPS functional test	Dec-03		Pass	UCB	
			SWEA T					1	Measured in SWEA HVPS functional test	Sep-03	Oct-03	Pass	CESR	
4.20 Removal of Instrument	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	MRD - 4.6.8	IDPU	т					IDPU software acceptance tests and IDPU functional tests shall verify correct handling of 1553 shutdown messages.	Oct-03		Pass	UCB	
Power	receiving a power shutdown warning message over the 1553 bus.	ICD - 3.2.2.9	Suite				т	ı	Suite level testing will verify correct actions are taken at the instrument level.	Oct-04		Pass	UCB	
4.21 Instantaneous Removal of	The Instruments shall be designed to withstand an instantaneous removal of power without a warning	MRD - 4.6.8	IDPU SEP		Т	Т			IDPU Functional (with MAG & STE-U Instruments) SEP Suite Functional	Oct-04		Pass	UCB	
Instrument Power	message from the S/C.	ICD - 3.2.2.9	SWEA	Т					SWEA/STE-D Functional				UCB	
	IMPACT doors and Boom release actuators shall be designed to receive a 100ms, +28V pulse, off unregulated power.		SEPT	I, T						Mar 04	Mar 04	Pass	Kiel	
4.22 One-Time Activation Electrical Characteristics	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	ICD - 3.2.3.1/3.2.3.2	SIT	I, T									UMd	Test actuation time at worst case voltage, auto-cutoff, wire redundancy
	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.		Boom	I, T						May-04	Aug-04	Pass	UCB	
	Mounting surfaces of each unit shall be clean and free of paint or other insulating material and shall be		SEP		т			ı	Bonding measurements at SEP I&T (ground strap)	Oct-04		Pass	CIT	
4.23 Electrical Bonding	capable of providing a DC bond resistance of no greater than 2.5mOhms when mounted to the next larger assembly structure. DC resistance	EMC - 3.2.3.1/3.2.3.2 ICD - 6.2.4	IDPU	т				ı	Bonding measurements	Oct-04		Pass	UCB	
	measurements between any two adjacent exterior case parts shall not exceed 2.5 mOhms.		Boom		т			ı	Bonding measurements ate Boom Suite I&T (Ground Strap)	Oct-04		Pass	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						т,	APL to build and verify thermal blankets				APL	
4.25 Electrical Bonding/ Blanket Grounding	A minimum of 2 ground wires is required for each blanket. A ground connection is required within 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						т	APL to build and verify thermal blankets				APL	
	Doors and other hinged or shafted devices that have		SIT	т				;	SIT door ground test				UMd / SS	
4.26 Electrical Bonding	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	EMC - 3.2.3.4 ICD - 6.2.4	STE	т				;	STE door ground test				UCB / PT	
	ohms to assure a drain path for electrostatic charge.		SEPT	т					SEPT door ground test				Kiel	
Electrical Harness	Harnesses are to be measured during fab to assure that connector-to-shield bond resistance is no greater	MRD - 4.6.9.3	SEP T					;	SEP suite harness test				CIT	UCB can provide support for this test to CIT

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Req# Parameter/ Req Title Section	Requirement	Document	Subassembly	Assembly Instrument	SEP Suite	Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization Notes / Comments
4.21 Configuration and	than 2.5 mOhms and to confirm continuity between	EMC - 3.2.5.5						_					
Fabrication	than 2.5 mOhms and to confirm continuity between each end is less than 1 ohm.	EIVIC - 3.2.5.5	Boom	т				ı	Boom suite harness test	Oct-04		Pass	UCB
			SEPT	Т									Kiel
Flantantatia Observina/	The maximum variation in surface potential between	MDD 4000	SIT	Т									Umd Test excludes surfaces to be covered with thermal blankets (which
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	MRD - 4.6.9.3 EMC - 3.2.6.2	SEPC		Т								CIT are not considered external surfaces). Test measures surface or bulk resistance only. UCB to support CIT for this test.
	materials shall not exceed 10^8 Ohms/sq.		воом			Т				Oct-04		Pass	UCB Tesistance only. OCB to support CTT for this test.
			IDPU	Т				- 1	Not external, N/A				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 4.182) 1) Differential mode test limits are 80dBmicroamps from 100 Hz to 3KHz then decreasing to 50dBmicroA at 15kHz. F) Common mode test limits are 80dBmicroamps from 100 Hz to 10kHz then decreasing to 50dBmicroA at 15kHz.	EMC - 4.1					т						Make to CMF A County Date (4701b) to CMF A county Fee
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					т		Suite EMC test at UCB subcontractor	Oct-04		Fail*	UCB Waiver for SWEA Sample Rate (172Hz) on SWEA power line tentatively approved by EMC Committee
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 4.18.2) B) Offerential 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 that level to 50MHz.	EMC - 4.2					т		Suite EMC test at UCB subcontractor	Oct-04		Fail*	UCB Waiver for power converter clock harmonics tentatively approved by
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 a feasured 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					т		Suite Eine test at GOD subconfidence	Gara		1 411	EMC committee
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-fr offilerential measurements. Common mode voltage shall not exceed 500 mV p-p. C) Time domain conducted current ripple shall not exceed 200 mA p-p fr offilerential measurements and 50mA p-p for common mode measurements.	EMC - 4.4					т		Suite EMC test at UCB subcontractor	Oct-04		Pass	исв
4.34 CE-07 Ripple and Spike Emissions, Time Domain	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 25W input and return. Common mode voltage measurements are to be made between a) +28V input and chassis, and b) +28V input return and chassis.	EMC - 4.4					т						

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		Level of Assembly/Ver Method								Comple	tion Date					
Parameter/ Req Title Section	Requirement	Document	Subassembly	Assembly	SEP Suite	Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization Notes / Comments			
CS-01 Conducted 4.35 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 differential 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 sweet 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 - 4.5					т	**	Suite EMC test at UCB subcontractor	Oct-04		Fail *	Some noise in LET detector at 50KHz, not scientifically significant Some noise in MAG at 30Hz. Acceptable at -6dB Some STE noise 30KHz, Acceptable at -6dB Waiver tentatively approved by EMC Committee			
CS-02 Conducted 4.36 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 differnital 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 critical for determining susceptibility shall be documented and approved by the EMC committee prior to testing.	EMC - 4.6					Т	:	Suite EMC test at UCB subcontractor	Oct-04		Fail*	Some LET noise 50-200KHz, peaked at 80KHz; drops to insignificant level at -6dB. Some STE Noise at 50KHz, drops to background at -6dB Waiver tentatively approved by EMC committee			
	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 votage, relative to nominal line votage, for MIL-STD-4618 spike #1(slow) and spike #2(flast) shall be 20V differential, 10V return-to-chassis or	EMC - 4.7					т	4	Suite EMC test at UCB subcontractor	Oct-04		Fail*	UCB Some detector counts with longer pulses 1553 errors with longer pulses (handled OK) Waiver tentatively approved by EMC Committee			
RE-01 Radiated Emissions, 4.38 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					т	;	Suite EMC test at UCB subcontractor	Oct-04		Fail*	See MAG Drive and harmonics UCB See SEP Serial Interface harmonics Waiver tentatively approved by EMC Committee			
RE-02 Radiated Emissions, 4.39 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) Narrowkand 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 limits are 110 dB microV/m/MHz at 14 kHz decreasing to 85 dBmicroV/mMHz at 200 MHz then increasing to 80 dBmicroV/m/MHz at 1.0 GHz.	EMC - 4.9					т		Suite EMC test at UCB subcontractor	Oct-04		Fail*	UCB SEP, IDPU Processor clock Harmonics, 24MHz - 1.4GHz Walver tentatively approved by EMC Committee			

v1.5	1-Mar-05	STEREO/ IMPACT Requirements Verification Matrix												
		Level of Assembly/Ver Method								Comple	tion Date			
Req# Parameter/ Req Title Section	Requirement	Document	Subassembly	Assembly	Component	SEP Suite Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization Organization	
	IMPACT is required to record data, in addition to													
GHz	I) mirrAc1 is required to record usals, 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. IMIMPAC1 is alto conduct a RS-30 stest to demonstrate	EMC - 4.9					т							
	INITE ACT Shall conduct a R-S-U3 test to derinoristrate 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 subsystems that be irradiated with an electric field intensity of 20													
RS-03 Radiated 4.41 Susceptibility, 14 kHz to 15 GHz	subsystem share be irradiated with an electric field internsity 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 that applied field shall be 40 V/m. D) Test frequencies at and above 100MHz shall be pulse modulated at 1142 with a 50% duly factor. Lower frequencies shall be CV. E) Frequency shall be manually swept over the indicated range while monitoring the subsystem for susceptibility. The sweep shall record performancy interinsical to exercise the subsystem and record performancy. F) if susceptibility is encountered, then threshold levels are to be determined and recorded. G) Specific criteria for determining susceptibility shall be documented and anonoved by the FMC committee notion to testing.	1				т		Suite EMC test at UCB subcontractor				Some detector counts 400MHz-4GHz, background by -612dB STE counts at up to 9GHz, including at transmit bacnd (8.5GHz) STE counts in transmit band only with AM modulation, not FM Waiver tentatively approved by EMC committee		
	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.		SEP			т			SEP Suite FM2 EMC test @ CIT				CIT / UCB Test at CIT with UCB support / equipment	
4.42 Acceptance Tests		EMC - 8.1	IDPU		т				IDPU / MAG / STE-U FM2 EMC test @ UCB				UCB	
			SWEA		т				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	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.	ICD - 4.4.2.1 Table 4-7	IDPU		т				IDPU CPT	Oct-04	Dec-05	Pass	исв	
	The IMPACT/PLASTIC IDPU shall be designed to accept the "synch with data word" mode code and compute UTC.													
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		Т				IDPU CPT	Oct-04	Dec-05	Pass	UCB	

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	-			Level		/Ver Method		Completion Date				
Req	Parameter/ Req Title Section	Requirement	Document	Subassembly	Instrument Component SEP Suite	Boom Suite IMPACT Suite Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization	Notes / Comments
		T. THE IMPACT/PLASTIC IDPU Shall receive										
5.3	Distribution of Instrument Command Packets	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 FLTCs that contain only fill data. 12. The IMPACT/PLASTIC IDPU shall be able to process fLTCs that contain and process fLTCs that contain only fill data. 13. The IMPACT/PLASTIC IDPU shall be able to process fill data.	ICD - 4.4.2.3 Table 4-9		Т		IDPU CPT	Oct-04	Dec-05	Pass	UCB	
5.4	Collection of Instrument Telemetry Packets Mode Codes for 1553 Bus Diagnostics	In the INPACT/PLASTIC IDPU shall ensure that the telementy 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 telementy 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 (Telementy 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 oncome that the telemetry buffer contains valid data before incrementing the TBDAC. 5. IMPACT/PLASTIC IDPU shall shall not change the TBDAC, nor change the data in the buffer until the (S/C) CADH 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 (ideally immediately following the CADH tread of the pravious the IMPACT/PLASTIC IDPU shall shore the Moder Code transcations defined in table 4-10 CONTAMINATION REQUIREMENTS	ICD - 4.4.2.4 ICD - 4.4.2.5.1 Table 4-10		Т		IDPU CPT				UCB	
6.0		CONTAMINATION REQUIREMENTS										
		Unless stated in Table 3.2-1, external surfaces of all	s	SEPT	т						Kiel	
		IMPACT components that are mounted externally on the spacecraft, shall meet a surface cleanliness level of 200 A for controlled BAC) per MIL STD 1246 with	;	SIT	т						UMd	

v1.5	1-Mar-05	STEREO/ IMPACT Requirements Verification Matrix												
		Level of Assembly/Ver Method							•		tion Date			
Req# Parameter/ Req Title Section	Requirement	Document	Subassembly	Assembly	Component	Boom Suite	IMPACT Suite	Observatory	Verification Description	FM#1	FM#2	Results (Pass/Fail)	Responsible Organization	Notes / Comments
	OF 300 A (OF EQUIVALENCE PAG) PER IVILE-31D-1240. WILLT								Unit surface cleanliness shall be verified by inspection at APL. Ensuring					
6.1 Surface Cleanliness Requirement	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	CC - 4.1 ICD - 7.2.1	SEPC		1	-			One surface detailiness shall be verified by inspection at AFE. Ensuring the units meet the cleanliness requirements and cleaning as needed are indicated under "Responsible Organization"				CIT	
	explicitly permitted. The IDPU and any other items which will be located inside the STEREO spacecraft shall meet the STEREO spacecraft requirement of		воом			т						UCB		
	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.		IDPU		т								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 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 10% 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 ES95.		SEPT		х							Pass	Kiel	Preliminary lists provided at PDR, "Final" lists provided at CDR; updated lists as required
			SIT		х							Pass	UMd	
			HET		х				One waiver approved			Pass	GSFC	
6.2 Materials List		CC - 8.1 ICD - 7.2.2	SEPC		х				Sep Central / LET list			Pass	CIT	
			воом		х				Boom / IDPU / STE / LVPS List. One Waiver approved			Pass	UCB	
			MAG		х							Pass	GSFC	
			SWEA		х							Pass	CESR	
	Prior to acceptance to being integrated on STEREO,		SEPT		т								Kiel	
	all payload components shall undergo a thermal		SIT		Т								UMd	
6.3 Outgassing Certification	vacuum certification with a Quartz Crystal Microbalance (QCM). This certification may be	CC - 8.3.4	SEPC		1	-							CIT	
0.5 Odigassing Certification	performed with on separate components of IMPACT or on all the components as an assembly. It shall be	ICD - 7.2.2	BOOM			т				Jun-04	Oct-04	Pass	UCB	
			SWEA		т					Feb-05		Pass	UCB	
	performed in accordance with paragraph 6.3.2.		IDPU		Т					Feb-05	Feb-05	Pass	UCB	
	SOFTWARE REQUIREMENTS													
			SEPC		1	•			SEP Central Software Acceptance Test				CIT	
			LET		т				LET Software Acceptance Test				CIT	
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	HET		T HET Software Acceptance Test		GSFC							
7.0 Sortware		ICD	SIT		т				SIT Software Acceptance Test				GSFC	
			IDPU		т				IDPU Boot Software Acceptance Test	Oct-03		Pass	UCB	Repeated subsections at Spacecraft ETU Interface test, 2003-10-28
			IDPU		т				IDPU Instrument Software Acceptance Test	Feb-05		Pass	UCB	IMPACT software rev 25, includes PLASTIC rev 2.6, (not final)
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