Appendix B. SCR Models and Analyses: Standby Mode Transition

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Table B-1. Standby Transition/Configuration Table

Current Mode	mSB_CMD	mSOCNormal	mCIRL	mSSA_Good	mSRU_Good	mIMU_Good	mTurnComplete	mDetumbleGood	tPORCount	mSunSeenGood	mSunMonGood	mSunSearchGood	mSRUAcqGood	tLaunchFlag	New Mode	New Condition
any		T														StandbyPowerNormal
any		F														StandbyPowerLimited
any	@T(mSB_CMD = goEARTH)													F	sTranSunSSA	
any	@T(mSB_CMD = goEARTH)													T	sTranEarth	
sTranEarth								@T	> 1						sTranSunSSA	
sTranEarth								@F							sTranSunSRU	
sTranEarth													@F		sTranSunSSA	
sTranEarth										@F					???	???
sTranEarth										@T				T		x-BandOn
sTranEarth										@T				F		EarthStandby
any	@T(mSB_CMD = goPOR)								increment counter					F	sTranSunSSA	
any	@T(mSB_								incre					T	sTranEarth	

	CMD = goPOR)								ment counter							
any				F	@F										sTranSunSRU	
any				T	@F										sTranSunSSA	
any	@T(SB_CMD=goSSA)			T											sTranSunSSA	
any	@T(SB_CMD=goSSA)			F											sTranSunSRU	
sTranSunSSA				F											sTranSunSRU only at beginning of the SSA Standby entry logic	
sTranSunSSA				T								@T		T		x-Band
sTranSunSSA				T								@T		F		SunSSAStandby
sTranSunSSA				T								@F			sTranSunSRU POR SSA first	
any						@F									sTranSunSRU	
sTranSunSRU			T										@F		sTranSunSSA POR SRU first	
sTranSunS			T										@T	T		x-Band

RU																
sTranSunSRU			T										@T	F		SunSRUStandby
sTranSunSRU			F											T		x-Band
sTranSunSRU			F											F		SunSRUStandby
any	@T(SB_CMD=goSRU)														sTranSunSRU	

Table B-2. Standby Specification Editor

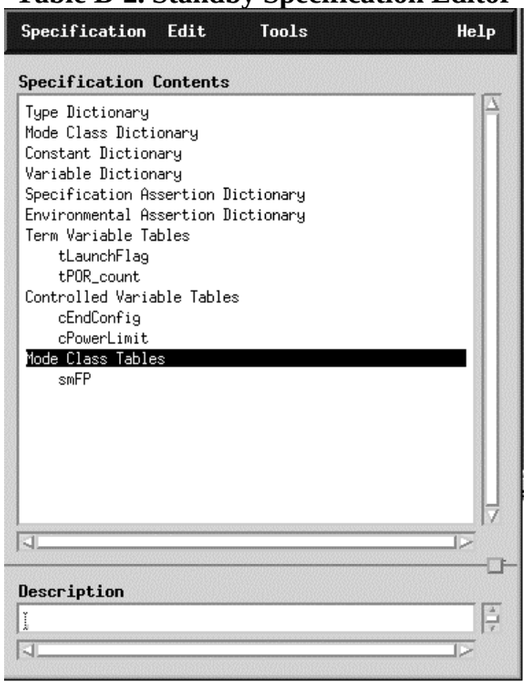

Table B-3. Standby Type Dictionary

Name	Base Type	Units	Legal Values	Comment
Boolean	Enumerated		TRUE, FALSE	
Character				
Enumerated				
Float				
Integer				
ModeClass				
String				
yEndConfig	Enumerated	N/A	None, EarthStandby, SunSSAStandby, SunSRUStandby, x_BandOn	Resulting spacecraft state at end of System Fault Protection Standby Mode Transition
yGND_CMD	Enumerated	N/A	None, setLaunchFlagFalse ,resetPORCount	Ground initiated commands. SetLaunchFlagFalse is set after Solar Arrays have been deployed
yPowerLimit	Enumerated	N/A	PowerNormal, PowerLimited	Spacecraft standby mode power configuration
ySB_CMD	Enumerated	N/A	None, goEarth, goSSA, goSRU, goPOR	spacecraft or ground initiated standby commands

Table B-4. Standby Mode Class Dictionary

Name	Modes	Initial Mode	Table?	Comment
smFP	sNone, sTranEarth, sTranSunSSA, sTranSunSRU	sNone	Yes	System Fault Protection Modes

Table B-5. Standby Constant Dictionary

Name	Class	Type	Value	Comment
kPOR_limit	Constant	Integer	1	Fault Protection limit on number of PORs

Table B-6. Standby Variable Dictionary

Name	Class	Type	Initial Value	Accuracy	Table?	Comment
cEndConfig	Controlled	yEndConfig	None	N/A	Yes	Configuration of the system at the end of Fault Protection Standby Mode Transition
cPowerLimit	Controlled	yPowerLimit	PowerNormal	N/A	Yes	Standby Power configuration (normal or limited)
mCIRL	Monitored	Boolean	True	N/A	No	Celestial Inertial Reference Loss
mDetumbleGood	Monitored	Boolean	True	N/A	No	True: s/c detumble good
mGND_CMD	Monitored	yGND_CMD	None	N/A	No	Ground command
mIMU_Good	Monitored	Boolean	True	N/A	No	False: IMU failure
mSB_CMD	Monitored	ySB_CMD	None	N/A	No	Spacecraft commands fault protection
mSOCNormal	Monitored	Boolean	True	N/A	No	True: Battery State of Charge is >= 60%
mSRUAcqGood	Monitored	Boolean	True	N/A	No	True: SRU Acquisition good
mSRU_Good	Monitored	Boolean	True	N/A	No	false: SRU

						failure
mSSA_Good	Monitored	Boolean	True	N/A	No	false: SSA failure
mSunSearch Good	Monitored	Boolean	True	N/A	No	True: Sun Search good
mSunSeenGo od	Monitored	Boolean	True	N/A	No	True: Sun Seen Good
tLaunchFlag	Term	Boolean	True	N/A	Yes	tLaunchFlag = false: initial DSN acquisition and confirmation of successful solar array deployment had occured. tLaunchFlag can only be set to FALSE by Ground Command (after Solar Arrays have been deployed); it is used to determine if the processor reboot is associated with launch (which is a planned reboot).
tPOR_count	Term	Integer	0	N/A	Yes	POR counter. tPOR_count will be automatically reset to zero after an hour has elapsed since the last reboot or if the ground resets the counter.

Table B-7. Standby Specification Assertion Dictionary

Name	D/E?	Expression	Comment
aEarthSB_OK1	E	cEndConfig = EarthStandby => (mSRU_Good) AND (mSSA_Good) AND (mIMU_Good)	Earth Standby requires working SRU, SSA and IMU
aEarthSB_OK2	E	cEndConfig = EarthStandby => mSunSeenGood AND mSunSearchGood AND mSRUAcqGood AND mDetumbleGood AND (mSOCNormal)	Earth Standby requires absence of h/w failure
aEarthSB_OK3	E	smFP = sTranEarth =>(mSRU_Good) AND (mSSA_Good) AND (mIMU_Good)	ref. aEarthSB_OK1
aPOR_2	E	mSB_CMD = goPOR => smFP != sNone	Processor reboot will always result in entry into one of the three standby modes
aPower_1	E	cPowerLimit = PowerLimited => NOT mSOCNormal	If battery power is not normal (< 60%) then the spacecraft is in imminent danger of mission catestrophic loss of low voltage power, and the spacecraft should be placed on limited power consumption.
aSun_SRU_OK1	E	NOT mSunSearchGood => smFP = sTranSunSRU	If the sun search is not successful
aSun_SRU_OK2	E	NOT mSSA_Good => smFP = sTranSunSRU	SUN_STANDBY_SRU does not use the sun sensor assembly (SSA) to directly measure the sun vector
aSun_SRU_OK3	E	NOT mIMU_Good => smFP = sTranSunSRU	SUN_STANDBY_SRU mode is the only mode that can function without a working IMU
aSun_SRU_OK4	E	NOT mDetumbleGood => smFP = sTranSunSRU	If the detumble fails the fault response will command SUN_STANDBY_SRU under the presumption that the IMU has failed.
aSun_SSA_OK1	E	(NOT mSOCNormal AND 'smFP != sTranSunSRU) => (smFP = sTranSunSSA)	Sun SSA Transition Mode is the preferred choice during a battery state of charge alert or emergency.although possible to be in sTranSunSRU due to

			other problems
aSun_SSA_OK2	E	cEndConfig = SunSSAStandby => mIMU_Good	Sun_Standby_SSA requires working IMU
aSun_SSA_OK3	E	cEndConfig = SunSSAStandby => mSunSearchGood	Sun_Standby_SSA requires SSA completes a successful sun search.

Table B-8. Standby tLaunchFlag Term Variable Table

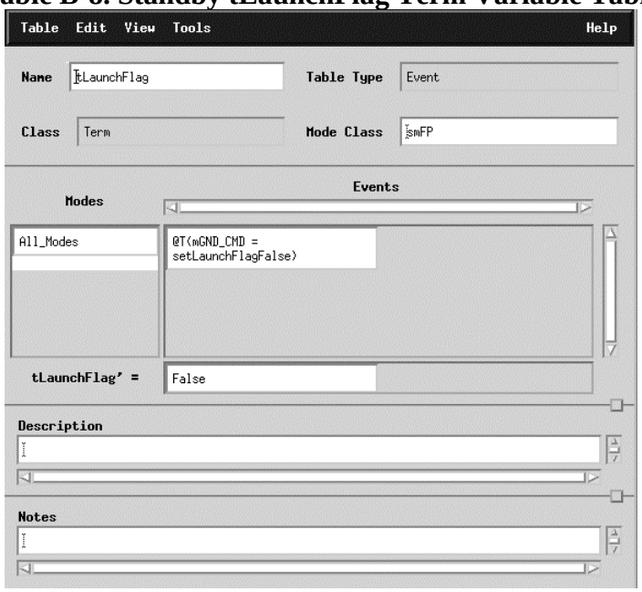

Table B-9. Standby Event Table for tPOR_count

Name		Mode Class
tPOR_count		smFP
Modes	**Events**	
All_Modes	@T(mSB_CMD = goPOR)	@T(mGND_CMD = resetPORCount)
tPOR_count =	'tPOR_count + 1	0

Table B-10. Standby Condition Table for cEndConfig

Name			Mode Class		
cEndConfig			smFP		
Modes	**Conditions**				
sTranEarth	FALSE	mSunSeenGood AND (tLaunchFlag)	FALSE	FALSE	mSunSeenGood AND (NOT tLaunchFlag)
sTranSunSSA	FALSE	mSunSearchGood AND (mSSA_Good AND tLaunchFlag)	FALSE	mSunSearchGood AND (mSSA_Good AND NOT tLaunchFlag)	FALSE
sTranSunSRU	FALSE	mSRUAcqGood AND (mCIRL AND tLaunchFlag)	mSRUAcqGood AND (mCIRL AND NOT tLaunchFlag)	FALSE	FALSE
sTranSunSRU	FALSE	NOT mCIRL AND tLaunchFlag	NOT mCIRL AND NOT tLaunchFlag	FALSE	FALSE
sNone	TRUE	FALSE	FALSE	FALSE	FALSE
cEndConfig =	None	x_BandOn	SunSRUStandby	SunSSAStandby	EarthStandby

Table B-11. Standby Event Table for cPowerLimit

Name		Mode Class
cPowerLimit		smFP
Modes	**Events**	
All_Modes	@T(mSOCNormal)	@F(mSOCNormal)
cPowerLimit =	PowerNormal	PowerLimited

Table B-12. Standby Mode Transition Table for smFP

Source Mode	Events	Destination Mode
All_Modes	@T(mSB_CMD = goEarth) WHEN (tLaunchFlag)	sTranEarth
All_Modes	@T(mSB_CMD = goEarth) WHEN (NOT tLaunchFlag)	sTranSunSSA
All_Modes	@T(mSB_CMD = goEarth) WHEN (tPOR_count > kPOR_limit)	sTranSunSSA
All_Modes	@T(mSB_CMD = goEarth) WHEN (NOT mDetumbleGood)	sTranSunSRU
All_Modes	@T(mSB_CMD = goEarth) WHEN (NOT mSRUAcqGood)	sTranSunSSA
All_Modes	@T(mSB_CMD = goSSA) WHEN mSSA_Good	sTranSunSSA
All_Modes	@T(mSB_CMD = goSSA) WHEN NOT mSSA_Good	sTranSunSRU
All_Modes	@T(mSB_CMD = goSSA) WHEN NOT mSunSearchGood	sTranSunSRU
All_Modes	@T(mSB_CMD = goSRU)	sTranSunSRU
All_Modes	@T(mSB_CMD = goPOR) WHEN (tPOR_count < kPOR_limit)	sTranEarth
All_Modes	@T(mSB_CMD = goPOR) WHEN (tPOR_count >= kPOR_limit)	sTranSunSSA
All_Modes	@F(mSRU_Good) WHEN (mSSA_Good)	sTranSunSSA
All_Modes	@F(mSRU_Good) WHEN (NOT mSSA_Good)	sTranSunSRU
All_Modes	@F(mIMU_Good)	sTranSunSRU
All_Modes	@F(mSSA_Good)	sTranSunSRU
All_Modes	@F(mSOCNormal)	sTranSunSSA
sTranEarth	@T(mDetumbleGood) WHEN (tPOR_count > kPOR_limit)	sTranSunSSA
sTranEarth	@F(mDetumbleGood)	sTranSunSRU
sTranEarth	@F(mSRUAcqGood)	sTranSunSSA
sTranEarth	@T(tPOR_count > kPOR_limit)	sTranSunSSA
sTranSunSSA	@F(mSunSearchGood)	sTranSunSRU
sTranSunSRU	@F(mSRUAcqGood) WHEN (mCIRL)	sTranSunSSA

Description

when sTranSunSSA: @T(mSunSearchGood) WHEN (mSSA_Good); do POR SSA first before sTranSunSRUwhen sTranSunSRU: @F(mSRUAcqGood) WHEN (mCIRL); do POR SRU first before sTranSunSSA

Notes

when sTranSunSSA: @T(mSunSearchGood) WHEN (mSSA_Good); do POR SSA first before sTranSunSRU
when sTranSunSRU: @F(mSRUAcqGood) WHEN (mCIRL); do POR SRU first before sTranSunSSA

Table B-13. Standby CC Checker

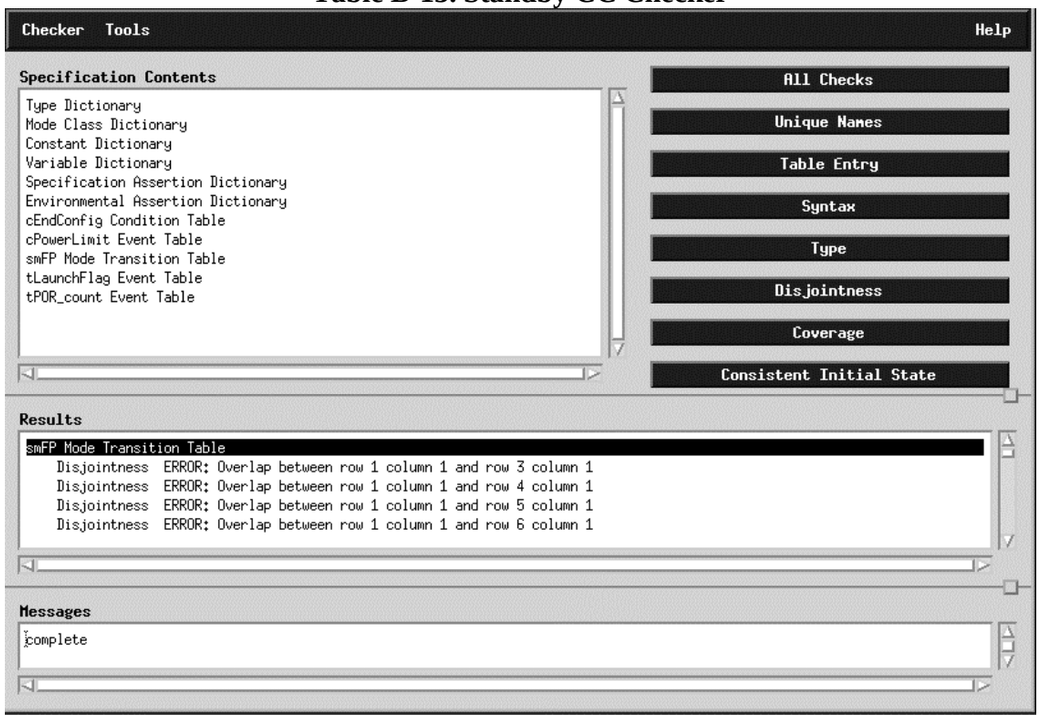

Table B-14. Standby Dependency Graph Browser

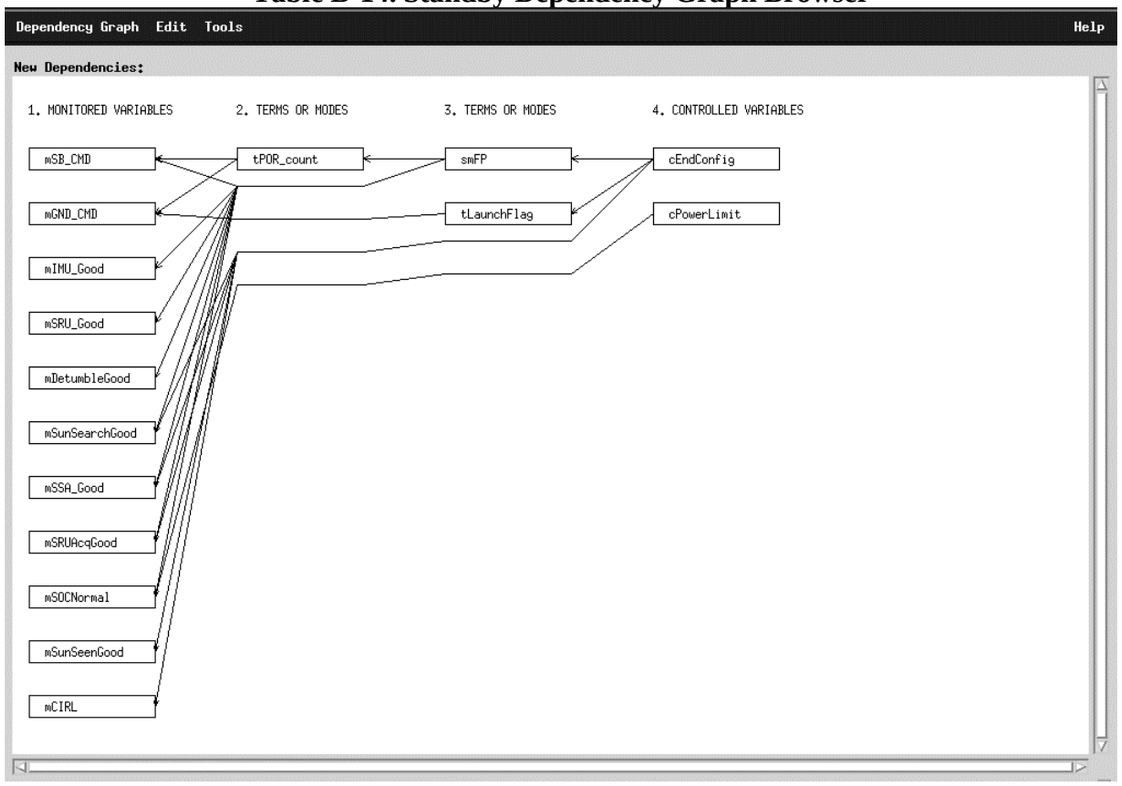
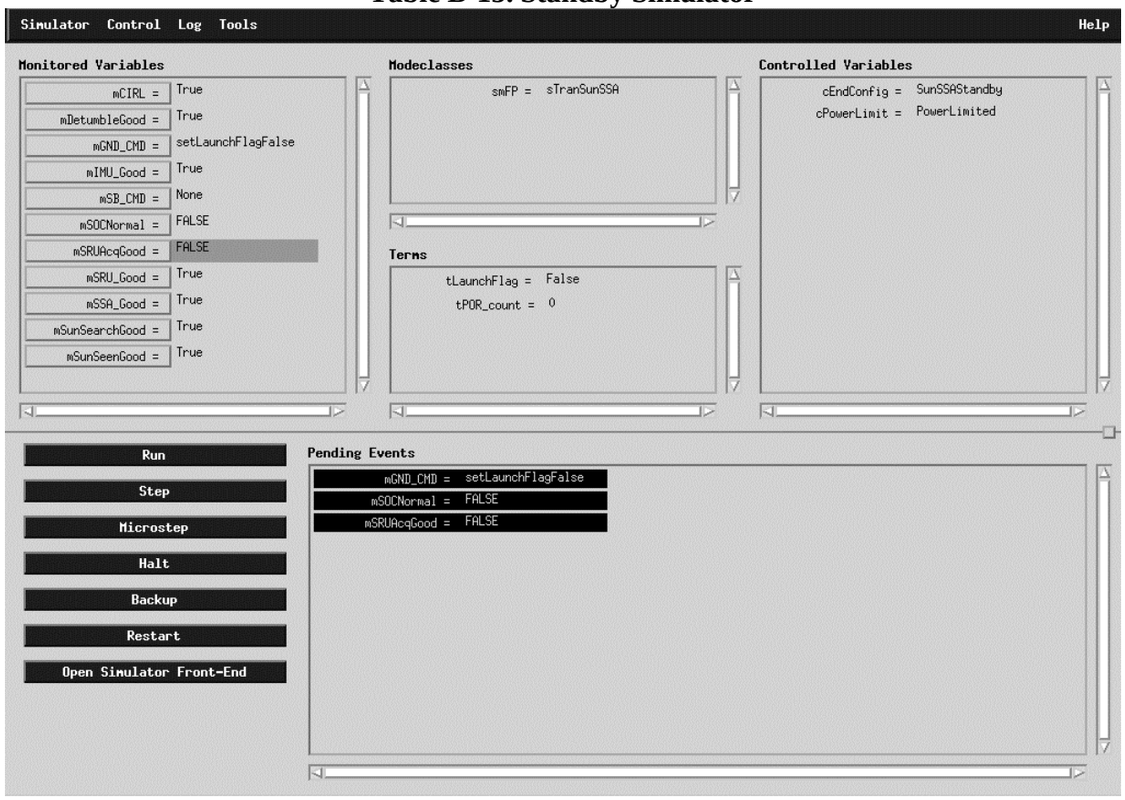
Table B-15. Standby Simulator