W. W. Hansen Experimental Physics Laboratory
STANFORD UNIVERSITY
STANFORD, CALIFORNIA 94305 - 4085

Gravity Probe B Relativity Mission

Science Gyro Spin Up

Overview

S0635, Rev. A

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Prepared by: M. LeMieux 7/26/02 Date

Prepared by: T. Walsh 7/29/0 Date

Approved by: D. Ross 8/5/02 Date

Approved by: G. Green 7/26/02 Date

Approved by: R. Brumley 8/1/02 Date

Approved by: B. Muhlfelder 7/26/02 Date

Approved by: G. Keiser 8/2/02 Date

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1. Purpose

Gyro Spin-Up [SU] is potentially the most dangerous phase of the entire GP-B mission. Since the gyros and GSS are directly and indirectly linked to all other spacecraft subsystems, it is imperative that the spacecraft be configured precisely prior to SU to ensure gyro and overall space vehicle health.

2. Subsystem Overview

The following subsystems will be involved in the following process.

ATC – ATC mode, roll rate, DF, thrusters
ECU – GIF heaters, Vatterfly valves
GMA – Valves, pressure transducers, gas flow
GSS – gyro charge, position, control effort, voltages
Ops – TLM formats, GN contacts, TDRS contacts, MOC staffing
SRE – SQUIDs
TRE – Telescope detectors, shutter
Dewar
Power Subsystem

3. Related Documentation

3.1. MOOG GMA Schematic – Drawing #SUGPB-26273 (See Appendix A)
3.2. ~~32k "Initialization" format table~~ 32K Spin-up format table
3.3. Science Document S0633, GMA Valve sequences
3.4. 2K format table
3.5. Science Document S0673, CPU Management

4. Discussion and Background

4.1. Terminology and acronyms
4.1.1. "0 Hz spin up" – While 0Hz and spin-up are contradictory, this term adequately describes the process of going through motions of a spin-up procedure without actually doing any spinning.
4.1.2. SU – Spin-Up
4.1.3. SOC – State of Charge

4.2. ATC

The ATC subsystem is charged with maintaining the spacecraft's attitude and orbit throughout the various stages of the mission. Although the ATC interacts with several other subsystems, very few hard requirements are set for gyro SU.

- ATC Mode – 2A [star trackers / thrusters / control gyros]
  - ATC to not use GPS data
    Note, the GPS system should be tested and functional (Timeline Event #980), but the ATC system should not be using GPS info for the duration of SU.
  - Drag Free Mode – Disabled.
    Note, the DF system should be tested and functional (Timeline Events #1441-1444), but not used for the duration of SU.
  - TRE – Disabled
    Note, the guidestar should be located and coarsely aligned prior to SU. With a guidestar-invalid condition, the ATC should be able to maintain attitude within 10 arc-sec. This is well within the science telescope field of view (60 arc-sec), and the T003-requirements document tolerance of 120 arc-sec for the duration of SU.
- Roll Rate – ~~Any~~ 1.0 RPM preferred for best spin axis alignment
  Note, the ATC can support any nominal roll rate throughout the duration of SU. However, a trade exists between needing a high roll rate for pointing accuracy [1.0 RPM], and a low roll rate for easier attitude control [0.1 RPM]. It is estimated that the final roll rate for SU will be somewhere between these two values.
- Thruster Flow Rate – Nominal [4-14 mg/s, 6.5 mg/s optimal]

See T003 Requirement

4.3. ECU

The following table outlines the required status of the systems the ECU directly controls.

- ECU Must be on
- Check ECU internal values (this algorithm can be found in ecu_verify.prc and ecu_monitor.prc)
- Ensure that required safe modes are enabled
- No other ECU activity during spin up process

4.4. GMA

- GMA Heaters must be on (Timeline event 880 shall be run prior to spin up)
- Pressure monitors should have nominal values (See schematic – Appendix A)
- Thermometer readings should be > 20°C
- Timeline event 890 - Vent_GMA_line_to_space shall be run prior to spin up

The following are the appropriate valve states immediately prior to and after spin up

Phases	Valve	Normally Open [NO]	Normally Closed [NC]
Initialization, launch and pre-SU	Supply Valves		V1,V2,V3,V4,V5,V6
	Gyro "quad" Valves	V7,V8,V11,V12,V15,V16,V19,V20	V9,V10,V13,V14,V17, V18,V21,V22
	Flux Flush "quad" Valves	V23,V24	V25,V26
	Vent "quad" Valves	V27,V28	V29,V30
Post-SU	Supply Valves		V1,V2,V3,V4,V5,V6
	Gyro "quad" Valves	V7,V8,V11,V12,V15,V16,V19,V20	V9,V10,V13,V14,V17, V18,V21,V22
	Flux Flush "quad" Valves	V23,V24	V25,V26
	Vent "quad" Valves	V27,V28,V29,V30	

0 Hz spin up

- All vatterfly and leakage 1 & 2 valves closed (EV's and LV's)

Low Hz spin up

- Gyro levitated
- Leakage valves opened (can stay open for entire process of the low Hz Spin up)
- Can turn heaters off if needed since they will stay open for the entire process

High Hz spin up (in addition to the low Hz spin up items

- Turn on the final filter heaters for performance

4.5. GSS

4.5.1. Functional Modes

The GSS can be operated through the use of six operational modes, as shown below. When on-orbit, either digital or analog Science Mission (SM) modes will control the GSS for all phases of the mission except SU & spin axis alignment. During SU and alignment, the primary control mode will be SU/Alignment – Digital DC, with a SU/Alignment – Analog providing backup.

The key difference between the SM-Digital and SU-Digital modes is that a greater GSS drive voltage is required for nulling the forces applied to the gyro by spin-up gases in the gyro housing. The SU-Digital mode allows for drive voltages of 50-300V to the GSS.

Functional Modes:

1. Science Mission (SM-digital)
2. Science Mission (SM-low backup-analog)
3. Science Mission (SM-high backup-analog)
4. SU & Alignment (digital)
5. SU & Alignment (backup-analog)
6. Ground Test (digital)

4.5.2. Mode 4: SU & Alignment – digital is the nominal GSS spin-up mode

4.5.3. Electrostatic Caging
- off during SU

4.5.4. Gyro Protection – part of mode 4
- Control arbiter – autonomous selection of active GSS functional mode (digital/analog)

4.5.5. Gyro Charge Control
- Inactive during spin-up
- CCCA/ECU function
- Nominal net charge setting (15mV)

4.5.6. GSS Charge measurement turned on – with high excitation

4.5.7. Spin Axis Alignment
- Not until after SU

4.5.8. Other
- GSS Survival heaters – off
- High voltage to GSS – part of mode 4
- Control algorithm changes – no changes to be made during SU (660Hz mode, part of functional mode 4)
- Aft GSS cards:
  1. Aft Comm Link (ACL)
  2. Aft Mux/Timing (AMT)
  3. Aft Clock Support (ACS)
  4. Aft Test Card (ATC)
- Forward GSS cards:
  1. Forward Comm Link (FCL)
  2. Forward Mode Register (FMR)
  3. A/D and D/A Converter (ADDA)
  4. Arbiter (ARB)
  5. Analog Backup (ABU)
  6. Mux/Oscillator (MUX)
  7. High Voltage Amp/Bridge (HVA) ... 3/GSS

4.5.9. Gyro State & Power State for each gyro for each spin-up TBD

4.6. Ops

4.6.1. TLM Formats & TDRS Support

TDRS contacts for GP-B must be scheduled several weeks in advance of the SU event. TDRS support is **mandatory** for the entire duration of a gyro SU sequence. In the interest of operational continuity, Ground Network (GN) supports will not be used (AGS, SGS). Therefore, a 2k TDRS TLM format will be used for all SU sequences, for all spin speeds. The following must be secured prior to SU:

- Continuous TDRS contacts scheduled through the SWSI interface for the duration of each gyro SU:
  - 0 Hz spin – approx. 15 min. max.
  - 1 Hz spin – approx. 15 min. max.
  - 170 Hz spin – approx. 3 hrs.
- GN supports (AGS, SGS) not scheduled

- Flight Director will ensure GSFC will be briefed on the SU activities so that NASA staff will be available to work any technical problems with TDRSS/White Sands.

4.6.2. Orbit Dynamics & ATC

Several important orbit dynamic factors can influence safe SU, including the South Atlantic Anomaly, the spacecraft roll rate, spin axis alignment, and orbit trim. The following is a summary of important Ops considerations for SU.

- Drag Free Mode – disabled
- Orbit Trim – orbit trim may be ongoing during SU, if necessary
- Roll Rate – between 0.1 Hz and 1.0 ~~Hz~~ RPM (1.0 RPM Preferred for High Speed Spin
  Note, it is imperative that gyro SU commence and terminate at the same relative point in a spacecraft roll cycle. *That is, if SU begins with the s/c roll angle of 45 degrees to the orbit plane, SU must terminate with the s/c at the same relative angle to the orbit plane.*
- Guidestar valid/invalid – invalid — may be either
  Note, the s/c must be coarsely aligned to the guidestar prior to SU. It is desired to have the s/c aligned within 22 arc-sec of the guidestar prior to each gyro SU.
- South Atlantic Anomaly – High speed SU[1] cannot occur if any part of the s/c's orbit passes through the SA anomaly during SU. Since the RAAN decreases as the earth rotates (RAAN goes from right to left), SU cannot generally occur unless the RAAN is less than approx. 300 deg. If SU occurs at this point, GP-B will have approx. 4 hours before the orbit will pass through the SA anomaly again.

It is not essential that the spin-up start and stop at the same roll phase. Because ~~of the time~~ it will take several minutes to start or stop the spin-up gas (after the valve has been open or closed), starting or stopping the spin-up gas at the same roll phase will not help with the spin-axis alignment. However, it degrades the spin-axis alignment

4.6.3. MOC Staffing

There is no requirement to have specific subsystem engineers present in the MOC during SU. However, it is required that all RTworks are functional properly and reporting pertinent red/green status, and by extension, certified personnel will be present to report to the Flight Director real-time status of the RTworks displays.

4.7. SRE

The following are the operational requirements for the SQUID and SRE systems.

- Auto-reset set to off
- Gain set to 1
- Range set to 3
- SQUID Bracket temperature less than 7.0K[2]
- Loops locked
- SRE FFTs turned on (and set with spin up parameters)

4.8. TRE

The TRE is not used for attitude control during SU operations. However, it is desired to have the TRE in a safe stand-by mode, rather than disabled or powered off. Most of the TRE setup and characterization tasks take place well before spin-up. These include all of the power-on and temperature adjusting, plus guide star acquisition and verification[3]. The following will outline in high level detail important considerations to protect the health of the telescope detectors immediately prior to SU:

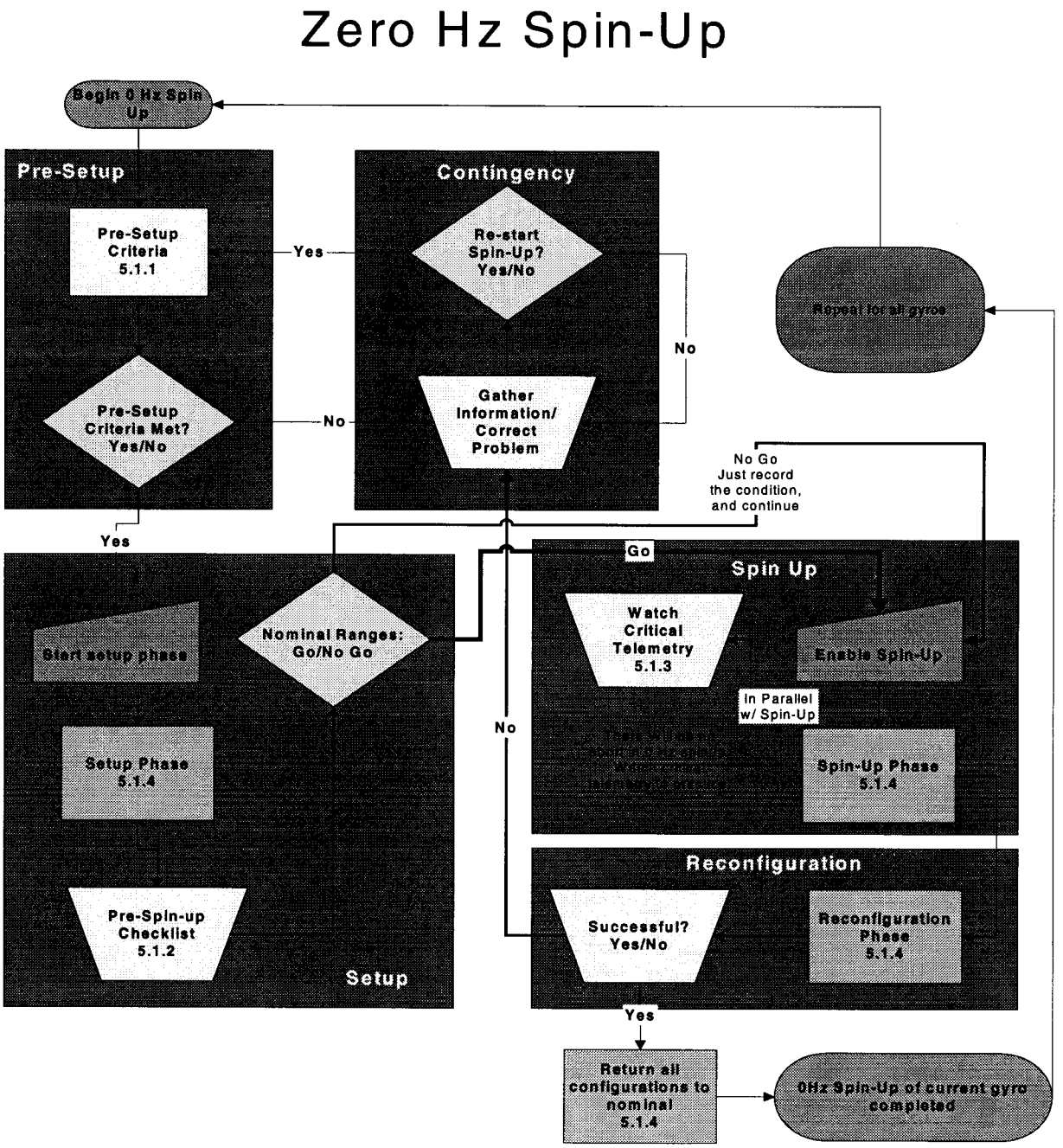
- Telescope detectors powered
- Detector heaters controlled by PID algorithm @ max. voltage (approx. 8V)
- If the PID algorithm causes an overload of the SRE signal processor, the detector heaters should be controlled internally by the TRE in local closed loop control (@ max. voltage, approx. 7.5V).
  Note, local closed loop heater control increases the detector noise level due to an unanticipated coupling mechanism, but since the detector information is not being used, noise level is immaterial.
- ST shutter set to nominal operations (closed when near earth's limb, open elsewhere).
- TRE applications disabled for CPU performance

[1] This is only a concern for High Hz Spin-Up, not for the Low and 0 Hz Spin-Ups.
[2] This temperature is controlled by the SRE.
[3] This only applies to the low and high Hz spin-ups.

5. Spin-Up

5.1. Zero Hz Spin-Up

Gyro 2 is the first gyro as it is suspected that it will be the drag free gyro. The 0 Hz spin-up is a practice of the subsequent spin-ups. However, in order ensure the health of the space vehicle, itmost potentially dangerous operations have been removed. Below is a flow chart that describes the process of spinning up.



5.1.1. The following items/constraints are in effect for the duration of spinning up all four gyros, and may need to be commanded independently from the process below. The mission planner will need to add separate timeline events or verify independently that these conditions are met.

5.1.1.1. Vatterfly valves[4]

- EV1 – closed
- EV2 – closed
- EV3 – closed
- EV4 – closed
- LV1 – closed
- LV2 – closed

5.1.1.2. The current/spin-up gyro is in spin-up mode prior to starting the setup phase.

5.1.1.3. Dewar HLD's shall be enabled[4]

5.1.1.4. The GMA heaters shall have been turned on before spin up[4]

5.1.1.5. Verify Roll Rate – The length of time to flow gas should be an integral multiple of the roll period. See S0633

5.1.2. Pre-Spin-Up Phase Telemetry Check (Pre-Enable)

Please talk to Bruce Cl & Rod Bromley

	Sub-sys	Description	Mnemonic	Value/ Range
5.1.2.1.	ECU	Final filter heaters	Open Loop[5]	
5.1.2.2.	ECU	Final filter temperature - Final filter 1&2 GRT/a: T-06P	TE_Fi1_2_aGT06P	
5.1.2.3.	ECU	Final filter temperature - Final filter 1&2 GRT/b: T-07P	TE_Fi1_2_bGT07P	
5.1.2.4.	ECU	Final filter temperature - Final filter 3&4 GRT/a: T-08P	TE_Fi3_4_aGT08P	
5.1.2.5.	ECU	Final filter temperature - Final filter 3&4 GRT/b: T-09P	TE_Fi3_4_bGT09P	
5.1.2.6.	ECU	Gyro temperature -Gyroscope #1 GRT: T-01Q	TE_Gyro_1_GT01Q	
5.1.2.7.	ECU	Gyro temperature -Gyroscope #2 GRT: T-02Q	TE_Gyro_2_GT02Q	
5.1.2.8.	ECU	Gyro temperature -Gyroscope #3 GRT: T-03Q	TE_Gyro_3_GT03Q	
5.1.2.9.	ECU	Gyro temperature -Gyroscope #4 GRT: T-04Q	TE_Gyro_4_GT04Q	
5.1.2.10.	ECU	Vatterfly valve states	See previous section	
5.1.2.11.	ECU	GMA pressure[6] – Calibrated P9A GMA pressure	DE_VACG_P9A_PWR DE_VACG_P9A_RNG DE_VACG_P9A_SIG SM_GMAPresP9A	
5.1.2.12.	ECU	GMA pressure[6] – Calibrated P9B GMA pressure	DE_VACG_P9B_PWR DE_VACG_P9B_RNG DE_VACG_P9B_SIG SM_GMAPresP9B	

[4] For the entire process starting before the first gyro and continuing past the end of the last gyro.
[5] All testing has been done with open loop.

	Sub-sys	Description	Mnemonic	Value/ Range
5.1.2.13.	GMA	GMA pressure[6] – Calibrated SP5 GMA pressure	SM_GMAPresSP5	
5.1.2.14.	GMA	GMA pressure[6] – Calibrated SP6 GMA pressure	SM_GMAPresSP6	
5.1.2.15.	GMA	GMA pressure[6] – Calibrated SP7 GMA pressure	SM_GMAPresSP7	
5.1.2.16.	GMA	GMA pressure[6] – Calibrated SP8 GMA pressure	SM_GMAPresSP8	
5.1.2.17.	GMA	GMA pressure[6] – GP4	DE_GMA_____CP1	0-24 psia
5.1.2.18.	GMA	GMA pressure[6] – GP3	DE_GMA_____CP2	100-2000 psia
5.1.2.19.	GMA	GMA pressure[6] – GP13	DE_GMA_____CP3	0-5 psia
5.1.2.20.	GMA	GMA pressure[6] – GP5	DE_GMA_____CP4	0-24 psia
5.1.2.21.	GMA	GMA pressure[6] - GMA Tank pressure: SP1 – GP2	DE_GMA_____SP1	100-2000 psia
5.1.2.22.	GMA	GMA pressure[6] – GMA Pressure 1st reg: SP2 – GP8	DE_GMA_____SP2	0-5 psia
5.1.2.23.	GMA	GMA pressure[6] – GP10	DE_GMA_____SP3A	0-5 psia
5.1.2.24.	GMA	GMA pressure[6] – GP14	DE_GMA_____SP3B	0-5 psia
5.1.2.25.	GMA	GMA pressure[6] – GMA Metering Valve: SP4 – GP1	DE_GMA_____SP4	100-2000 psia
5.1.2.26.	GMA	GMA pressure[6] – GMA Input to gyro 1: SP5 – GP7	DE_GMA_____SP5	0-5 psia
5.1.2.27.	GMA	GMA pressure[6] – GMA Input to gyro 2: SP6 – GP9	DE_GMA_____SP6	0-5 psia
5.1.2.28.	GMA	GMA pressure[6] – GMA Input to gyro 3: SP7 – GP11	DE_GMA_____SP7	0-5 psia
5.1.2.29.	GMA	GMA pressure[6] – GMA Input to gyro 4: SP8 – GP12	DE_GMA_____SP8	0-5 psia
5.1.2.30.	GMA	GMA pressure[6] – GMA vent pressure: SP9 – GP6	DE_GMA_____SP9	0-5 psia
5.1.2.31.	GMA	GMA Temp. - GMA #1A SDT/a	TE_GMA_SDT_1A	
5.1.2.32.	GMA	GMA Temp. - GMA #1B SDT/b	TE_GMA_SDT_1B	
5.1.2.33.	GMA	GMA Temp. - GMA #2A SDT/a	TE_GMA_SDT_2A	
5.1.2.34.	GMA	GMA Temp. - GMA #2B SDT/b	TE_GMA_SDT_2B	
5.1.2.35.	GMA	GMA Temp. - GMA #3A SDT/a	TE_GMA_SDT_3A	
5.1.2.36.	GMA	GMA Temp. - GMA #3B SDT/b	TE_GMA_SDT_3B	
5.1.2.37.	GSS	ARBITER_STATE (0= PON STATE, 1= PRIME,2=SBT ,3=SB1 ,4=SB2 , 5=HBT, 6=HB1, 7=HB2, 8=LB1, 9=LB2 ,10-15 are spare:)	PY_ARB_STATE_1, PY_ARB_STATE_2, PY_ARB_STATE_3, PY_ARB_STATE_4	1=PRIME
5.1.2.38.	GSS	Snapshots enabled	PY_snapNbl1, PY_snapNbl2, PY_snapNbl3, PY_snapNbl4	
5.1.2.39.	GSS	Snapshot Mode [7] Threshold snapshots	PY_ssSelctGss1, PY_ssSelctGss2, PY_ssSelctGss3,	

[6] These mnemonics represent the old GMA. esponding mnemonics for the new GMA were unavailable (not released) at the time this version of this document was released.

[7] Only the mnemonic corresponding to the currently spinning gyros apply. This is irrelevant for the 0 Hz spin-up (practice).

	Sub-sys	Description	Mnemonic	Value/ Range
			PY_ssSelctGss4	
5.1.2.40.	GSS	Control Effort X[7]	SY_CtrEffortX_1, SY_CtrEffortX_2, SY_CtrEffortX_3, SY_CtrEffortX_4	
5.1.2.41.	GSS	Control Effort Y [7]	SY_CtrEffortY_1, SY_CtrEffortY_2, SY_CtrEffortY_3, SY_CtrEffortY_4	
5.1.2.42.	GSS	Control Effort Z[7]	SY_CtrEffortZ_1, SY_CtrEffortZ_2, SY_CtrEffortZ_3, SY_CtrEffortZ_4	
5.1.2.43.	GSS	Electrode voltages[7] X1	SY_cmdGyVltX1_1, SY_cmdGyVltX1_2, SY_cmdGyVltX1_3, SY_cmdGyVltX1_4	
5.1.2.44.	GSS	Electrode voltages[7] X2	SY_cmdGyVltX2_1, SY_cmdGyVltX2_2, SY_cmdGyVltX2_3, SY_cmdGyVltX2_4	
5.1.2.45.	GSS	Electrode voltages[7] Y1	SY_cmdGyVltY1_1, SY_cmdGyVltY1_2, SY_cmdGyVltY1_3, SY_cmdGyVltY1_4	
5.1.2.46.	GSS	Electrode voltages[7] Y2	SY_cmdGyVltY2_1, SY_cmdGyVltY2_2, SY_cmdGyVltY2_3, SY_cmdGyVltY2_4	
5.1.2.47.	GSS	Electrode voltages[7] Z1	SY_cmdGyVltZ1_1, SY_cmdGyVltZ1_2, SY_cmdGyVltZ1_3, SY_cmdGyVltZ1_4	
5.1.2.48.	GSS	Electrode voltages[7] Z2	SY_cmdGyVltZ2_1, SY_cmdGyVltZ2_2, SY_cmdGyVltZ2_3, SY_cmdGyVltZ2_4	
5.1.2.49.	GSS	Position, a-axis (sm filtered data) [7]	RY_pstna1, RY_pstna2, RY_pstna3, RY_pstna4	
5.1.2.50.	GSS	Position, b-axis (sm filtered data) [7]	RY_pstnb1, RY_pstnb2, RY_pstnb3, RY_pstnb4	
5.1.2.51.	GSS	Position, c-axis (sm filtered data) [7]	RY_pstnc1, RY_pstnc2, RY_pstnc3, RY_pstnc4	
5.1.2.52.	GSS	Communications to Host - 1 Hz Sync Fail Flag[7]	PY_1HzSncFail1, PY_1HzSncFail2, PY_1HzSncFail3, PY_1HzSncFail4	Ok
5.1.2.53.	GSS	Communications to Host - 10 Hz Sync Fail Flag[7]	PY_10HzSncFail1, PY_10HzSncFail2, PY_10HzSncFail3, PY_10HzSncFail4	Ok
5.1.2.54.	GSS	Communications to SRE Timing Chain 16FO_A_ACTIVE (0 = SRE 16f0 A absent, 1 = SRE 16f0 A present) OR	PY_16FO_A_On_1, PY_16FO_A_On_2, PY_16FO_A_On_3, PY_16FO_A_On_4 OR PY_16FO_B_On_1,	SRE A Present OR SRE B Present

	Sub-sys	Description	Mnemonic	Value/ Range
		16FO_B_ACTIVE (0 = SRE 16f0 B absent, 1 = SRE 16f0 B present) [7]	PY_16FO_B_On_2, PY_16FO_B_On_3, PY_16FO_B_On_4	
5.1.2.55.	GSS	Aft GSS Hardware Status - Aft Green Board Bits (0=red, 1=green) [7]	SY_GrnBrd1_1, SY_GrnBrd1_2, SY_GrnBrd1_3, SY_GrnBrd1_4	-1 (0xFFFF)
5.1.2.56.	GSS	Fwd GSS Hardware Status - Fwd Green Board Bits (0=red, 1=green) [7]	SY_GrnBrd2_1, SY_GrnBrd2_2, SY_GrnBrd2_3, SY_GrnBrd2_N	-1 (0xFFFF)
5.1.2.57.	GSS	Control Rate (0=10Hz, 1=n/a, 2=660Hz, 3=220Hz, 4=alternate 10 Hz , 5=1553 only) [7]	PY_cntrlRate_1, PY_cntrlRate_2, PY_cntrlRate_3, PY_cntrlRate_4	220Hz
5.1.2.58.	GSS	Interrupt Timeout Flag Summary[7]	SY_intTmoFlgs_1, SY_intTmoFlgs_2, SY_intTmoFlgs_3, SY_intTmoFlgs_4	OK
5.1.2.59.	GSS	Payload Processor Error Flag (1=OK, 0=failure) [7]	PY_gssppFail1, PY_gssppFail2, PY_gssppFail3, PY_gssppFail4	OK
5.1.2.60.	GSS	GSW Failure Flag (1=OK, 0=failure) [7]	PY_gswFail1, PY_gswFail2, PY_gswFail3, PY_gswFail4	OK
5.1.2.61.	GSS	Gyro Commands Enabled Flag (0 = disabled, 1 = enabled) [7]	PY_gyrCmdEbl_1, PY_gyrCmdEbl_2, PY_gyrCmdEbl_3, PY_gyrCmdEbl_4	Enabled
5.1.2.62.	GSS	Gyro Commands Enabled Flag (0 = disabled, 1 = enabled) [7]	PY_gyrCmdEbl_1, PY_gyrCmdEbl_2, PY_gyrCmdEbl_3, PY_gyrCmdEbl_4	Enabled
5.1.2.63.	GSS	I/O Mode (0=normal, 1=sine, 2=manual out, 3=constant) [7]	PY_ioState_1, PY_ioState_2, PY_ioState_3, PY_ioState_4	Normal
5.1.2.64.	GSS	ATC position filter enabled (1=enabled, 0=disabled) [7]	PY_ATCpsFlNbl1, PY_ATCpsFlNbl2, PY_ATCpsFlNbl3, PY_ATCpsFlNbl4	Enabled
5.1.2.65.	GSS	Electrode Voltage Square Sum Filter Enabled (1=enabled, 0=disabled) [7]	PY_eVVfltNbl1, PY_eVVfltNbl2, PY_eVVfltNbl3, PY_eVVfltNbl4	Enabled
5.1.2.66.	GSS	Electrode Mean Voltage Filter Enabled (1=enabled, 0=disabled) [7]	PY_eMVfltNbl1, PY_eMVfltNbl2, PY_eMVfltNbl3, PY_eMVfltNbl4	Enabled
5.1.2.67.	GSS	Position Signal Filter Enabled (1=enabled, 0=disabled) [7]	PY_posFltNbl1, PY_posFltNbl2, PY_posFltNbl3, PY_posFltNbl4	Enabled
5.1.2.68.	GSS	Control Effort Filter Enabled	PY_ceFltNbl1,	Enabled

	Sub-sys	Description	Mnemonic	Value/ Range
		(1=enabled, 0=disabled) [7]	PY_ceFltNbl2, PY_ceFltNbl3, PY_ceFltNbl4	
5.1.2.69.	GSS	Bridge Oscillator Amplitude (0 = High Oscillator level, 1 = Low Oscillator level) [7]	PY_oscSwitch1, PY_oscSwitch2, PY_oscSwitch3, PY_oscSwitch4	LOW
5.1.2.70.	GSS	Charge Bias Flag (0 = 0V, 1 = +3V, 2 = -3V) [7]	PY_UV_bias1, PY_UV_bias2, PY_UV_bias3, PY_UV_bias4	0V
5.1.2.71.	GSS	BU Spin Up Radius Select (0 = center, 1 = radial position 1, 3 = radial position 2, 7 = radial position 3) [7]	PY_SU_R_Cmd_1, PY_SU_R_Cmd_2, PY_SU_R_Cmd_3, PY_SU_R_Cmd_4	TBD (On-orbit)
5.1.2.72.	GSS	FSU Mission Mode (0 = power on, 1 = Science Mission, 2 = Spin Up, 3 = Ground Test) [7]	PY_missionMode1, PY_missionMode2, PY_missionMode3, PY_missionMode4	SMM
5.1.2.73.	GSS	Controller Mode (0=idle by default, 1=CTM, 2=GTM, 3=SUM, 4=SMM) [7]	PY_cntrlState_1, PY_cntrlState_2, PY_cntrlState_3, PY_cntrlState_4	SMM
5.1.2.74.	GSS	Controller phase (0=idle, 1=CTM calibrate D/A, 2=CTM calibrate A/D, 3=CTM calibrate amps, 4=CTM calibrate bridge, 11=GTM init, 12=GTM prepare lift, 13=GTM lift, 14=GTM soft shutdown, 15=GTM hard shutdown, 21=SUM init, 22=SUM prepare lift, 23=SUM lift, 24=SUM soft shutdown, 25=SUM hard shutdown, 31=SMM init, 32=SMM prepare lift, 33=SMM lift, 34=SMM soft shutdown, 35=SMM hard shutdown) [7]	PY_cntrlPhase_1, PY_cntrlPhase_2, PY_cntrlPhase_3, PY_cntrlPhase_4	SMM lift
5.1.2.75.	GSS	Gyro status: 0=idle, 1=initializing controller, 2=preparing lift, 3=ready to lift, 4=lifting, 5=levitated, 6=position shutdown, 7=timer shutdown, 8=hard shutdown, 9=operator shutdown, 20=DFM ready, 21=DFM active, 22=DFM violated [7]	PY_gyroStat_1, PY_gyroStat_2, PY_gyroStat_3, PY_gyroStat_4	levitated
5.1.2.76.	GSS	Suspension Failed Flag (1=OK, 0=failure) [7]	PY_suspFail1, PY_suspFail2, PY_suspFail3, PY_suspFail4	OK
5.1.2.77.	GSS	Charge Measurement Enabled [7]	PY_ChgMtFltEn1, PY_ChgMtFltEn2, PY_ChgMtFltEn3, PY_ChgMtFltEn4	Enabled
5.1.2.78.	GSS	GyroCharge (Science Support-32 bit Float) [7]	SY_gyroCharge1, SY_gyroCharge2, SY_gyroCharge3, SY_gyroCharge4	**TBD**
5.1.2.79.	GSS	CM mode (1 = lo, 0 = hi) [7]	PY_chrgMode_1, PY_chrgMode_2,	Low

	Sub-sys	Description	Mnemonic	Value/ Range
			PY_chrgMode_3, PY_chrgMode_4	
5.1.2.80.	GSS	CM excitation rate [7]	SY_exctRate1, SY_exctRate2, SY_exctRate3, SY_exctRate4	**TBD**
5.1.2.81.	GSS	CM excitation amplitude[7]	SY_exctAmpl1, SY_exctAmpl2, SY_exctAmpl3, SY_exctAmpl4	**TBD**
5.1.2.82.	GSS	charge axis (0=uninitialized, 1=a, 2=b, 3=c) [7]	PY_chrgAxis_1, PY_chrgAxis_2, PY_chrgAxis_3, PY_chrgAxis_4	**TBD**
5.1.2.83.	GSS	Charge Control Enabled (1=enabled, 0=disabled) [7]	PY_gccNbl_1, PY_gccNbl_2, PY_gccNbl_3, PY_gccNbl_4	disabled
5.1.2.84.	SRE	All SQUIDs should be in range 3[7]	PQ_SQ_RangeCmd1, PQ_SQ_RangeCmd2, PQ_SQ_RangeCmd3, PQ_SQ_RangeCmd4	3
5.1.2.85.	SRE	All SQUIDs should be in gain 1[7]	PQ_SQ_PGainCmd1, PQ_SQ_PGainCmd2, PQ_SQ_PGainCmd3, PQ_SQ_PGainCmd4	1
5.1.2.86.	SRE	SQUID bracket temperature - SQUID bracket 1 Sensor 1 data for SRE-A[7]	SQ_Bkt1Sensor1A	
5.1.2.87.	SRE	SQUID bracket temperature - SQUID bracket 1 Sensor 2 data for SRE-B	SQ_Bkt1Sensor2B	
5.1.2.88.	SRE	SQUID bracket temperature - SQUID bracket 2 Sensor 1 data for SRE-B	SQ_Bkt2Sensor1B	
5.1.2.89.	SRE	SQUID bracket temperature - SQUID bracket 2 Sensor 2 data for SRE-A	SQ_Bkt2Sensor2A	
5.1.2.90.	SRE	SQUID bracket Sensor 1 temperature setpoint command for SRE-A	SQ_Bkt1Sr1SPCdA	
5.1.2.91.	SRE	SQUID bracket Sensor 2 temperature setpoint command for SRE-B	SQ_Bkt1Sr2SPCdB	
5.1.2.92.	SRE	SQUID bracket Sensor 1 temperature setpoint command for SRE-B	SQ_Bkt2Sr1SPCdB	
5.1.2.93.	SRE	SQUID bracket Sensor 2 temperature setpoint command for SRE-A	SQ_Bkt2Sr2SPCdA	
5.1.2.94.	SRE	SQUID bracket 1 sensor 1 Lo gain enable command for SRE-A	PQ_SB1_LGainCdA	
5.1.2.95.	SRE	SQUID bracket2 sensor1 Lo gain enable command for SRE-B	PQ_SB1_LGainCdB	

	Sub-sys	Description	Mnemonic	Value/ Range
5.1.2.96.	SRE	SQUID bracket2 sensor2 Lo gain enable command for SRE-A	PQ_SB2_LGainCdA	
5.1.2.97.	SRE	SQUID bracket1 sensor2 Lo gain enable command for SRE-B	PQ_SB2_LGainCdB	
5.1.2.98.	SRE	The FFT should be on. [7]	SQ_Status_1, SQ_Status_2, SQ_Status_3, SQ_Status_4	
5.1.2.99.	SRE	FFT Window[7]	PQ_FFT_Window_1, PQ_FFT_Window_2, PQ_FFT_Window_3, PQ_FFT_Window_4	
5.1.2.100	SRE	PQ_FFT_Mode[7]	PQ_FFT_Mode_1, PQ_FFT_Mode_2, PQ_FFT_Mode_3, PQ_FFT_Mode_4	
5.1.2.101	SRE	SRE CPU management - "Spin-Up" mode The initialization parameters should be set to default values.	N/A	
5.1.2.102	Power , SM	Power - State of Charge #1 test	PM_BttrySOCLmt1	
5.1.2.103	FSW	ATC Mode 2A	SF_VMS_EvtIndex	
5.1.2.104		Reserved		

5.1.2.105.Gyro State Conditions

<table>
<tr><td>0 Hz</td><td></td><td colspan="4">States of other gyros</td></tr>
<tr><td></td><td></td><td>2</td><td>3</td><td>4</td><td>1</td></tr>
<tr><td rowspan="4">SpinUp Gyro</td><td>2</td><td>N/A</td><td colspan="3" rowspan="3"></td></tr>
<tr><td>3</td><td rowspan="3">Caged</td><td>N/A</td></tr>
<tr><td>4</td><td>Gyro 3 will remain un-caged and suspended as it was at the end of its 0Hz spin-up process. A high voltage test will be performed on this gyro at this time. This test is not part of this document.</td><td>N/A</td><td rowspan="2">Caged</td></tr>
<tr><td>1</td><td colspan="2"></td><td>N/A</td></tr>
</table>

5.1.3. Abort Conditions (Critical conditions to track – no abort in 0 Hz Spin-Up)

	Sub-sys	Description	Mnemonic	Value/ Range
5.1.3.1.	Power ,SM	Power - State of Charge #1 test	PM_BttrySOCLmt1	
5.1.3.2.	ECU	pressure - Calibrated P9A pressure	SM_GMAPresP9A	
5.1.3.3.	ECU	pressure - Calibrated P9B	SM_GMAPresP9B	

	Sub-sys	Description	Mnemonic	Value/ Range
		pressure		
5.1.3.4.	GSS	Gyro Charge[7]	SY_cmData1, SY_cmData2, SY_cmData3, SY_cmData4	
5.1.3.5.	GSS	Gyro Charge[7]	SY_gyroCharge1, SY_gyroCharge2, SY_gyroCharge3 SY_gyroCharge4	
5.1.3.6.	GSS	Control Effort X[7]	SY_CtrEffortX_1, SY_CtrEffortX_2, SY_CtrEffortX_3, SY_CtrEffortX_4	
5.1.3.7.	GSS	Control Effort Y	SY_CtrEffortY_1, SY_CtrEffortY_2, SY_CtrEffortY_3, SY_CtrEffortY_4	
5.1.3.8.	GSS	Control Effort Z[7]	SY_CtrEffortZ_1, SY_CtrEffortZ_2, SY_CtrEffortZ_3, SY_CtrEffortZ_4	
5.1.3.9.	GSS	Gyro temperature - Gyroscope #1 GRT: T-01Q	TE_Gyro_1_GT01Q	
5.1.3.10.	GSS	Gyro temperature - Gyroscope #2 GRT: T-02Q	TE_Gyro_2_GT02Q	
5.1.3.11.	GSS	Gyro temperature - Gyroscope #3 GRT: T-03Q	TE_Gyro_3_GT03Q	
5.1.3.12.	GSS	Gyro temperature - Gyroscope #4 GRT: T-04Q	TE_Gyro_4_GT04Q	
5.1.3.13.		Lead Bag temp. - Station 200 dewar GRT/a: T-01D	TE_St2Dw_aGT01D	
5.1.3.14.		Final filter temperature sensors. - Final filter 1&2 GRT/a: T-06P	TE_Fi1_2_aGT06P	
5.1.3.15.		Final filter temperature sensors. Final filter 1&2 GRT/b: T-07P	TE_Fi1_2_bGT07P	
5.1.3.16.		Final filter temperature sensors.Final filter 3&4 GRT/a: T-08P	TE_Fi3_4_aGT08P	
5.1.3.17.		Final filter temperature sensors. Final filter 3&4 GRT/b: T-09P	TE_Fi3_4_bGT09P	
5.1.3.18.		Safemodes - GSS 1234 Aliveness 1Hz[7]	PM_DI1HGSS1A1V, PM_DI1HGSS2A1V, PM_DI1HGSS3A1V, PM_DI1HGSS4A1V	
5.1.3.19.		Safemodes - SRE Aliveness 1Hz	PM_DI1HSREA1v	
5.1.3.20.		Safemodes - ECU Aliveness 10Hz	PM_ECU_A1v10Hz	
5.1.3.21.		Safemodes - GSS 1234 Aliveness 10Hz[7]	PM_GSS1_A1v10Hz, PM_GSS2_A1v10Hz, PM_GSS3_A1v10Hz,	

	Sub-sys	Description	Mnemonic	Value/ Range
			PM_GSS4_A1v10Hz	
5.1.3.22.		Safemodes - SRE Aliveness 10Hz	PM_SRE_A1v10Hz	
5.1.3.23.		Safemodes - High Vacuum P9A Pressure	PM_SpinP9ATest	
5.1.3.24.		Safemodes - High Vacuum P9B Pressure	PM_SpinP9BTest	
5.1.3.25.		Safemodes - Science Telescope 1st Failure	PM_ST_1st_Fail	
5.1.3.26.		Safemodes - Dewar Porous Plug Breakthrough	PM_DewPPTmp_Brk	
5.1.3.27.		Safemodes - Dewar Porous Plug Choke	PM_DewPPTmp_Chk	
5.1.3.28.		Safemodes - QBS Temperature	PM_QBS_Temp	
5.1.3.29.	SRE	Spin frequency est bin number[7]	SQ_SpinFrqBin_1, SQ_SpinFrqBin_2, SQ_SpinFrqBin_3, SQ_SpinFrqBin_4	
5.1.3.30.	SRE	Delta spin frequency estimation[7]	SQ_DelSpinFrq_1, SQ_DelSpinFrq_2, SQ_DelSpinFrq_3, SQ_DelSpinFrq_4	
5.1.3.31.	GSS	Gyro position - Position, a-axis (sm filtered data) [7]	RY_pstna1, RY_pstna2, RY_pstna3, RY_pstna4	
5.1.3.32.	GSS	Gyro position - Position, b-axis (sm filtered data) [7]	RY_pstnb1, RY_pstnb2, RY_pstnb3, RY_pstnb4	
5.1.3.33.	GSS	Gyro position - Position, c-axis (sm filtered data) [7]	RY_pstnc1, RY_pstnc2, RY_pstnc3, RY_pstnc4	

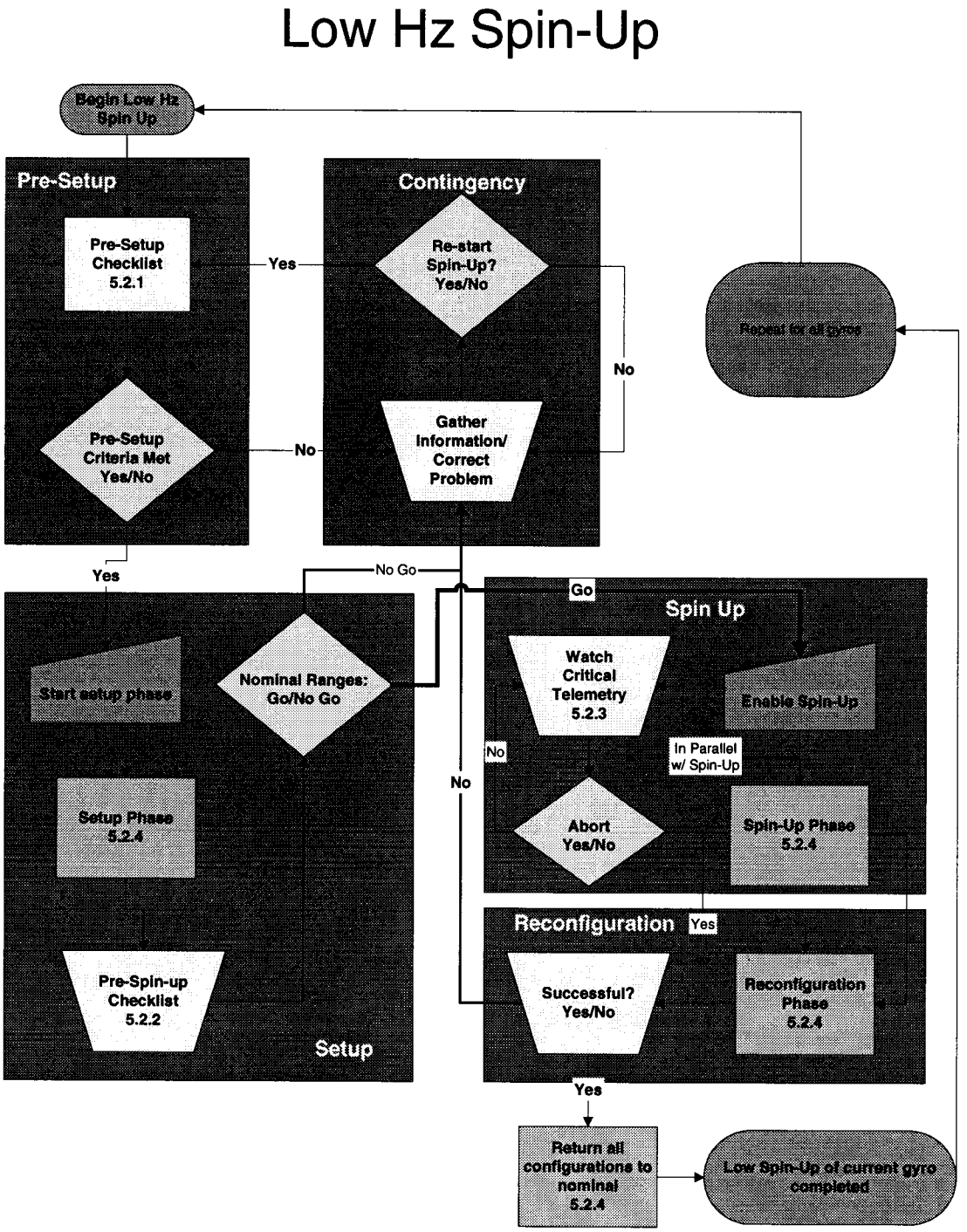
5.1.4. Gyro 2, 3, 4, 1 (In order) x = the current gyro (0 Hz)

Phase	Step	Description	Duration	Details
SETUP	5.1.4.1.	Switch to mode 2A		
	5.1.4.2.	Setup the ECU for spin-up	5m	• Enable all HLD's • Disable Vatt_Valve HLD's • Disable Vatt_Latr HLD's
	5.1.4.3.	SRE Setup	5m	• Turn_Off_Auto_Reset_x[8] • SREI00_Set_FLL_x_Gain_1 • SREI00_Set_FLL_x_Range_3 • Disable Cal Signal The state of the applications is defined by S0673, CPU Management
	5.1.4.4.	Disable 1st SOC safemode macro.[9]	5m	
	5.1.4.5.	**Setup** GMA for Spin-up gyro x as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Setup"
	5.1.4.6.	Real-time commanding	5m	
	5.1.4.7.	TDRSS for verification of configuration - 15 min of coverage	1h	N/A
SPIN UP	5.1.4.8.	Issue command to **enable** the timeline[10]	5m	
	5.1.4.9.	**Spin-up** gyro x as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Spin Up"
RECONFIG	5.1.4.10.	**Reconfigure** GMA as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.	5m	See S0633 – See the steps labeled "Reconfig"
	5.1.4.11.	Enable 1st SOC safemode macro.	5m	
	5.1.4.12.	Re-enable SRE Calibration signal		• Re-enable cal signal
	5.1.4.13.	ECU setup to nominal		• Enable Vatt_Valve HLD's • Enable Vatt_Latr HLD's
POST RECONFIG	5.1.4.14.	**Post-reconfigure** GMA sequene	10 m	See S0633 – See the steps labeled "Post-Reconfig"
	5.1.4.15.	Switch back from mode 2A to TBD		
	5.1.4.16.	Reserved		

[8] There is currently no plan to turn Auto Reset back on.
[9] This is done to avoid inadvertently interrupting spin up by calling SOC safemode macros during the spin up process.
[10] This is a run through of the process. The enable is here to maintain similarity with the High Hz process.

5.2. Low Hz Spin-Up

Low speed spin-up takes place over the course of two days for all 4 gyros. Leakage Valve LV1 is open at the beginning of the low Hz spin-up from previous tasks (i.e., low temperature bake-out and magnetic flux reduction).



5.2.1. The following items/constraints are in effect for the duration of spinning up all four gyros, and may need to be commanded independently from the process below. The mission planner will need to add separate timeline events or verify independently that these conditions are met.

5.2.1.1. Vatterfly valves

- EV1 – open
- EV2 – open
- EV3 – open
- EV4 – open
- LV1 – open
- LV2 – closed[11]

5.2.1.2. The current gyro shall be in spin-up mode for at least 8 hours and preferably over night before starting the setup phase. All four high power amplifiers shall be on.

5.2.1.3. Dewar HLD's shall be enabled

5.2.1.4. The GMA heaters shall have been turned on before starting the setup phase.

5.2.1.5. GSS - The analog system shall be on

5.2.1.6. GSS – All four in 660 Hz mode

5.2.1.7. SRE CPU Management in "Spin-Up" mode (FFT's are on)

5.2.1.8. Shutter shall be open for the duration of the slow speed spin-up

5.2.1.9. Final filter heaters in closed loop mode

5.2.2. Pre-Spin-Up Phase Telemetry Check

	Sub-sys	Description	Mnemonic	Value/ Range
5.2.2.1.	ECU	Final filter heaters	Open Loop[5]	
5.2.2.2.	ECU	Final filter temperature - Final filter 1&2 GRT/a: T-06P	TE_Fi1_2_aGT06P	
5.2.2.3.	ECU	Final filter temperature - Final filter 1&2 GRT/b: T-07P	TE_Fi1_2_bGT07P	
5.2.2.4.	ECU	Final filter temperature - Final filter 3&4 GRT/a: T-08P	TE_Fi3_4_aGT08P	
5.2.2.5.	ECU	Final filter temperature - Final filter 3&4 GRT/b: T-09P	TE_Fi3_4_bGT09P	
5.2.2.6.	ECU	Gyro temperature -Gyroscope #1 GRT: T-01Q	TE_Gyro_1_GT01Q	
5.2.2.7.	ECU	Gyro temperature -Gyroscope #2 GRT: T-02Q	TE_Gyro_2_GT02Q	
5.2.2.8.	ECU	Gyro temperature -Gyroscope #3 GRT: T-03Q	TE_Gyro_3_GT03Q	
5.2.2.9.	ECU	Gyro temperature -Gyroscope #4 GRT: T-04Q	TE_Gyro_4_GT04Q	
5.2.2.10.	ECU	Vatterfly valve states	See previous section	

[11] Leakage Valves represent a single point of failure. LV2 is left not operated to minimize the risk.

	Sub-sys	Description	Mnemonic	Value/ Range
5.2.2.11.	ECU	Pressure[6] - Calibrated P9A pressure	DE_VACG_P9A_PWR DE_VACG_P9A_RNG DE_VACG_P9A_SIG SM_GMAPresP9A	
5.2.2.12.	ECU	Pressure[6] - Calibrated P9B pressure	DE_VACG_P9B_PWR DE_VACG_P9B_RNG DE_VACG_P9B_SIG SM_GMAPresP9B	
5.2.2.13.	GMA	GMA pressure[6] - Calibrated SP5 GMA pressure	SM_GMAPresSP5	
5.2.2.14.	GMA	GMA pressure[6] - Calibrated SP6 GMA pressure	SM_GMAPresSP6	
5.2.2.15.	GMA	GMA pressure[6] - Calibrated SP7 GMA pressure	SM_GMAPresSP7	
5.2.2.16.	GMA	GMA pressure[6] - Calibrated SP8 GMA pressure	SM_GMAPresSP8	
5.2.2.17.	GMA	GMA pressure[6] – GP4	DE_GMA_____CP1	0-24 psia
5.2.2.18.	GMA	GMA pressure[6] – GP3	DE_GMA_____CP2	100-2000 psia
5.2.2.19.	GMA	GMA pressure[6] – GP13	DE_GMA_____CP3	0-5 psia
5.2.2.20.	GMA	GMA pressure[6] – GP5	DE_GMA_____CP4	0-24 psia
5.2.2.21.	GMA	GMA pressure[6] - GMA Tank pressure: SP1 – GP2	DE_GMA_____SP1	100-2000 psia
5.2.2.22.	GMA	GMA pressure[6] – GMA Pressure 1st reg: SP2 – GP8	DE_GMA_____SP2	0-5 psia
5.2.2.23.	GMA	GMA pressure[6] – GP10	DE_GMA_____SP3A	0-5 psia
5.2.2.24.	GMA	GMA pressure[6] – GP14	DE_GMA_____SP3B	0-5 psia
5.2.2.25.	GMA	GMA pressure[6] – GMA Metering Valve: SP4 – GP1	DE_GMA_____SP4	100-2000 psia
5.2.2.26.	GMA	GMA pressure[6] – GMA Input to gyro 1: SP5 – GP7	DE_GMA_____SP5	0-5 psia
5.2.2.27.	GMA	GMA pressure[6] – GMA Input to gyro 2: SP6 – GP9	DE_GMA_____SP6	0-5 psia
5.2.2.28.	GMA	GMA pressure[6] – GMA Input to gyro 3: SP7 – GP11	DE_GMA_____SP7	0-5 psia
5.2.2.29.	GMA	GMA pressure[6] – GMA Input to gyro 4: SP8 – GP12	DE_GMA_____SP8	0-5 psia
5.2.2.30.	GMA	GMA pressure[6] – GMA vent pressure: SP9 – GP6	DE_GMA_____SP9	0-5 psia
5.2.2.31.	GMA	GMA Temp. - GMA #1A SDT/a	TE_GMA_SDT_1A	
5.2.2.32.	GMA	GMA Temp. - GMA #1B SDT/b	TE_GMA_SDT_1B	
5.2.2.33.	GMA	GMA Temp. - GMA #2A SDT/a	TE_GMA_SDT_2A	
5.2.2.34.	GMA	GMA Temp. - GMA #2B SDT/b	TE_GMA_SDT_2B	
5.2.2.35.	GMA	GMA Temp. - GMA #3A SDT/a	TE_GMA_SDT_3A	
5.2.2.36.	GMA	GMA Temp. - GMA #3B SDT/b	TE_GMA_SDT_3B	
5.2.2.37.	GSS	ARBITER_STATE (0= PON STATE, 1= PRIME,2=SBT ,3=SB1 ,4=SB2 , 5=HBT, 6=HB1, 7=HB2, 8=LB1, 9=LB2 ,10-15 are spare:)[7]	PY_ARB_STATE_1, PY_ARB_STATE_2, PY_ARB_STATE_3, PY_ARB_STATE_4	1=PRIME
5.2.2.38.	GSS	Snapshots enabled[7]	PY_snapNbl1, PY_snapNbl2, PY_snapNbl3, PY_snapNbl4	

	Sub-sys	Description	Mnemonic	Value/ Range
5.2.2.39.	GSS	Snapshot Mode[7] Threshold snapshots	PY_ssSelctGss1, PY_ssSelctGss2, PY_ssSelctGss3, PY_ssSelctGss4	
5.2.2.40.	GSS	Control Effort X[7]	SY_CtrEffortX_1, SY_CtrEffortX_2, SY_CtrEffortX_3, SY_CtrEffortX_4	
5.2.2.41.	GSS	Control Effort Y[7]	SY_CtrEffortY_1, SY_CtrEffortY_2, SY_CtrEffortY_3, SY_CtrEffortY_4	
5.2.2.42.	GSS	Control Effort Z[7]	SY_CtrEffortZ_1, SY_CtrEffortZ_2, SY_CtrEffortZ_3, SY_CtrEffortZ_4	
5.2.2.43.	GSS	Electrode voltages[7] X1	SY_cmdGyVltX1_1, SY_cmdGyVltX1_2, SY_cmdGyVltX1_3, SY_cmdGyVltX1_4	
5.2.2.44.	GSS	Electrode voltages[7] X2	SY_cmdGyVltX2_1, SY_cmdGyVltX2_2, SY_cmdGyVltX2_3, SY_cmdGyVltX2_4	
5.2.2.45.	GSS	Electrode voltages[7] Y1	SY_cmdGyVltY1_1, SY_cmdGyVltY1_2, SY_cmdGyVltY1_3, SY_cmdGyVltY1_4	
5.2.2.46.	GSS	Electrode voltages[7] Y2	SY_cmdGyVltY2_1, SY_cmdGyVltY2_2, SY_cmdGyVltY2_3, SY_cmdGyVltY2_4	
5.2.2.47.	GSS	Electrode voltages[7] Z1	SY_cmdGyVltZ1_1, SY_cmdGyVltZ1_2, SY_cmdGyVltZ1_3, SY_cmdGyVltZ1_4	
5.2.2.48.	GSS	Electrode voltages[7] Z2	SY_cmdGyVltZ2_1, SY_cmdGyVltZ2_2, SY_cmdGyVltZ2_3, SY_cmdGyVltZ2_4	
5.2.2.49.	GSS	Position, a-axis (sm filtered data) [7]	RY_pstna1, RY_pstna2, RY_pstna3, RY_pstna4	
5.2.2.50.	GSS	Position, b-axis (sm filtered data) [7]	RY_pstnb1, RY_pstnb2, RY_pstnb3, RY_pstnb4	
5.2.2.51.	GSS	Position, c-axis (sm filtered data) [7]	RY_pstnc1, RY_pstnc2, RY_pstnc3, RY_pstnc4	
5.2.2.52.	GSS	Communications to Host - 1 Hz Sync Fail Flag[7]	PY_1HzSncFail1, PY_1HzSncFail2, PY_1HzSncFail3, PY_1HzSncFail4	Ok
5.2.2.53.	GSS	Communications to Host - 10 Hz Sync Fail Flag[7]	PY_10HzSncFail1, PY_10HzSncFail2, PY_10HzSncFail3, PY_10HzSncFail4	Ok
5.2.2.54.	GSS	Communications to SRE Timing Chain	PY_16FO_A_On_1, PY_16FO_A_On_2,	SRE A Present

	Sub-sys	Description	Mnemonic	Value/ Range
		16FO_A_ACTIVE (0 = SRE 16f0 A absent, 1 = SRE 16f0 A present) OR 16FO_B_ACTIVE (0 = SRE 16f0 B absent, 1 = SRE 16f0 B present) [7]	PY_16FO_A_On_3, PY_16FO_A_On_4 OR PY_16FO_B_On_1, PY_16FO_B_On_2, PY_16FO_B_On_3, PY_16FO_B_On_4	OR SRE B Present
5.2.2.55.	GSS	Aft GSS Hardware Status - Aft Green Board Bits (0=red, 1=green) [7]	SY_GrnBrd1_1, SY_GrnBrd1_2, SY_GrnBrd1_3, SY_GrnBrd1_4	-1 (0xFFFF)
5.2.2.56.	GSS	Fwd GSS Hardware Status - Fwd Green Board Bits (0=red, 1=green) [7]	SY_GrnBrd2_1, SY_GrnBrd2_2, SY_GrnBrd2_3, SY_GrnBrd2_N	-1 (0xFFFF)
5.2.2.57.	GSS	Control Rate (0=10Hz, 1=n/a, 2=660Hz, 3=220Hz, 4=alternate 10 Hz , 5=1553 only) [7]	PY_cntrlRate_1, PY_cntrlRate_2, PY_cntrlRate_3, PY_cntrlRate_4	220Hz
5.2.2.58.	GSS	Interrupt Timeout Flag Summary[7]	SY_intTmoFlgs_1, SY_intTmoFlgs_2, SY_intTmoFlgs_3, SY_intTmoFlgs_4	OK
5.2.2.59.	GSS	Payload Processor Error Flag (1=OK, 0=failure) [7]	PY_gssppFail1, PY_gssppFail2, PY_gssppFail3, PY_gssppFail4	OK
5.2.2.60.	GSS	GSW Failure Flag (1=OK, 0=failure) [7]	PY_gswFail1, PY_gswFail2, PY_gswFail3, PY_gswFail4	OK
5.2.2.61.	GSS	Gyro Commands Enabled Flag (0 = disabled, 1 = enabled) [7]	PY_gyrCmdEbl_1, PY_gyrCmdEbl_2, PY_gyrCmdEbl_3, PY_gyrCmdEbl_4	Enabled
5.2.2.62.	GSS	Gyro Commands Enabled Flag (0 = disabled, 1 = enabled) [7]	PY_gyrCmdEbl_1, PY_gyrCmdEbl_2, PY_gyrCmdEbl_3, PY_gyrCmdEbl_4	Enabled
5.2.2.63.	GSS	I/O Mode (0=normal, 1=sine, 2=manual out, 3=constant) [7]	PY_ioState_1, PY_ioState_2, PY_ioState_3, PY_ioState_4	Normal
5.2.2.64.	GSS	ATC position filter enabled (1=enabled, 0=disabled) [7]	PY_ATCpsFlNbl1, PY_ATCpsFlNbl2, PY_ATCpsFlNbl3, PY_ATCpsFlNbl4	Enabled
5.2.2.65.	GSS	Electrode Voltage Square Sum Filter Enabled (1=enabled, 0=disabled) [7]	PY_eVVfltNbl1, PY_eVVfltNbl2, PY_eVVfltNbl3, PY_eVVfltNbl4	Enabled
5.2.2.66.	GSS	Electrode Mean Voltage Filter Enabled (1=enabled, 0=disabled) [7]	PY_eMVfltNbl1, PY_eMVfltNbl2, PY_eMVfltNbl3, PY_eMVfltNbl4	Enabled
5.2.2.67.	GSS	Position Signal Filter Enabled (1=enabled, 0=disabled) [7]	PY_posFltNbl1, PY_posFltNbl2,	Enabled

	Sub-sys	Description	Mnemonic	Value/ Range
			PY_posFltNbl3, PY_posFltNbl4	
5.2.2.68.	GSS	Control Effort Filter Enabled (1=enabled, 0=disabled) [7]	PY_ceFltNbl1, PY_ceFltNbl2, PY_ceFltNbl3, PY_ceFltNbl4	Enabled
5.2.2.69.	GSS	Bridge Oscillator Amplitude (0 = High Oscillator level, 1 = Low Oscillator level) [7]	PY_oscSwitch1, PY_oscSwitch2, PY_oscSwitch3, PY_oscSwitch4	LOW
5.2.2.70.	GSS	Charge Bias Flag (0 = 0V, 1 = +3V, 2 = -3V) [7]	PY_UV_bias1, PY_UV_bias2, PY_UV_bias3, PY_UV_bias4	0V
5.2.2.71.	GSS	BU Spin Up Radius Select (0 = center, 1 = radial position 1, 3 = radial position 2, 7 = radial position 3) [7]	PY_SU_R_Cmd_1, PY_SU_R_Cmd_2, PY_SU_R_Cmd_3, PY_SU_R_Cmd_4	TBD (On-orbit)
5.2.2.72.	GSS	FSU Mission Mode (0 = power on, 1 = Science Mission, 2 = Spin Up, 3 = Ground Test) [7]	PY_missionMode1, PY_missionMode2, PY_missionMode3, PY_missionMode4	SMM
5.2.2.73.	GSS	Controller Mode (0=idle by default, 1=CTM, 2=GTM, 3=SUM, 4=SMM) [7]	PY_cntrlState_1, PY_cntrlState_2, PY_cntrlState_3, PY_cntrlState_4	SMM
5.2.2.74.	GSS	Controller phase (0=idle, 1=CTM calibrate D/A, 2=CTM calibrate A/D, 3=CTM calibrate amps, 4=CTM calibrate bridge, 11=GTM init, 12=GTM prepare lift, 13=GTM lift, 14=GTM soft shutdown, 15=GTM hard shutdown, 21=SUM init, 22=SUM prepare lift, 23=SUM lift, 24=SUM soft shutdown, 25=SUM hard shutdown, 31=SMM init, 32=SMM prepare lift, 33=SMM lift, 34=SMM soft shutdown, 35=SMM hard shutdown) [7]	PY_cntrlPhase_1, PY_cntrlPhase_2, PY_cntrlPhase_3, PY_cntrlPhase_4	SMM lift
5.2.2.75.	GSS	Gyro status: 0=idle, 1=initializing controller, 2=preparing lift, 3=ready to lift, 4=lifting, 5=levitated, 6=position shutdown, 7=timer shutdown, 8=hard shutdown, 9=operator shutdown, 20=DFM ready, 21=DFM active, 22=DFM violated [7]	PY_gyroStat_1, PY_gyroStat_2, PY_gyroStat_3, PY_gyroStat_4	levitated
5.2.2.76.	GSS	Suspension Failed Flag (1=OK, 0=failure) [7]	PY_suspFail1, PY_suspFail2, PY_suspFail3, PY_suspFail4	OK
5.2.2.77.	GSS	Charge Measurement Enabled [7]	PY_ChgMtFltEn1, PY_ChgMtFltEn2, PY_ChgMtFltEn3, PY_ChgMtFltEn4	Enabled
5.2.2.78.	GSS	GyroCharge (Science Support-32 bit Float) [7]	SY_gyroCharge1, SY_gyroCharge2, SY_gyroCharge3,	

	Sub-sys	Description	Mnemonic	Value/ Range
			SY_gyroCharge4	
5.2.2.79.	GSS	CM mode (1 = lo, 0 = hi) [7]	PY_chrgMode_1, PY_chrgMode_2, PY_chrgMode_3, PY_chrgMode_4	Low
5.2.2.80.	GSS	CM excitation rate [7]	SY_exctRate1, SY_exctRate2, SY_exctRate3, SY_exctRate4	
5.2.2.81.	GSS	CM excitation amplitude[7]	SY_exctAmpl1, SY_exctAmpl2, SY_exctAmpl3, SY_exctAmpl4	
5.2.2.82.	GSS	charge axis (0=uninitialized, 1=a, 2=b, 3=c) [7]	PY_chrgAxis_1, PY_chrgAxis_2, PY_chrgAxis_3, PY_chrgAxis_4	
5.2.2.83.	GSS	Charge Control Enabled (1=enabled, 0=disabled) [7]	PY_gccNbl_1, PY_gccNbl_2, PY_gccNbl_3, PY_gccNbl_4	disabled
5.2.2.84.	SRE	All SQUIDs should be in range 3[7]	PQ_SQ_RangeCmd1, PQ_SQ_RangeCmd2, PQ_SQ_RangeCmd3, PQ_SQ_RangeCmd4	3
5.2.2.85.	SRE	All SQUIDs should be in gain 1[7]	PQ_SQ_PGainCmd1, PQ_SQ_PGainCmd2, PQ_SQ_PGainCmd3, PQ_SQ_PGainCmd4	1
5.2.2.86.	SRE	SQUID bracket temperature - SQUID bracket 1 Sensor 1 data for SRE-A	SQ_Bkt1Sensor1A	
5.2.2.87.	SRE	SQUID bracket temperature - SQUID bracket 1 Sensor 2 data for SRE-B	SQ_Bkt1Sensor2B	
5.2.2.88.	SRE	SQUID bracket temperature - SQUID bracket 2 Sensor 1 data for SRE-B	SQ_Bkt2Sensor1B	
5.2.2.89.	SRE	SQUID bracket temperature - SQUID bracket 2 Sensor 2 data for SRE-A	SQ_Bkt2Sensor2A	
5.2.2.90.	SRE	SQUID bracket Sensor 1 temperature setpoint command for SRE-A	SQ_Bkt1Sr1SPCdA	
5.2.2.91.	SRE	SQUID bracket Sensor 2 temperature setpoint command for SRE-B	SQ_Bkt1Sr2SPCdB	
5.2.2.92.	SRE	SQUID bracket Sensor 1 temperature setpoint command for SRE-B	SQ_Bkt2Sr1SPCdB	
5.2.2.93.	SRE	SQUID bracket Sensor 2 temperature setpoint command for SRE-A	SQ_Bkt2Sr2SPCdA	
5.2.2.94.	SRE	SQUID bracket 1 sensor 1 Lo gain enable command for SRE-A	PQ_SB1_LGainCdA	

	Sub-sys	Description	Mnemonic	Value/ Range
5.2.2.95.	SRE	SQUID bracket2 sensor1 Lo gain enable command for SRE-B	PQ_SB1_LGainCdB	
5.2.2.96.	SRE	SQUID bracket2 sensor2 Lo gain enable command for SRE-A	PQ_SB2_LGainCdA	
5.2.2.97.	SRE	SQUID bracket1 sensor2 Lo gain enable command for SRE-B	PQ_SB2_LGainCdB	
5.2.2.98.	SRE	The FFT should be on. /	SQ_Status_1, SQ_Status_2, SQ_Status_3, SQ_Status_4	
5.2.2.99.	SRE	FFT Window/	PQ_FFT_Window_1, PQ_FFT_Window_2, PQ_FFT_Window_3, PQ_FFT_Window_4	
5.2.2.100	SRE	PQ_FFT_Mode/	PQ_FFT_Mode_1, PQ_FFT_Mode_2, PQ_FFT_Mode_3, PQ_FFT_Mode_4	
5.2.2.101	SRE	SRE CPU management - "Spin-Up" mode – The initialization parameters should be set to default values.	N/A	
5.2.2.102	Power, SM	Power - State of Charge #1 test	PM_BttrySOCLmt1	
5.2.2.103	FSW	ATC Mode 2A	SF_VMS_EvtIndex	
5.2.2.104		Reserved		

5.2.2.105.Gyro State Conditions

Low Hz		States of other gyros			
		4	3	1	2
SpinUp Gyro	4	*N/A*			
	3	• Spinning – Low Hz • GSS – charge measurement on • Charge management is off • Gyro shall be centered • High Voltage Amplifiers on for all gyros	*N/A*		The Gyros will be left in the same state the were in immediately after their respective spin-ups.
	1			*N/A*	
	2				*N/A*

5.2.3. Abort Conditions

	Sub-sys	Description	Mnemonic	Value/ Range
5.2.3.1.	Power ,SM	Power - State of Charge #1 test	PM_BttrySOCLmt1	
5.2.3.2.	ECU	pressure - Calibrated P9A pressure	SM_GMAPresP9A	
5.2.3.3.	ECU	pressure - Calibrated P9B pressure	SM_GMAPresP9B	
5.2.3.4.	GSS	Gyro Charge[7]	SY_cmData1, SY_cmData2, SY_cmData3, SY_cmData4	
5.2.3.5.	GSS	Gyro Charge[7]	SY_gyroCharge1, SY_gyroCharge2, SY_gyroCharge3 SY_gyroCharge4	
5.2.3.6.	GSS	Control Effort X[7]	SY_CtrEffortX_1, SY_CtrEffortX_2, SY_CtrEffortX_3, SY_CtrEffortX_4	
5.2.3.7.	GSS	Control Effort Y	SY_CtrEffortY_1, SY_CtrEffortY_2, SY_CtrEffortY_3, SY_CtrEffortY_4	
5.2.3.8.	GSS	Control Effort Z[7]	SY_CtrEffortZ_1, SY_CtrEffortZ_2, SY_CtrEffortZ_3, SY_CtrEffortZ_4	
5.2.3.9.	GSS	Gyro temperature - Gyroscope #1 GRT: T-01Q	TE_Gyro_1_GT01Q	
5.2.3.10.	GSS	Gyro temperature - Gyroscope #2 GRT: T-02Q	TE_Gyro_2_GT02Q	
5.2.3.11.	GSS	Gyro temperature - Gyroscope #3 GRT: T-03Q	TE_Gyro_3_GT03Q	
5.2.3.12.	GSS	Gyro temperature - Gyroscope #4 GRT: T-04Q	TE_Gyro_4_GT04Q	
5.2.3.13.		Lead Bag temp. - Station 200 dewar GRT/a: T-01D	TE_St2Dw_aGT01D	
5.2.3.14.		Final filter temperature sensors. - Final filter 1&2 GRT/a: T-06P	TE_Fi1_2_aGT06P	
5.2.3.15.		Final filter temperature sensors. Final filter 1&2 GRT/b: T-07P	TE_Fi1_2_bGT07P	
5.2.3.16.		Final filter temperature sensors. Final filter 3&4 GRT/a: T-08P	TE_Fi3_4_aGT08P	
5.2.3.17.		Final filter temperature sensors. Final filter 3&4 GRT/b: T-09P	TE_Fi3_4_bGT09P	
5.2.3.18.		Safemodes - GSS 1234 Aliveness 1Hz[7]	PM_DI1HGSS1A1V, PM_DI1HGSS2A1V, PM_DI1HGSS3A1V, PM_DI1HGSS4A1V	
5.2.3.19.		Safemodes - SRE Aliveness 1Hz	PM_DI1HSREA1v	

	Sub-sys	Description	Mnemonic	Value/ Range
5.2.3.20.		Safemodes - ECU Aliveness 10Hz	PM_ECU_A1v10Hz	
5.2.3.21.		Safemodes - GSS 1234 Aliveness 10Hz[7]	PM_GSS1_A1v10Hz, PM_GSS2_A1v10Hz, PM_GSS3_A1v10Hz, PM_GSS4_A1v10Hz	
5.2.3.22.		Safemodes - SRE Aliveness 10Hz	PM_SRE_A1v10Hz	
5.2.3.23.		Safemodes - High Vacuum P9A Pressure	PM_SpinATest	
5.2.3.24.		Safemodes - High Vacuum P9B Pressure	PM_SpinP9BTest	
5.2.3.25.		Safemodes - Science Telescope 1st Failure	PM_ST_1st_Fail	
5.2.3.26.		Safemodes - Dewar Porous Plug Breakthrough	PM_DewPPTmp_Brk	
5.2.3.27.		Safemodes - Dewar Porous Plug Choke	PM_DewPPTmp_Chk	
5.2.3.28.		Safemodes - QBS Temperature	PM_QBS_Temp	
5.2.3.29.	SRE	Spin frequency est bin number[7]	SQ_SpinFrqBin_1, SQ_SpinFrqBin_2, SQ_SpinFrqBin_3, SQ_SpinFrqBin_4	
5.2.3.30.	SRE	Delta spin frequency estimation[7]	SQ_DelSpinFrq_1, SQ_DelSpinFrq_2, SQ_DelSpinFrq_3, SQ_DelSpinFrq_4	
5.2.3.31.	GSS	Gyro position - Position, a-axis (sm filtered data) [7]	RY_pstna1, RY_pstna2, RY_pstna3, RY_pstna4	
5.2.3.32.	GSS	Gyro position - Position, b-axis (sm filtered data) [7]	RY_pstnb1, RY_pstnb2, RY_pstnb3, RY_pstnb4	
5.2.3.33.	GSS	Gyro position - Position, c-axis (sm filtered data) [7]	RY_pstnc1, RY_pstnc2, RY_pstnc3, RY_pstnc4	

5.2.4. Gyro 4, 3, 1, 2 (In order) x = the current gyro (Low Hz)

Phase	Step	Description	Duration	Details
SETUP	5.2.4.1.	Switch to 32K Spin-Up format	5m	
	5.2.4.2.	Switch to default ECU Sample Table	5m	
	5.2.4.3.	Setup ATC for spin-up	5m	Switch to mode 2A
	5.2.4.4.	Setup the ECU for spin-up	5m	• Enable all HLD's • Disable Vatt_Valve HLD's • Disable Vatt_Latr HLD's
	5.2.4.5.	GSS Pre-spin-up Check	5m	
	5.2.4.6.	SRE Setup	5m	• Set_FLL_x_Gain_1 • Set_FLL_x_Range_2 • Disable Calibration Signal The state of the applications is defined by S0673, CPU Management
	5.2.4.7.	Enable GSS Snapshots on the spin-up gyro only	5m	
	5.2.4.8.	Disable 1st SOC safemode macro.	5m	
	5.2.4.9.	**Setup** GMA for Spin-up gyro x as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Setup"
	5.2.4.10.	Real-time commanding	5m	
	5.2.4.11.	TDRSS for verification of configuration - 1h of coverage	2h	N/A
SPIN UP	5.2.4.12.	Issue command to **enable** the timeline	5m	
	5.2.4.13.	**Spin-up** gyro x as described in Science Document S0633, Science Gyro Spin Up, GMA Valve Sequences.	~15m	See S0633 – See the steps labeled "Spin Up"
RECONFIG	5.2.4.14.	**Reconfigure** GMA as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Reconfig"

POST RECONFIG	5.2.4.15.	Wait 10 min.	10 min.	
	5.2.4.16.	Enable 1st SOC safemode macro	5m	
	5.2.4.17.	Re-enable SRE Calibration signal		Enable Calibration Signal
	5.2.4.18.	ECU setup to nominal		• Enable Vatt_Valve HLD's • Enable Vatt_Latr HLD's
	5.2.4.19.	Re-center gyro	5m	
	5.2.4.20.	**Post-reconfigure** GMA sequene	30 min.	See S0633 – See the steps labeled "Post-Reconfig"
	5.2.4.21.	Switch to default format	5m	
	5.2.4.22.	Return ATC to nominal state	5m	Mode 1A

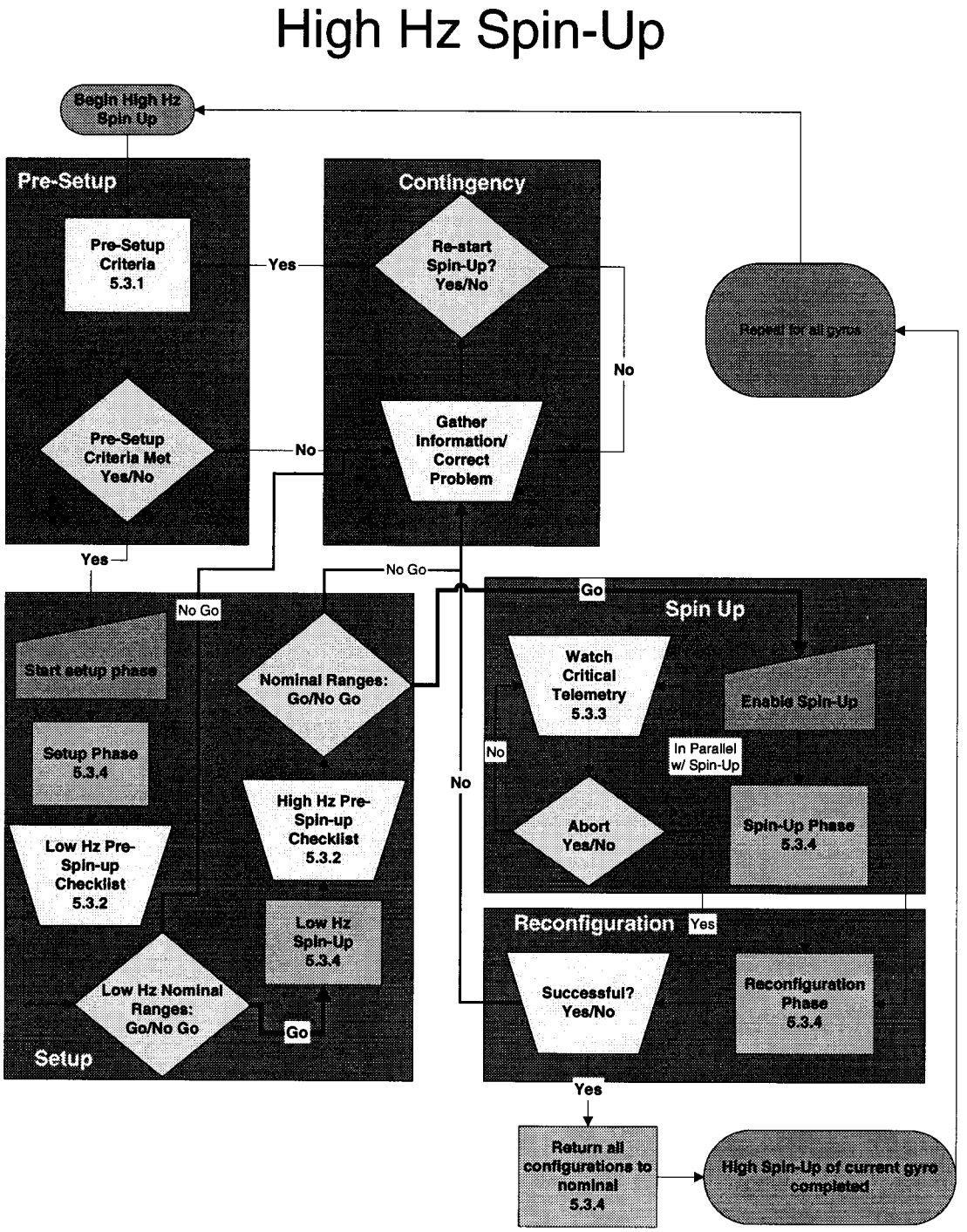
5.2.5. GMA Evacuation (only after the last gyro spin-up)

Step	Description	Duration	Details
5.2.5.1.	GMA Evacuation	10m	See S0633

5.2.6. Exit state

5.2.6.1. Leakage Valve Open (LV)
5.2.6.2. All four exhaust valves open (EV1, EV2, EV3, EV4)
5.2.6.3. ATC Mode 1A
5.2.6.4. Gyros centered, levitated, and spinning
5.2.6.5. SRE Calibration signal disabled
5.2.6.6. SRE FFTs on
5.2.6.7. SRE set to range 1 and gain 2
5.2.6.8. GSS in digital spin-up mode 4 (See section 4.5)

5.3. High Hz Spin-Up



5.3.1. The following items/constraints are in effect for the duration of spinning up all four gyros, and may need to be commanded independently from the process below. The mission planner will need to add separate timeline events or verify independently that these conditions are met.

5.3.1.1. Vatterfly valves

- EV1 – open
- EV2 – open
- EV3 – open
- EV4 – open
- LV1 – open
- LV2 – closed[11]

5.3.1.2. The current gyro shall be in spin-up mode for at least 8 hours and preferably over night before starting the setup. All four high power amplifiers shall be on.

5.3.1.3. Dewar HLD's should be enabled

5.3.1.4. The GMA heaters should have been turned on before spin up

5.3.1.5. GSS – All four in 660Hz mode

5.3.1.6. GSS – The analog system shall be on

5.3.1.7. SRE CPU Management "Spin-Up" mode (FFT's are on)

5.3.1.8. Shutter shall be open for the duration of the high speed spin-up

5.3.2. Pre-Spin-Up Phase Telemetry Check

	Sub-sys	Description	Mnemonic	Value/ Range
5.3.2.1.	ECU	Final filter heaters	Open Loop[5]	
5.3.2.2.	ECU	Final filter temperature - Final filter 1&2 GRT/a: T-06P	TE_Fi1_2_aGT06P	
5.3.2.3.	ECU	Final filter temperature - Final filter 1&2 GRT/b: T-07P	TE_Fi1_2_bGT07P	
5.3.2.4.	ECU	Final filter temperature - Final filter 3&4 GRT/a: T-08P	TE_Fi3_4_aGT08P	
5.3.2.5.	ECU	Final filter temperature - Final filter 3&4 GRT/b: T-09P	TE_Fi3_4_bGT09P	
5.3.2.6.	ECU	Gyro temperature -Gyroscope #1 GRT: T-01Q	TE_Gyro_1_GT01Q	
5.3.2.7.	ECU	Gyro temperature -Gyroscope #2 GRT: T-02Q	TE_Gyro_2_GT02Q	
5.3.2.8.	ECU	Gyro temperature -Gyroscope #3 GRT: T-03Q	TE_Gyro_3_GT03Q	
5.3.2.9.	ECU	Gyro temperature -Gyroscope #4 GRT: T-04Q	TE_Gyro_4_GT04Q	
5.3.2.10.	ECU	Vatterfly valve states	See previous section	
5.3.2.11.	ECU	pressure[6] - Calibrated P9A pressure	DE_VACG_P9A_PWR DE_VACG_P9A_RNG DE_VACG_P9A_SIG SM_GMAPresP9A	
5.3.2.12.	ECU	pressure[6] - Calibrated P9B	DE_VACG_P9B_PWR	

	Sub-sys	Description	Mnemonic	Value/ Range
		pressure	DE_VACG_P9B_RNG DE_VACG_P9B_SIG SM_GMAPresP9B	
5.3.2.13.	GMA	GMA pressure[6] - Calibrated SP5 GMA pressure	SM_GMAPresSP5	
5.3.2.14.	GMA	GMA pressure[6] - Calibrated SP6 GMA pressure	SM_GMAPresSP	
5.3.2.15.	GMA	GMA pressure[6] - Calibrated SP7 GMA pressure	SM_GMAPresSP7	
5.3.2.16.	GMA	GMA pressure[6] - Calibrated SP8 GMA pressure	SM_GMAPresSP8	
5.3.2.17.	GMA	GMA pressure[6] – GP4	DE_GMA_____CP1	0-24 psia
5.3.2.18.	GMA	GMA pressure[6] – GP3	DE_GMA_____CP2	100-2000 psia
5.3.2.19.	GMA	GMA pressure[6] – GP13	DE_GMA_____CP3	0-5 psia
5.3.2.20.	GMA	GMA pressure[6] – GP5	DE_GMA_____CP4	0-24 psia
5.3.2.21.	GMA	GMA pressure[12] - GMA Tank pressure: SP1 – GP2	DE_GMA_____SP1	100-2000 psia
5.3.2.22.	GMA	GMA pressure[6] – GMA Pressure 1st reg: SP2 – GP8	DE_GMA_____SP2	0-5 psia
5.3.2.23.	GMA	GMA pressure[6] – GP10	DE_GMA_____SP3A	0-5 psia
5.3.2.24.	GMA	GMA pressure[6] – GP14	DE_GMA_____SP3B	0-5 psia
5.3.2.25.	GMA	GMA pressure[6] – GMA Metering Valve: SP4 – GP1	DE_GMA_____SP4	100-2000 psia
5.3.2.26.	GMA	GMA pressure[6] – GMA Input to gyro 1: SP5 – GP7	DE_GMA_____SP5	0-5 psia
5.3.2.27.	GMA	GMA pressure[6] – GMA Input to gyro 2: SP6 – GP9	DE_GMA_____SP6	0-5 psia
5.3.2.28.	GMA	GMA pressure[6] – GMA Input to gyro 3: SP7 – GP11	DE_GMA_____SP7	0-5 psia
5.3.2.29.	GMA	GMA pressure[6] – GMA Input to gyro 4: SP8 – GP12	DE_GMA_____SP8	0-5 psia
5.3.2.30.	GMA	GMA pressure[6] – GMA vent pressure: SP9 – GP6	DE_GMA_____SP9	0-5 psia
5.3.2.31.	GMA	GMA Temp. - GMA #1A SDT/a	TE_GMA_SDT_1A	
5.3.2.32.	GMA	GMA Temp. - GMA #1B SDT/b	TE_GMA_SDT_1B	
5.3.2.33.	GMA	GMA Temp. - GMA #2A SDT/a	TE_GMA_SDT_2A	
5.3.2.34.	GMA	GMA Temp. - GMA #2B SDT/b	TE_GMA_SDT_2B	
5.3.2.35.	GMA	GMA Temp. - GMA #3A SDT/a	TE_GMA_SDT_3A	
5.3.2.36.	GMA	GMA Temp. - GMA #3B SDT/b	TE_GMA_SDT_3B	
5.3.2.37.	GSS	ARBITER_STATE (0= PON STATE, 1= PRIME,2=SBT ,3=SB1 ,4=SB2 , 5=HBT, 6=HB1, 7=HB2, 8=LB1, 9=LB2 ,10-15 are spare:)[7]	PY_ARB_STATE_1, PY_ARB_STATE_2, PY_ARB_STATE_3, PY_ARB_STATE_4	1=PRIME
5.3.2.38.	GSS	Snapshots enabled[7]	PY_snapNbl1, PY_snapNbl2, PY_snapNbl3, PY_snapNbl4	
5.3.2.39.	GSS	Snapshot Mode[7] Threshold snapshots	PY_ssSelctGss1, PY_ssSelctGss2, PY_ssSelctGss3,	

	Sub-sys	Description	Mnemonic	Value/ Range
			PY_ssSelctGss4	
5.3.2.40.	GSS	Control Effort X[7]	SY_CtrEffortX_1, SY_CtrEffortX_2, SY_CtrEffortX_3, SY_CtrEffortX_4	
5.3.2.41.	GSS	Control Effort Y[7]	SY_CtrEffortY_1, SY_CtrEffortY_2, SY_CtrEffortY_3, SY_CtrEffortY_4	
5.3.2.42.	GSS	Control Effort Z[7]	SY_CtrEffortZ_1, SY_CtrEffortZ_2, SY_CtrEffortZ_3, SY_CtrEffortZ_4	
5.3.2.43.	GSS	Electrode voltages[7] X1	SY_cmdGyVltX1_1, SY_cmdGyVltX1_2, SY_cmdGyVltX1_3, SY_cmdGyVltX1_4	
5.3.2.44.	GSS	Electrode voltages[7] X2	SY_cmdGyVltX2_1, SY_cmdGyVltX2_2, SY_cmdGyVltX2_3, SY_cmdGyVltX2_4	
5.3.2.45.	GSS	Electrode voltages[7] Y1	SY_cmdGyVltY1_1, SY_cmdGyVltY1_2, SY_cmdGyVltY1_3, SY_cmdGyVltY1_4	
5.3.2.46.	GSS	Electrode voltages[7] Y2	SY_cmdGyVltY2_1, SY_cmdGyVltY2_2, SY_cmdGyVltY2_3, SY_cmdGyVltY2_4	
5.3.2.47.	GSS	Electrode voltages[7] Z1	SY_cmdGyVltZ1_1, SY_cmdGyVltZ1_2, SY_cmdGyVltZ1_3, SY_cmdGyVltZ1_4	
5.3.2.48.	GSS	Electrode voltages[7] Z2	SY_cmdGyVltZ2_1, SY_cmdGyVltZ2_2, SY_cmdGyVltZ2_3, SY_cmdGyVltZ2_4	
5.3.2.49.	GSS	Position, a-axis (sm filtered data) [7]	RY_pstna1, RY_pstna2, RY_pstna3, RY_pstna4	
5.3.2.50.	GSS	Position, b-axis (sm filtered data) [7]	RY_pstnb1, RY_pstnb2, RY_pstnb3, RY_pstnb4	
5.3.2.51.	GSS	Position, c-axis (sm filtered data) [7]	RY_pstnc1, RY_pstnc2, RY_pstnc3, RY_pstnc4	
5.3.2.52.	GSS	Communications to Host - 1 Hz Sync Fail Flag[7]	PY_1HzSncFail1, PY_1HzSncFail2, PY_1HzSncFail3, PY_1HzSncFail4	Ok
5.3.2.53.	GSS	Communications to Host - 10 Hz Sync Fail Flag[7]	PY_10HzSncFail1, PY_10HzSncFail2, PY_10HzSncFail3, PY_10HzSncFail4	Ok
5.3.2.54.	GSS	Communications to SRE Timing Chain 16FO_A_ACTIVE (0 = SRE 16f0 A absent, 1 = SRE 16f0 A present) OR	PY_16FO_A_On_1, PY_16FO_A_On_2, PY_16FO_A_On_3, PY_16FO_A_On_4 OR PY_16FO_B_On_1,	SRE A Present OR SRE B Present

	Sub-sys	Description	Mnemonic	Value/ Range
		16FO_B_ACTIVE (0 = SRE 16f0 B absent, 1 = SRE 16f0 B present) [7]	PY_16FO_B_On_2, PY_16FO_B_On_3, PY_16FO_B_On_4	
5.3.2.55.	GSS	Aft GSS Hardware Status - Aft Green Board Bits (0=red, 1=green) [7]	SY_GrnBrd1_1, SY_GrnBrd1_2, SY_GrnBrd1_3, SY_GrnBrd1_4	-1 (0xFFFF)
5.3.2.56.	GSS	Fwd GSS Hardware Status - Fwd Green Board Bits (0=red, 1=green) [7]	SY_GrnBrd2_1, SY_GrnBrd2_2, SY_GrnBrd2_3, SY_GrnBrd2_N	-1 (0xFFFF)
5.3.2.57.	GSS	Control Rate (0=10Hz, 1=n/a, 2=660Hz, 3=220Hz, 4=alternate 10 Hz , 5=1553 only) [7]	PY_cntrlRate_1, PY_cntrlRate_2, PY_cntrlRate_3, PY_cntrlRate_4	220Hz
5.3.2.58.	GSS	Interrupt Timeout Flag Summary[7]	SY_intTmoFlgs_1, SY_intTmoFlgs_2, SY_intTmoFlgs_3, SY_intTmoFlgs_4	OK
5.3.2.59.	GSS	Payload Processor Error Flag (1=OK, 0=failure) [7]	PY_gssppFail1, PY_gssppFail2, PY_gssppFail3, PY_gssppFail4	OK
5.3.2.60.	GSS	GSW Failure Flag (1=OK, 0=failure) [7]	PY_gswFail1, PY_gswFail2, PY_gswFail3, PY_gswFail4	OK
5.3.2.61.	GSS	Gyro Commands Enabled Flag (0 = disabled, 1 = enabled) [7]	PY_gyrCmdEbl_1, PY_gyrCmdEbl_2, PY_gyrCmdEbl_3, PY_gyrCmdEbl_4	Enabled
5.3.2.62.	GSS	Gyro Commands Enabled Flag (0 = disabled, 1 = enabled) [7]	PY_gyrCmdEbl_1, PY_gyrCmdEbl_2, PY_gyrCmdEbl_3, PY_gyrCmdEbl_4	Enabled
5.3.2.63.	GSS	I/O Mode (0=normal, 1=sine, 2=manual out, 3=constant) [7]	PY_ioState_1, PY_ioState_2, PY_ioState_3, PY_ioState_4	Normal
5.3.2.64.	GSS	ATC position filter enabled (1=enabled, 0=disabled) [7]	PY_ATCpsFlNbl1, PY_ATCpsFlNbl2, PY_ATCpsFlNbl3, PY_ATCpsFlNbl4	Enabled
5.3.2.65.	GSS	Electrode Voltage Square Sum Filter Enabled (1=enabled, 0=disabled) [7]	PY_eVVfltNbl1, PY_eVVfltNbl2, PY_eVVfltNbl3, PY_eVVfltNbl4	Enabled
5.3.2.66.	GSS	Electrode Mean Voltage Filter Enabled (1=enabled, 0=disabled) [7]	PY_eMVfltNbl1, PY_eMVfltNbl2, PY_eMVfltNbl3, PY_eMVfltNbl4	Enabled
5.3.2.67.	GSS	Position Signal Filter Enabled (1=enabled, 0=disabled) [7]	PY_posFltNbl1, PY_posFltNbl2, PY_posFltNbl3, PY_posFltNbl4	Enabled
5.3.2.68.	GSS	Control Effort Filter Enabled	PY_ceFltNbl1,	Enabled

	Sub-sys	Description	Mnemonic	Value/ Range
		(1=enabled, 0=disabled) [7]	PY_ceFltNbl2, PY_ceFltNbl3, PY_ceFltNbl4	
5.3.2.69.	GSS	Bridge Oscillator Amplitude (0 = High Oscillator level, 1 = Low Oscillator level) [7]	PY_oscSwitch1, PY_oscSwitch2, PY_oscSwitch3, PY_oscSwitch4	LOW
5.3.2.70.	GSS	Charge Bias Flag (0 = 0V, 1 = +3V, 2 = -3V) [7]	PY_UV_bias1, PY_UV_bias2, PY_UV_bias3, PY_UV_bias4	0V
5.3.2.71.	GSS	BU Spin Up Radius Select (0 = center, 1 = radial position 1, 3 = radial position 2, 7 = radial position 3) [7]	PY_SU_R_Cmd_1, PY_SU_R_Cmd_2, PY_SU_R_Cmd_3, PY_SU_R_Cmd_4	TBD (On-orbit)
5.3.2.72.	GSS	FSU Mission Mode (0 = power on, 1 = Science Mission, 2 = Spin Up, 3 = Ground Test) [7]	PY_missionMode1, PY_missionMode2, PY_missionMode3, PY_missionMode4	SMM
5.3.2.73.	GSS	Controller Mode (0=idle by default, 1=CTM, 2=GTM, 3=SUM, 4=SMM) [7]	PY_cntrlState_1, PY_cntrlState_2, PY_cntrlState_3, PY_cntrlState_4	SMM
5.3.2.74.	GSS	Controller phase (0=idle, 1=CTM calibrate D/A, 2=CTM calibrate A/D, 3=CTM calibrate amps, 4=CTM calibrate bridge, 11=GTM init, 12=GTM prepare lift, 13=GTM lift, 14=GTM soft shutdown, 15=GTM hard shutdown, 21=SUM init, 22=SUM prepare lift, 23=SUM lift, 24=SUM soft shutdown, 25=SUM hard shutdown, 31=SMM init, 32=SMM prepare lift, 33=SMM lift, 34=SMM soft shutdown, 35=SMM hard shutdown) [7]	PY_cntrlPhase_1, PY_cntrlPhase_2, PY_cntrlPhase_3, PY_cntrlPhase_4	SMM lift
5.3.2.75.	GSS	Gyro status: 0=idle, 1=initializing controller, 2=preparing lift, 3=ready to lift, 4=lifting, 5=levitated, 6=position shutdown, 7=timer shutdown, 8=hard shutdown, 9=operator shutdown, 20=DFM ready, 21=DFM active, 22=DFM violated [7]	PY_gyroStat_1, PY_gyroStat_2, PY_gyroStat_3, PY_gyroStat_4	levitated
5.3.2.76.	GSS	Suspension Failed Flag (1=OK, 0=failure) [7]	PY_suspFail1, PY_suspFail2, PY_suspFail3, PY_suspFail4	OK
5.3.2.77.	GSS	Charge Measurement Enabled [7]	PY_ChgMtFltEn1, PY_ChgMtFltEn2, PY_ChgMtFltEn3, PY_ChgMtFltEn4	Enabled
5.3.2.78.	GSS	GyroCharge (Science Support-32 bit Float) [7]	SY_gyroCharge1, SY_gyroCharge2, SY_gyroCharge3, SY_gyroCharge4	**TBD**
5.3.2.79.	GSS	CM mode (1 = lo, 0 = hi) [7]	PY_chrgMode_1, PY_chrgMode_2,	Low

	Sub-sys	Description	Mnemonic	Value/ Range
			PY_chrgMode_3, PY_chrgMode_4	
5.3.2.80.	GSS	CM excitation rate [7]	SY_exctRate1, SY_exctRate2, SY_exctRate3, SY_exctRate4	
5.3.2.81.	GSS	CM excitation amplitude[7]	SY_exctAmpl1, SY_exctAmpl2, SY_exctAmpl3, SY_exctAmpl4	
5.3.2.82.	GSS	charge axis (0=uninitialized, 1=a, 2=b, 3=c) [7]	PY_chrgAxis_1, PY_chrgAxis_2, PY_chrgAxis_3, PY_chrgAxis_4	
5.3.2.83.	GSS	Charge Control Enabled (1=enabled, 0=disabled) [7]	PY_gccNbl_1, PY_gccNbl_2, PY_gccNbl_3, PY_gccNbl_4	disabled
5.3.2.84.	SRE	All SQUIDs should be in range 3[7]	PQ_SQ_RangeCmd1, PQ_SQ_RangeCmd2, PQ_SQ_RangeCmd3, PQ_SQ_RangeCmd4	3
5.3.2.85.	SRE	All SQUIDs should be in gain 1[7]	PQ_SQ_PGainCmd1, PQ_SQ_PGainCmd2, PQ_SQ_PGainCmd3, PQ_SQ_PGainCmd4	1
5.3.2.86.	SRE	SQUID bracket temperature - SQUID bracket 1 Sensor 1 data for SRE-A	SQ_Bkt1Sensor1A	
5.3.2.87.	SRE	SQUID bracket temperature - SQUID bracket 1 Sensor 2 data for SRE-B	SQ_Bkt1Sensor2B	
5.3.2.88.	SRE	SQUID bracket temperature - SQUID bracket 2 Sensor 1 data for SRE-B	SQ_Bkt2Sensor1B	
5.3.2.89.	SRE	SQUID bracket temperature - SQUID bracket 2 Sensor 2 data for SRE-A	SQ_Bkt2Sensor2A	
5.3.2.90.	SRE	SQUID bracket Sensor 1 temperature setpoint command for SRE-A	SQ_Bkt1Sr1SPCdA	
5.3.2.91.	SRE	SQUID bracket Sensor 2 temperature setpoint command for SRE-B	SQ_Bkt1Sr2SPCdB	
5.3.2.92.	SRE	SQUID bracket Sensor 1 temperature setpoint command for SRE-B	SQ_Bkt2Sr1SPCdB	
5.3.2.93.	SRE	SQUID bracket Sensor 2 temperature setpoint command for SRE-A	SQ_Bkt2Sr2SPCdA	
5.3.2.94.	SRE	SQUID bracket 1 sensor 1 Lo gain enable command for SRE-A	PQ_SB1_LGainCdA	
5.3.2.95.	SRE	SQUID bracket2 sensor1 Lo gain enable command for SRE-B	PQ_SB1_LGainCdB	

	Sub-sys	Description	Mnemonic	Value/ Range
5.3.2.96.	SRE	SQUID bracket2 sensor2 Lo gain enable command for SRE-A	PQ_SB2_LGainCdA	
5.3.2.97.	SRE	SQUID bracket1 sensor2 Lo gain enable command for SRE-B	PQ_SB2_LGainCdB	
5.3.2.98.	SRE	The FFT should be on. And Parameters set for low Hz Spin-up.	SQ_Status_1, SQ_Status_2, SQ_Status_3, SQ_Status_4	
5.3.2.99.	SRE	FFT Window	PQ_FFT_Window_1, PQ_FFT_Window_2, PQ_FFT_Window_3, PQ_FFT_Window_4	
5.3.2.100	SRE	PQ_FFT_Mode	PQ_FFT_Mode_1, PQ_FFT_Mode_2, PQ_FFT_Mode_3, PQ_FFT_Mode_4	
5.3.2.101	SRE	SRE CPU management - "Spin-Up" mode – The initialization parameters should be set to default values.	N/A	
5.3.2.102	Power, SM	Power - State of Charge #1 test	PM_BttrySOCLmt1	
5.3.2.103	FSW	ATC Mode 2A	SF_VMS_EvtIndex	
5.3.2.104		Reserved		

5.3.2.105. Gyro State Conditions

High Hz		States of other gyros			
		4	3	1	2
SpinUp Gyro	4	*N/A*			
	3	• Spinning – Low Hz • GSS – charge measurement on	*N/A*	The Gyros will be left in the same state the were in immediately after their respective spin-ups.	
	1	• Charge management is off • Gyro shall be centered • High Voltage Amplifiers on for all gyros		*N/A*	
	2				*N/A*

5.3.3. Abort Conditions

	Sub-sys	Description	Mnemonic	Value/ Range
5.3.3.1.	Power ,SM	Power - State of Charge #1 test	PM_BttrySOCLmt1	
5.3.3.2.	ECU	pressure - Calibrated P9A pressure	SM_GMAPresP9A	
5.3.3.3.	ECU	pressure - Calibrated P9B pressure	SM_GMAPresP9B	
5.3.3.4.	GSS	Gyro Charge[7]	SY_cmData1, SY_cmData2, SY_cmData3, SY_cmData4	
5.3.3.5.	GSS	Gyro Charge[7]	SY_gyroCharge1, SY_gyroCharge2, SY_gyroCharge3 SY_gyroCharge4	
5.3.3.6.	GSS	Control Effort X[7]	SY_CtrEffortX_1, SY_CtrEffortX_2, SY_CtrEffortX_3, SY_CtrEffortX_4	
5.3.3.7.	GSS	Control Effort Y[7]	SY_CtrEffortY_1, SY_CtrEffortY_2, SY_CtrEffortY_3, SY_CtrEffortY_4	
5.3.3.8.	GSS	Control Effort Z[7]	SY_CtrEffortZ_1, SY_CtrEffortZ_2, SY_CtrEffortZ_3, SY_CtrEffortZ_4	
5.3.3.9.	GSS	Gyro temperature - Gyroscope #1 GRT: T-01Q	TE_Gyro_1_GT01Q	
5.3.3.10.	GSS	Gyro temperature - Gyroscope #2 GRT: T-02Q	TE_Gyro_2_GT02Q	
5.3.3.11.	GSS	Gyro temperature - Gyroscope #3 GRT: T-03Q	TE_Gyro_3_GT03Q	
5.3.3.12.	GSS	Gyro temperature - Gyroscope #4 GRT: T-04Q	TE_Gyro_4_GT04Q	
5.3.3.13.		Lead Bag temp. - Station 200 dewar GRT/a: T-01D	TE_St2Dw_aGT01D	
5.3.3.14.		Final filter temperature sensors. - Final filter 1&2 GRT/a: T-06P	TE_Fi1_2_aGT06P	
5.3.3.15.		Final filter temperature sensors. Final filter 1&2 GRT/b: T-07P	TE_Fi1_2_bGT07P	
5.3.3.16.		Final filter temperature sensors. Final filter 3&4 GRT/a: T-08P	TE_Fi3_4_aGT08P	
5.3.3.17.		Final filter temperature sensors. Final filter 3&4 GRT/b: T-09P	TE_Fi3_4_bGT09P	

	Sub-sys	Description	Mnemonic	Value/ Range
5.3.3.18.		Safemodes - GSS 1234 Aliveness 1Hz[7]	PM_DI1HGSS1A1V, PM_DI1HGSS2A1V, PM_DI1HGSS3A1V, PM_DI1HGSS4A1V	
5.3.3.19.		Safemodes - SRE Aliveness 1Hz	PM_DI1HSREA1v	
5.3.3.20.		Safemodes - ECU Aliveness 10Hz	PM_ECU_A1v10Hz	
5.3.3.21.		Safemodes - GSS 1234 Aliveness 10Hz[7]	PM_GSS1_A1v10Hz, PM_GSS2_A1v10Hz, PM_GSS3_A1v10Hz, PM_GSS4_A1v10Hz	
5.3.3.22.		Safemodes - SRE Aliveness 10Hz	PM_SRE_A1v10Hz	
5.3.3.23.		Safemodes - High Vacuum P9A Pressure	PM_SpinP9ATest	
5.3.3.24.		Safemodes - High Vacuum B Pressure	PM_SpinP9BTest	
5.3.3.25.		Safemodes - Science Telescope 1st Failure	PM_ST_1st_Fail	
5.3.3.26.		Safemodes - Dewar Porous Plug Breakthrough	PM_DewPPTmp_Brk	
5.3.3.27.		Safemodes - Dewar Porous Plug Choke	PM_DewPPTmp_Chk	
5.3.3.28.		Safemodes - QBS Temperature	PM_QBS_Temp	
5.3.3.29.	SRE	Spin frequency est bin number[7]	SQ_SpinFrqBin_1, SQ_SpinFrqBin_2, SQ_SpinFrqBin_3, SQ_SpinFrqBin_4	
5.3.3.30.	SRE	Delta spin frequency estimation[7]	SQ_DelSpinFrq_1, SQ_DelSpinFrq_2, SQ_DelSpinFrq_3, SQ_DelSpinFrq_4	
5.3.3.31.	GSS	Gyro position - Position, a-axis (sm filtered data)[7]	RY_pstna1, RY_pstna2, RY_pstna3, RY_pstna4	
5.3.3.32.	GSS	Gyro position - Position, b-axis (sm filtered data)[7]	RY_pstnb1, RY_pstnb2, RY_pstnb3, RY_pstnb4	
5.3.3.33.	GSS	Gyro position - Position, c-axis (sm filtered data)[7]	RY_pstnc1, RY_pstnc2, RY_pstnc3, RY_pstnc4	

5.3.4. Gyro 4, 3, 1, 2 (In order) x = the current gyro (High Hz)

Low Hz Spin-up – perform immediately prior to the High Hz Spin-Up

Phase	Step	Description	Duration	Details
SETUP	5.3.4.1.	Switch to 32K Spin-Up format	5m	
	5.3.4.2.	Switch to default ECU Sample Table	5m	
	5.3.4.3.	Setup ATC for spin-up	5m	Switch to mode 2A
	5.3.4.4.	Setup the ECU for spin-up	5m	• Enable all HLD's • Disable Vatt_Valve HLD's • Disable Vatt_Latr HLD's
	5.3.4.5.	GSS Pre-spin-up Check	5m	
	5.3.4.6.	SRE Setup	5m	• Set_FLL_x_Gain_1 • Set_FLL_x_Range_2 • Disable Calibration Signal The state of the applications is defined by S0673, CPU Management
	5.3.4.7.	Enable GSS Snapshots on the spin-up gyro only	5m	
	5.3.4.8.	Disable 1st SOC safemode macro.	5m	
	5.3.4.9.	**Setup** GMA for Spin-up gyro x as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Setup"
	5.3.4.10.	Real-time commanding	5m	
	5.3.4.11.	TDRSS for verification of configuration - 1h of coverage	2h	N/A
SPIN UP	5.3.4.12.	Issue command to **enable** the timeline	5m	
	5.3.4.13.	**Spin-up** gyro x as described in Science Document S0633, Science Gyro Spin Up, GMA Valve Sequences.	~15m	See S0633 – See the steps labeled "Spin Up"
RECONFIG	5.3.4.14.	**Reconfigure** GMA as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Reconfig"

Note: Between low Hz spin-up and high Hz spin up need to reset ~~spin-up~~ FFT parameters.
-Mac

High Hz Spin-up Process

Phase	Step	Description	Duration	Details
SETUP	5.3.4.15.	Enable SRE Snapshots. (Disable GSS snapshots.)		
	5.3.4.16.	**Setup** GMA for Spin-up gyro x as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.		See S0633 – See the steps labeled "Setup"
	5.3.4.17.	Wait 10 minutes	10m	
	5.3.4.18.	Enable GSS Snapshots (Disable SRE Snapshots)		
	5.3.4.19.	TDRSS for verification of configuration - 3 hr of coverage	30m	N/A
SPIN UP	5.3.4.20.	Issue command to **enable** the timeline	5m	
	5.3.4.21.	**Spin-up** gyro x as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.	167m	See S0633 – See the steps labeled "Spin Up"
RECONFIG	5.3.4.22.	**Reconfigure** GMA as described in S0633, Science Gyro Spin Up, GMA Valve Sequences.	15s	See S0633 – See the steps labeled "Reconfig"
POST RECONFIG	5.3.4.23.	Wait 30 min.	30 m	Wait 30 min
	5.3.4.24.	Enable 1st SOC safemode macro	5m	
	5.3.4.25.	Re-enable SRE Calibration signal		Enable Calibration Signal
	5.3.4.26.	ECU setup to nominal		• Enable Vatt_Valve HLD's • Enable Vatt_Latr HLD's
	5.3.4.27.	Re-center gyro	5m	
	5.3.4.28.	• **Post-reconfigure** GMA sequene • V29 and V30 are intentionally left open following the last high speed spin-up (of the last gyro: gyro 2)	15m	See S0633 – See the steps labeled "Post-Reconfig
	5.3.4.29.	Return ATC to nominal state	5m	Mode 1A
	5.3.4.30.	Reserved		

5.3.5. Exit state

5.3.5.1. Leak Valve Open (LV)
5.3.5.2. All four exhaust valves open (EV1, EV2, EV3, EV4)
5.3.5.3. V29 and V30 open (For the duration of the science mission)
5.3.5.4. ATC Mode 1A
5.3.5.5. Gyros centered, levitated, and spinning
5.3.5.6. SRE Calibration signal disabled
5.3.5.7. SRE FFTs on
5.3.5.8. SRE set to range 1 and gain 2
5.3.5.9. GSS in digital spin-up mode 4 (See section 4.5)

Appendix A - MOOG-GMA Schematic