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Gravity Probe B Relativity Mission

On-orbit Anomaly Resolution Plan

S0897 Rev. B

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ITAR Statement

This plan does not contain any US Export Controlled Information, however, actual anomaly resolution actions referred to in Sections 2, 3 and 4 of this document will include US Export Controlled Information and must be provided the safeguards consistent with the International Traffic in Arms Regulations (ITAR).

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Change Log

Rev A:

1. Update per N. Bennett's redlines to Rev -; Note changes in names of anomalies – Major, medium, and minor.
2. Addition of LM International Licensing ITAR language to cover sheet; no ITAR-controlled information contained in this document.
3. Updated section 3, 4 to add the Anomaly Review Coordinator role and redefine the roles and responsibilities of the Anomaly Teams and the Anomaly Review Board.

Rev B: [MOC action item references in square brackets]

1. Add section to define interface procedures between NEAR (New Engineering Analysis Room) and main Anomaly Room. (Section 3.3.4)
2. Add section to detail procedure for tracking of vehicle "observations" – 2nd tier anomalies that do not affect the current timeline but bear watching (Section 2.3) [MOC-972]
3. Updated anomaly reporting and status dissemination process (Section 3.6) [MOC-1077, MOC-1223, MOC-1060]
4. Added communications/loop monitoring procedures for anomaly room (Section 3.8) [MOC-1341]. Added conference call and direct phone line information.
5. Updated checklist for more complete anomaly analysis [MOC-1336, MOC-1344]
6. Clearly delineated Anomaly Resolution Coordinator as anomaly room lead and point of contact. (Section 3.3) [MOC-1349, MOC-1218]
7. Incorporates lessons learned from SIM7, PE1, PE2
8. Add section on Anomaly Room protocol per RL 798 (Section 4)

Acronyms and Abbreviations:

ARB	<u>A</u> nomaly <u>R</u> eview <u>B</u> oard
<i>Board</i>	Anomaly Review <u>B</u> oard
<i>Coordinator</i>	Anomaly Resolution <u>C</u> oordinator
MD	<u>M</u> ission <u>D</u> irector
FD	<u>F</u> light <u>D</u> irector
<i>Team</i>	Anomaly <u>T</u> eam
NEAR	<u>N</u> ew <u>E</u> ngineering <u>A</u> nalysis <u>R</u> oom
ITF	<u>I</u> ntegrated <u>T</u> est <u>F</u> acility (LMCO B/205)
TCR	<u>T</u> imeline <u>C</u> hange <u>R</u> quest
PPCR	<u>P</u> assplan <u>C</u> hange <u>R</u> quest
SPC	<u>S</u> tored <u>P</u> rogram <u>C</u> ommand (command macro)
SAR	<u>S</u> pacecraft <u>A</u> nomaly <u>R</u> eport (TQSM database)
TQSM	MOC online database and log
MOC	<u>M</u> ission <u>O</u> perations <u>C</u> enter
SCR	<u>S</u> oftware <u>C</u> hange <u>R</u> quest
OCR	<u>O</u> perations <u>C</u> hange <u>R</u> quest (for templates and ops procedures)

1. Scope

This document acts as a set of guidelines for the procedures and processes used to identify, understand, and resolve functional or operational anomalies of the Gravity Probe B spacecraft or its ground system that arise during on-orbit operations.

The various types of anomalies are defined, the role/scope/authority of the Anomaly Review Board (ARB) is established, the plans used to identify and report anomalies are outlined, the anomaly resolution process is described, and the methods and timetable for anomaly status reporting is presented.

2. Anomaly Definition

An anomaly is any unanticipated or undesired event, condition or configuration of the spacecraft or ground equipment. Obvious anomalies include: safemode activations, vehicle states that show stored program command templates executed along failure paths (usually shown by event messages), and any inability to command or receive telemetry from the vehicle.

2.1 Declaration of an Anomaly

Only the Flight Director or Mission Director has the power to declare an anomaly. Once an anomaly is declared, its investigation and resolution takes priority over Anomaly Review Board (ARB) activities, such as investigation and tracking of vehicle observations (see section 2.3)

2.2 Anomaly Classification:

Space vehicle anomalies are categorized as follows: 1) major, 2) medium, and 3) minor by their degree of impact on space vehicle operations.

Non-vehicle anomalies are classified as Ground Systems anomalies.

The response plans for these anomalies are detailed in Section 5.

2.2.1 Major Space Vehicle Anomalies

Major Space Vehicle Anomalies endanger the safety of the spacecraft and/or the payload. These anomalies have contingency plans that have been pre-approved for immediate identification and response within the MOC at the direction of the Flight Director. Response to these anomalies is time-critical.

Examples of pre-approved contingency plans are: stopping the timeline if the yet-to-be-executed stored program commands pose risk to the vehicle, executing time-critical abort sequences for procedures that have clearly define abort criteria, or executing sequences that safe the vehicle (closing GMA valves, changing the vehicle mode, ensuring the vehicle is power positive).

Since the list of pre-approved anomaly response procedures will change over time, including minor anomalies, the Contingency Procedure Binder contains a coversheet that flags those procedures that are pre-approved for Flight Director execution without requiring program notification.

Though Mission Director approval to execute these response plans is not required, notification of the action to the Mission Director should be made as soon as practical.

2.2.2 Medium Space Vehicle Anomalies

Medium Space Vehicle Anomalies do not endanger the safety of the space vehicle but may impact the execution of planned timeline. These are the most probable type of anomaly because the vehicle safing mechanisms are designed to allow the vehicle to be autonomous for 72 hours given any single failure. The response to these anomalies is not time-critical.

Examples of anomalies that do not require immediate action include: the execution of any safe modes, Stored Program Commands (SPCs) that executed along pre-designed failure paths, and a vehicle state that needs to be reconfigured prior to resuming the planned timeline.

Medium space vehicle anomalies can also be detected in off-line data analysis. When this occurs, the engineer contacts the subsystem RE or his management (science, payload electronics or LM manager) to help determine whether the anomaly is real and not a data analysis problem. If they determine that there is an anomaly, the anomaly is reported to the program through the Mission Director and to Anomaly Resolution Coordinator. If it has implications with the on-going timeline execution, they must notify the Mission Director and Flight Director immediately.

2.2.3 Minor Space Vehicle Anomalies

A Minor Space Vehicle anomaly does not endanger the safety of the space vehicle and does not stop the execution of the timeline. These anomalies also do not have any future implications to on-orbit operations.

This category covers extremely low risk problems with the vehicle that are typically completely corrected by taking the appropriate pre-approved action, and are covered by Flight Rules.

Examples include recovering Solid State Recorder (SSR) data before it is overwritten and reconfiguring the communication subsystem to ensure a viable command and telemetry path. Since the SSR playbacks and communications configurations are handled by stored program command templates (SPCs) it will take manual intervention to recover the vehicle from the loss of a Space Network (SN) or Ground Network (GN) contact. The losses of contacts on these networks are considered minor.

Though Mission Director approval to execute these is not required, notification of the action to the Mission Director and the ARB should be made as soon as practical.

2.2.4 Ground Systems Anomalies

A ground Systems anomaly is an issue with the ground data systems, or the MOC, and is not a result of space vehicle malfunction or mis-configuration.

The Flight Director will initially attempt to verify and correct the problem through the use of pre-approved contingency procedures. These anomalies are covered by Flight Rules.

Examples of Ground Systems Anomalies include: Loss of a Pod (ground system console set), Loss of a Programmable Telemetry Processor (PTP), Loss of a White Sands Data Interface Service Capability (WDISC) Desktop, Loss of a server that runs Mission Planning tools, Loss of the T1 data lines to the Space Network (SN) or Ground Network (GN), etc.

The Flight Director is responsible for the preliminary review of the effect of the Ground Systems anomaly on the timeline and assessing any impact to vehicle operations. Examples of ground related spacecraft issues include: inability to perform a time critical command sequence, inability to verify critical command sequences in real-time, loss of SSR playback data, Stored Program Command (SPC) list exhaust, safemode activation due to no ground commanding in a 12 hour period, inability to review spacecraft data for more than a 72 hour period.

In the event no contingency procedure is available or the ground systems anomaly will impact the timeline, the Mission Director must be notified. The Flight Director should continue to expedite the recovery of the ground systems by contacting the appropriate personnel. The Mission Director should assess the impact to the timeline and work towards mitigating issues as well as coordinate any needed re-planning efforts with the Mission Planning team.

2.3 Space Vehicle “Observations” Tracking

In addition to anomalies, the space vehicle may exhibit off-nominal or unexpected behavior that does not appear initially to be an operational or functional issue and does not violate any limits, but may warrant attention over time.

Any team member who notices such “curiosities” is requested to contact the anomaly room with the report. These items are designated an “observation” and will be reported to the Anomaly Review Board and Mission Director and the program on a daily basis.

Workload permitting, the Anomaly Resolution Coordinator follows up with the reporting party on a regular basis to receive updates on the issue. The same tracking system and investigative process is used to resolve the observation, however, the process will be conducted on a non-interfering basis with issues designated an Anomaly by the mission director.

Such observation items may be elevated to an anomaly category if it is judged by the Anomaly Review Board or Mission Director to be serious enough to warrant a high-priority investigation.

3. Anomaly Review Process

3.1 Organization

The anomaly review process is organized into three different entities: the Anomaly Resolution Coordinator, the Anomaly Review Board, and a number of Anomaly teams. The roles of these entities are outlined below (see Figure 1 for reporting structure)

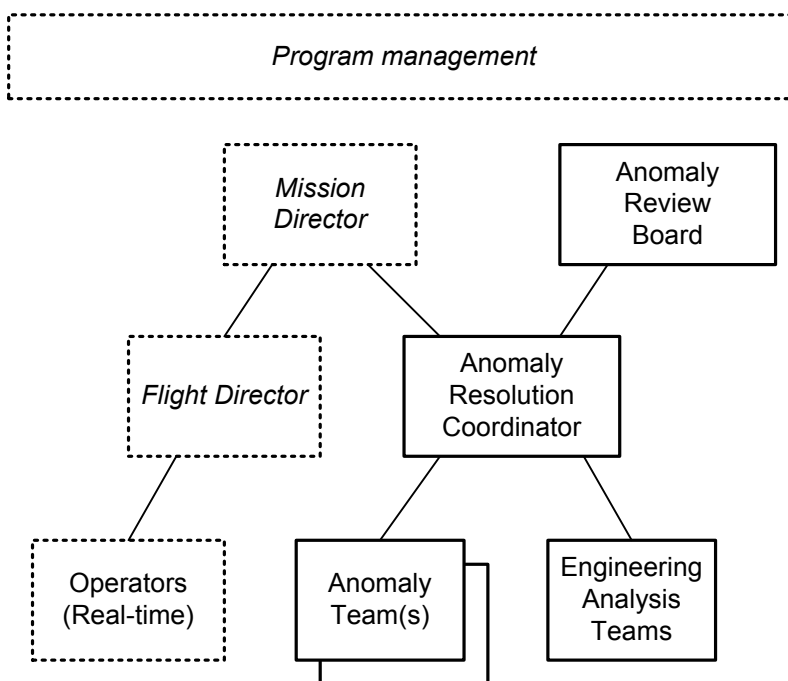


Figure 1 - Anomaly Review Team Organization

3.2 Management Reporting

In the event of a Major Space Vehicle anomaly the Flight Director immediately notifies the Stanford University Program Manager in parallel with the Mission Director. The Mission Director and Program evaluates the anomaly and reports their findings to the MSFC Program Manager or his designee. Any incident which causes the timeline to be stopped shall require immediate notification to the Stanford Program Manager.

Other classes of anomalies are reported to Program Management through the Mission Director as soon as practical aft the board’s initial assessment. These are presented in a written form in the daily anomaly report by the Anomaly Resolution coordinator (see Section 3).

3.3 Anomaly Resolution Staff Positions

3.3.1 Anomaly Resolution Coordinator

The *Anomaly Resolution Coordinator*, or simply *Coordinator*, is the heart of the anomaly resolution process. This function is staffed by a small team of system engineers to accomplish the following management and control functions:

1. Receive, log, and track anomalies as reported by the Mission Director
2. Form and manage Anomaly Teams under direction of the Anomaly Review Board chair.
3. Coordinate anomaly resolution activities with Anomaly Review Board.
4. Report anomaly status to the program via a summary spreadsheet on the gpbops website (see section 3.6) daily written anomaly report.

This position is a 7-day staffed position in the Anomaly Room (near the MOC) to enable rapid assessment of anomalies by the program. After-hours support is provided on an on-call basis. A coordinator hand-off (shift change) checklist is provided in Section 7.

The Anomaly Resolution Coordinator is the point of contact for the anomaly process and will respond to calls/queries on the voice loop as “ARB”

3.3.2 Anomaly Teams

An *Anomaly Team* is a group of technical experts assigned to investigate a particular anomaly. These teams report their status to the Anomaly Resolution Coordinator and to the Anomaly Review Board when requested.

The teams operate on an on-call basis and the membership is ad-hoc based on the needs of a particular anomaly. 24 hour, 7 day contact information for team leads by technical subject is provided in the GP-B staffing plan.

3.3.3 Anomaly Review Board

The *Anomaly Review Board*, or simply the *ARB* or *Board*, oversees the program-wide anomaly assessment and root cause investigation. This board is composed of senior Stanford University, Lockheed-Martin, and NASA technical managers who have broad knowledge of the operation of the spacecraft, the payload, and the overall science mission.

An anomaly board chairperson is designated in the staffing plan as the anomaly room leader. Each anomaly will have a designated chair, which will generally be the chair identified in the staffing plan, however, an alternate chair may be appointed on an anomaly-by-anomaly basis to aid in management and technical resolution of the anomaly.

The anomaly review board convenes during anomaly investigations; during non-anomaly periods the board members are engaged with other program activities. This board:

1. Determine the membership of the anomaly teams.
2. Assesses the technical approach of the anomaly teams.
3. Oversees the progress of the investigations.
4. Prioritizes program resources for the various investigations.
5. Makes final recommendation to the program for anomaly resolution.

Members of the board are available on an on-call basis and will be available on a 24 hour, 7 day schedule. Contact information for the anomaly board members is provided in the GP-B staffing plan.

3.3.4 Engineering Analysis Teams

The Engineering Analysis Teams are the program technical experts who monitor and assess the health and performance of the spacecraft and payload, but are not part of the real-time operations. These groups include

1. Stanford engineering teams (End Station III, Cypress)
2. Lockheed-Martin engineering teams (B/205 Integrated Test Facility)
3. Science data analysis teams (GP-B modular)
4. New Engineering Analysis Room (NEAR) (End Station III shadow POD)

All of these teams are monitoring the operation of the spacecraft and payload in both real time and through off-line data processing and analysis.

In the event that an anomaly or issue is noted by any of these teams, the team lead shall contact the anomaly room (preferred) or the Mission Director to report the issue.

The engineering analysis teams shall not contact the flight director or any of the real-time operations team directly. The anomaly room shall coordinate all interfaces with the real time operations team. This strict interface has been put in place to minimize non-operations communications traffic with the MOC to avoid confusion or to avoid interruptions of critical real-time event monitoring and execution.

3.4 **Anomaly Assessment**

Upon receipt of a new anomaly report, the Anomaly Coordinator and the Anomaly Review Board evaluates the anomaly using the detailed checklist provided at the end of this document. In summary, the coordinator:

1. Assess vehicle safety issues.
2. Assess dewar lifetime implications.
3. Assess short and long term mission implications.
4. Estimate response time requirement .
5. Schedules an initial screening with the subsystem REs and Anomaly Board members.
6. Identify priority among other anomaly team activities
7. Identify near and long-term timeline flow implications.
8. Determine anomaly team membership
9. Develop fault tree to find root cause.
10. Formulate investigation schedule and identify key decision points.

3.5 **Anomaly Investigation and Resolution**

Once the vehicle is in a safe configuration the Anomaly Team lead, in consultation with the Anomaly Review Board and the Anomaly Resolution Coordinator, develops, tests, and implements a plan to isolate and correct the anomaly.

Once an Anomaly Team has performed their analysis of a given anomaly, they meet with the Anomaly Review Board and recommend any resolution options to correct the problem or any further investigative steps they feel need to be made to come to a resolution method. If more than one option is recommended, the Anomaly Team also prioritizes recommendations.

The Anomaly Resolution Coordinator and the Anomaly Review Board then decides upon a resolution method and give approval to implement the mitigation.

1. If the resolution consists of an already-existing contingency procedure that the Anomaly Team approves for use as is, the procedure will be executed in the appropriate manner, usually by an SPC load
2. If the contingency procedure does not exist, the Anomaly Team will develop the appropriate procedure, soliciting whatever additional help they need via the Anomaly Review Board. The procedure will undergo testing via the ITF for approval and sign-off, as with any other procedure. The Anomaly Review Board will also provide sign-off and approval for implementation of any contingency procedure.

Once the Anomaly Review Board has a mitigation plan in place and secures agreement from the Mission Director, a timeline change request (TCR) or pass plan change request (PPCR) is submitted to mission planning to insert the new activities into the mission timeline.

3.6 Anomaly Tracking and Status Reporting and Products

The Anomaly Resolution Coordinator and his team have the responsibility for tracking the investigation process and generating the reports required by the program. These reports include:

1. Anomaly status and associated documentation is tracked in the Anomaly Room in file folders, one for each anomaly. In addition, an electronic notebook (written as a text file, or a Microsoft Word or Excel file) is maintained on each anomaly. The Anomaly Coordinator records all significant activities, team assignments, resolution schedules, etc. in this electronic file.

In addition to the notebooks, a summary spreadsheet will be maintained as a quick reference to the anomalies in work.

This electronic notebooks and associated files are stored on the ITAR drive on RELGYRO in \\relgyro.stanford.edu\dbm\itar\ARB_database

2. At 15-minute intervals, the set of files in the RELGYRO ARB_database archive are imported and pushed to the web at https://gpbops.stanford.edu/ARB_Database for program-wide distribution.
3. A Spacecraft Anomaly Report (SAR) will be opened in the on-line mission log database (TQSM), once an anomaly has been designated. This database will have a link to the information in the https://gpbops.stanford.edu/ARB_Database
4. Daily status meeting: Anomaly summaries and status will be presented by the ARB chair at the daily morning meeting. This report will be provided via e-mail to all members of the GP-B community as specified by GP-B program management (principle investigators, independent evaluation boards, NASA Marshall team, etc.)
5. At periodic intervals, the ARB will provide to the team a briefing of anomaly status on the MOC loop.
6. Status alpha-pages and e-mails will be generated when an anomaly is opened, screening meeting scheduled are scheduled, and when the anomaly is closed. All ARB team members, Mission Directors, and Flight Directors will receive a page as a courtesy.

Note, the Flight Director, Mission Director, program management, or principle investigator (or designee) may request and receive status information on any and all anomalies at any time from the Anomaly Resolution Coordinator or the Anomaly Review Board.

3.7 Anomaly Closure

Once the cause of the anomaly has been identified, and rectifying or mitigating activities are complete, the Anomaly Team and Anomaly Review Board will submit the anomaly for closure to the Mission Director. After review, the Mission Director will close the Spacecraft Anomaly Report in the TQSM database.

On closure, the Anomaly Resolution Coordinator will alpha-page all ARB, FD, and MD personnel that the anomaly has been closed.

3.8 Real-time Communications with Anomaly Room

3.8.1 MOC Voice Loops

When staffed, the ARB monitors the MOC communications loop to stay apprised of vehicle activities or issues.

Two-way communications with the ARB take place on the NET4 loop. During periods of focused ARB activity in the anomaly room, the ARB will discontinue monitoring of the MOC loop to minimize extraneous noise in the room. At all times, however, the ARB can be contacted on the NET4 loop.

The anomaly room's call sign on the voice loops is "ARB". To minimize the potential for confusion, it is preferred that the use of the word "anomaly" only be associated with an anomaly and not as a call sign for the anomaly room.

3.8.2 Conference Phone

The Anomaly Room maintains a set of conference call phone numbers and access codes to aid with offsite communication during anomaly investigations. For security reasons, the access codes will be periodically changed. All outgoing pages and e-mails announcing a convening of the ARB includes the full phone number and access code for the conference call.

Conference call services are provided by LINK Conference Service LLC, on contact to Stanford University. Reservations or operator assistance can be obtained at 1-800-756-8280. Consult with an Anomaly Resolution Coordinator or Board member should you need conference call phone number or access code.

3.8.3 Direct Phone Line

The direct (incoming) phone line to the anomaly room is 1-650-725-5616.

4. Anomaly Room Protocols

The following are general rules of protocol that shall be followed by all personnel when using the Anomaly Room.

4.1 General use of the Anomaly Room

The Anomaly Room is a meeting area for the GP-B team to solve on-orbit problems with the space vehicle. All GP-B members using the room are requested to only enter the room while working on or reporting an anomaly or observation to the Anomaly Resolution Board.

In addition to being a meeting room, the Anomaly Room is the de-facto office of one to two Anomaly Resolution Coordinators and up to three Anomaly Board members during the IOC phase of on-orbit operations. During quiet periods, the ARB members will generally be actively working on anomaly reports, presentations for meetings, monitoring on-orbit operations, reviewing upcoming activities, and other room maintenance activities. It is requested that side conversations be kept to a minimum to allow the various team members to focus on their tasks.

During period of high activity, the screening meetings in the anomaly room will be scheduled. The Board and Coordinators will endeavor to start and end meetings on-time, with sufficient time in between to allow the previous meeting to clear and the new meeting team to enter and set up (roughly 5 minutes). It is important that all GP-B members take seriously the requests of the ARB and efficiently clear the room (and phone line if needed) to effectively handle multiple anomalies.

4.2 Overflow Anomaly Room

In the event that multiple anomaly rooms are needed, the End Station III conference room (NEAR area) will become a satellite anomaly room. This room is equipped with a conference phone, computer, video projector, and communications loop transceiver. Across the hall, shadow pod M has been installed, and can be used to facilitate anomaly investigations as required.

4.3 Anomaly Meeting Management

Anomaly screening meetings are coordinated via the GP-B paging website. Status alpha-pages and e-mails will be generated when an anomaly is opened, screening meeting scheduled are scheduled, and when the anomaly is closed. All ARB team members, Mission Directors, and Flight Directors, and NEAR personnel will receive a page as a courtesy, and a telecon number will be provided when appropriate for off-site members.

Though all team members will receive a page, it is expected that only the active-duty or on-call personnel check in upon receipt of a page. All active-duty and on call members will, in addition, receive a direct phone call from a Coordinator to back-up the alpha-page. Off-duty members are welcome to participate in the telecon, however, are not required to do so.

As much as possible, meetings will be scheduled with a minimum 15-minute lead time so that team members may return to the anomaly room or otherwise prepare for the meeting.

The screening meetings will start promptly at the time scheduled.

4.4 Facility Maintenance

In the event that any maintenance—facility, hardware or software—needs to be performed in the Anomaly Room, approval of the ARB chair or on-shift Anomaly Coordinator must first be obtained. In special cases, the ARB may require the action to be scheduled at a later time if critical activities are underway. Computer maintenance issues should be brought to Jeff Wade's attention as soon as convenient.

4.5 Food/Drinks

Food and drinks are generally allowed in the Anomaly Room. However, food should be eaten at the central table, away from the computer equipment and Pod-J (shadow pod). MOC-approved mugs are permitted in the vicinity of the computer systems. All empty containers should be discarded external from the Anomaly Room since garbage pick-up doesn't occur in this area.

4.6 Cell Phone Use

If cell phones are brought into the Anomaly Room, they must be put in vibrate mode or turned off. No ringing cell phones will be tolerated during operations, however, general cell phone use is permitted in the Anomaly Room.

5. Anomaly Identification and Response Plan

The following is an outline of the steps to be followed in response to an anomaly. Note, iteration will likely be required within this plan as an anomaly investigation proceeds:

1. Any real-time operations team member that suspects an anomaly informs the current shift Flight Director.
2. The Flight Director collects information and recognizes it as a an anomaly.
 - a. In the event of a **major anomaly**, the Flight Director uses pre-approved contingency procedures to safe the vehicle
 - b. In the event of a time **medium critical anomaly**, the Flight Director consults with the Mission Director on course of action.
 - c. In the event of a time **minor anomaly**, the Flight Director uses pre-approved contingency procedures or flight rules to recover from the anomaly.
 - d. In the event of a **ground system anomaly**, the Flight Director informs the Mission Director and the system RE of the observation for evaluation.
3. The Flight Director notifies the Mission Director of the anomaly and continue to assess the real-time operations issues and timeline impact of the anomaly.
4. The Mission Director determines what additional actions may be necessary. This can include selecting an Anomaly Team lead to investigate. The Anomaly Resolution Coordinator is notified when any anomaly investigations are commissioned.
5. The Anomaly Resolution Coordinator convenes the Anomaly Review Board, briefs the board on the anomaly, commissions an Anomaly Team, and coordinates with the board for resources, schedule, and milestones for investigation.
6. The Mission Director works with the Anomaly Review Board to assess short and long-term implications to the mission timeline.
7. The Anomaly Resolution Coordinator tracks the actions of the Anomaly Team and maintains the status documents (databases) for the program.
8. The Anomaly Review Board monitors Anomaly Team's activities and augments the makeup of the team as needed to successfully understand the anomaly.
9. Once the anomaly is understood, the Anomaly Resolution Coordinator and the Anomaly Review Board baseline a plan for resolution. Should this anomaly require software changes or procedure changes, the Anomaly Resolution Coordinator will work with the Anomaly Team and the Flight Software Team to generate SCRs and OCRs as required.
10. The Anomaly Review Board reviews and endorses recommended mitigations from the Anomaly Teams and coordinates their insertion into the timeline with the Mission Director. The interface between the Board and Mission Planning is via the Timeline Change Request (TCR) process. If real-time commanding is required, a pass plan change request (PPCR) is coordinated with the Flight Director.
11. The Mission Director briefs the Flight Director of the chosen course of action.
12. The Anomaly Team monitors and assess the effects of the mitigations via flight telemetry and reports results to the ARB.
13. The ARB and Anomaly Team assesses downstream implications of anomaly and possible operational changes to mitigate any negative effects.
14. The Anomaly Resolution Coordinator completes the post anomaly report.
15. The Mission Director closes the anomaly in the TQSM database.

6. Anomaly Assessment Checklist

Title:	☐ Anomaly ID: A -
Day/Time:	☐ Observation ID: O -
Type (preliminary assessment):	☐ MAJOR* ☐ Medium ☐ Minor
Type (final assessment):	☐ MAJOR* ☐ Medium ☐ Minor

T: Team, C: Coordinator, B: Board, R: System RE, D: Mission Director, F: Flight Director, P: Mission Planning

*Major anomalies require immediate notification of Program Manager and Mission Director.

Anomaly Report

Item	Who	What	When/Initial
1.	M,C	Receive and log anomaly in database on ITAR drive.	
2.	C	Open anomaly report log folder	
3.	C	Notify Board members on call from daily roster	

Mission Assessment Phase

Item	Who	What	When/Initial
4.	B,C,R	Conduct screening in Anomaly Room and via telecon.	
5.	B,C,R	Collect data surrounding anomaly; verify anomaly via crosscheck	
6.	B,R	Develop fault tree	
7.	B,R	Generate hypotheses of the source of the problem.	
8.	B,C,R	Confirm initial assessment of anomaly type: <i>Major, Medium, Minor</i>	
9.	B,C	Assess short term vehicle safety implications	
10.	B,C	Assess long-term vehicle and timeline implications	
11.	B,C	Confirm safemode configuration/enable/activation status	
12.	B,C,T	Identify anomaly team(s), team leader(s)	
13.	B,C,T	Fix target time (SV load sequence or RT pass) to implement fix.	
14.	C, P	Notify mission planning of potential changes to timeline, target loads.	
15.	B,C,T	Baseline investigation plan, reporting times, product delivery times. Scheduled update(s) for board:	

Root Cause Assessment Phase (in processes investigation - iterative)			
Item	Who	What	When/Initial
16.	C,T	Track and log investigations team status meetings	
17.	C,B,T	Convene board for both scheduled and unscheduled updates from team.	
18.	C	Maintain status briefing charts for daily meetings (10am PT)	
19.	C	Maintain summary spreadsheet on Relgyro ITAR drive (section 3.6, p 10)	

Corrective Action Phase			
Item	Who	What	When/Initial
20.	C,B,T,P	Conduct screening of proposed corrective action in Anomaly Room, telecon.	
21.	B,P	Assess and endorse corrective action proposal	
22.	B,M	Obtain approval from MD for corrective action.	
23.	T,P	Generate mission planning change request (TCR, PPSR)	
24.	M	Approve final corrective action (nominal: at daily load signoff meetings)	

Implementation Phase			
Item	Who	What	When/Initial
25.	P	Implement corrective action in timeline	
26.	T	Assess effect of mitigation.	
27.	T	Evaluate effect on monitor limit levels.	
28.	T,C,B,M	Team reports effects of mitigation to MD, Board	
29.	B,T	Assess long term implications of mitigation (recurring, OCRs, CARDS, Database updates, changes in defaults)	

Closeout Phase			
Item	Who	What	When/Initial
30.	C	Update TQSM with anomaly root cause, corrective action, and resolution data.	
31.	C,T,B	Document and report results of corrective action	
32.	M	Close anomaly in electronic database	
33.	C	Scan and archive closed anomaly folder	

7. Anomaly Resolution Coordinator Hand-off (shift-change) Checklist

Maintaining current electronic notebooks allows for efficient shift changes between ARB coordinators. The following is the baseline checklist used during a shift-change.

Anomaly Resolution Coordinator Hand-off (shift-change) Checklist		
Item	Who	What
1.	C	Summarize status of GP-B Space Vehicle. Current status and timeline. (review on-line daily status charts)
2.	C	Summarize status of each "open" anomaly. (review "anomaly" information in electronic notebook)
3.	C	Summarize status of each "open" observation. (review "observation" information in electronic notebook).
4.	C	Summarize status of ARB board staffing, flight director staffing, mission director staffing and on-call team members