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# g-LIMIT PR4 Systems Engineering



## Increment 3 Microgravity Science Glovebox Investigations Design Review



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## **g-LIMIT PR4 Agenda**



- Introduction Brad Perkins
- Project Status Clark Darty
- Systems Overview Brad Perkins
- Science Overview Mark Whorton
- Hardware Overview Dean Alhorn
- Controls Analysis Mark Whorton
- Thermal Analysis Srinivas Bukkapatnam
- Safety Keith Skinner
- Software Scott Akridge
- Kinematics Analysis Geoff Beech
- Manufacturing Jim Hester
- Review Process Ed Gollop



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## **g-LIMIT PR4 Scope**



- **PR3 Preboard directed g-LIMIT to:**
  - » Proceed with procurement of low risk parts
  - » Do not proceed with Dynamic Characterization Payload (DCP) or TRIAX accelerometer procurements
  - » Resolve software manpower shortages and costs overrun
- **PR4 Scope:**
  - » Delta CDR level for Hardware
  - » Software at CDR level
  - » Review includes interfaces and activities for g-LIMIT operations through Increment 3



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## Major Changes to g-LIMIT Since PR3



- DCP and TRIAX hardware deleted
- ORUs deleted
- One Science Requirement deleted (rejection of payload-induced disturbance)
- Sampling rate reduced from 1000 Hz to 500 Hz
- Reduction in software effort



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## **g-LIMIT PR4 Issues/Concerns**



- Hardware design is late, ~ 6 weeks (due to availability of parts and late communication problem between boards in PIP) {RED on stoplight chart}
- Late hardware design and Functional Equivalent Unit (FEU) jeopardizes software schedule (critical path) {RED on stoplight chart}
- Loss of avionics and software personnel threatens to further compromise schedule
- On June 1, Astrionics management actioned avionics lead and software lead to issue written assessment of impacts/risks
- Laptop/g-LIMIT software at PDR level. Original software developer resigned but has been contracted for support.
- Increment 4, I-16 PODF procedures are delinquent {RED on stoplight chart}
- Recovery plan will be formulated and presented to Preboard



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## g-LIMIT Team Membership



### ● Team Members:

- Clark Darty/SD46 Project Manager
- Brad Perkins/SD41 Systems Engineer
- Mark Whorton/TD55 Principle Investigator
- Dean Alhorn/ED17 Co-PI/Lead Designer
- Scott Akridge/ED14 SW Lead
- Frankie Jernigan/FD36 Operations Lead
- Mary Etta Wright/SD43 Test Lead
- Melanie Stinson/QS30 S&MA Lead
- Pat Ragland/ED43 CM Lead
- Jim Hester/ED37 Manufacturing



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## g-LIMIT Team Membership



NAME	ORG	LOCATION	PHONE / FAX #
Akridge, Scott	ED14	4487/B274	544-1510
Alhorn, Dean	ED17	4487/A100B	544-9093
Allen, Tim	TBE/rqts	offsite	726-5072
Baugher, Charles	SD43	4201	544-7417
Beech, Geoff	ED42	4487/C102	544-4118
Belt, JoAnn	Svt/Ops	Offsite	544-0548
Bissell, David		offsite	
Boxx, Dayna	Svt/Ther	offsite	971-9411
Broach, Tim	Svt/Int	4493	544-3231
Bukkapatnum, S	Svt/Ther	offsite	971-9413
Callicutt, Donna	Svt/Soft	4487/B279	544-3294
Chisler, Keith	CST	4201/422	961-0353
Darty, Clark	SD46	4201/336	544-2728
Gollop, Ed	PW	4487A222	544-6341
Harrison, Phil	ED21	4610/	544-1521
Hester, Jim	ED37	4705/A208	544-0690
Horton, Kathryn	ED23	4610/4023-A	544-6891
Jefferson, Pamela	ED27	4619	544-7083
Jernigan, Frankie	FD36	4610/2083	544-2487/
Kim, Young	TD55	4203/5227	544-1438/5416
Lanter, Gayle	ED22	4610/5019	544-4532/4-7234
Manley, Sharon	Svt/rqts	Offsite	726-2814
Montgomery, Randy	ED16	4487/C214	544-3713
Myers, George	TD55	4203/5232	544-1477/5416
Murphy, Lucinda	SD42	4201/439	544-7202
Newman, Larry	MCI	4487/B281	544-4841
Ogle, Julia	CST/Ops	Offsite	890-3016
Perkins, Brad	SD41	4201/210	544-1357/544-4716
Phillips, Ron	Svt/soft	4487/B281	544-3795
Ragland, Pat	ED43	4201/218A	544-6347
Roark, Walt	SD46	4201/340-E	544-8643
Robinson, Sally			
Roeske, Kathy	CST/ops	Offsite	890-3030
Sizemore, Rick	HEL/qual	4471/C101	544-2306
Skinner, Keith	HEL/safe	4471/A111	544-0987
Stinson, Melanie	QS30	4201/228B	544-5013
Sutherland, Tom	ED17	4487/AB205	544-7704/
Traylor, Lynn	ED43	4201/218A	544-5892
Varnavas, Kosta	ED13	4487/B231B	544-2638
Wegrich, Rich	ED35	4612/1412	544-2626
Weir, John	ED19	4487A135	544-3814
Whorton, Mark	SD41/ TD55	4201/212	544-1435/544-4716
Williams, Wendy	FD36	4610/2069	544-6885/4228
Wright, Mary Etta	SD43	4493	544-9362



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## **g-LIMIT PR4 Objectives**



- Review g-LIMIT Final Design
- Verify Design compatibility with Requirements:
  - » g-LIMIT Design Definition Document (DDD)
  - » g-LIMIT Requirements, Verification and Compliance (RVC) Document (Draft, Revision A)
  - » Interface Control document
- Ensure SW requirements are adequately documented and compatible with DDD and RVC
- Assess g-LIMIT documentation and analysis status
- Assess compatibility of g-LIMIT operating requirements with MSG integration and mission operations requirements and plans
- Authority to proceed with hardware fabrication and SW development



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## **g-LIMIT PR4 Review Team Structure**



- **PR4 Lead Subteam:**

- Review Team Lead :SD41/Brad Perkins
- Review and Database Administrator:ED43/Pat Ragland



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## **g-LIMIT PR4 Review Subteams**



- **Avionics Subteam:**

- » Lead: ED17/Jim Randolph
- » Computers: ED13/David Trice
- » Software: ED14/Luis Trevino
- » Electrical/cables: ED15/Art Davis
- » EEE Parts: ED16/C. Gamble, O. Myers

- **Science Subteam:**

- » TD55/Susan Elrod
- » TD55/Mark Darden

- **Structures, Mechanics, and  
Thermal Subteam:**

- » Lead: ED20/Jim Lindsey
- » Structural Dynamic and Loads:  
ED21/Richard Fischer
- » Strength Analysis: ED22/Lisa Barker
- » Structural Design: ED23/Michael  
Karigan
- » Thermal Analysis: ED25/Cindy  
Fortenberry
- » Dynamic Test: ED27/Bob Engberg



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## **g-LIMIT PR4 Review Subteams**



- **Systems Engineering Subteam:**
  - » Lead: SD42/Yvette Scott
  - » Verification: SD42/Tom Smith
  - » Test: SD43/Sam Ortega
  - » Materials: ED35/Mike Mitchell
  - » Fabrication: ED37/Jim Hester
- **Independent Assessment:**
  - » Ken Fernandez
  - » Gerald Nurre
- **Payload Operations and Integration Subteam:**
  - » Lead: FD35/Sam Digesu
  - » MSG Integration:
  - » Operations: Larry Bauer
  - » Training: Wendy Williams
- **Safety and Mission Assurance Subteam:**
  - » Lead: QS30/Melanie Stinson
  - » Safety: Susan Cantrell
  - » Quality: Marie Webb
  - » Reliability: Richard Sanders



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## g-LIMIT PR4 Preboard Membership



- SD46/James Poe Co-Chair
- SD42/Helen Grant Co-Chair
- SD42/Tom Smith GBX Systems Engineering
- SD46/Charles Baugher Science
- ED43/Pat Ragland Secretary
- ED17/Justino Montenegro Avionics/Software
- ED20/Pete Rodriguez Structures, Mechanics and Thermal
- ED37/Tim Vaughn Materials Processing and Manufacturing
- FD30/Irene Taylor Payload Operations and Integration
- QS30/Chris Cowart Safety and Mission Assurance



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## g-LIMIT PR4 Review Schedule



- Kick-off Meeting 6/5/00
  - » Distribution of Initial Data Package
- Distribution of Second Data Package to Sub-team Leads 6/12/00
- Screening Group Meetings, first 6/12/00  
second 6/19/00  
third 6/26/00
- RID Submittal Cut-off 6/23/00
- Preboard Meeting 6/30/00



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## **g-LIMIT PR4 Technical Data Package**



- **Non-Riddable Documentation:**
  - » g-LIMIT Requirements, Verification and Compliance Document (RVC), Rev A
  - » g-LIMIT Design Definition Document (DDD)
  - » g-LIMIT Phase II Safety Data Package
  - » Operations Concept Document
  - » SW Requirements Specification for PIP and IM, Rev A
  - » g-LIMIT Project Schedule
  - » PR4 Documentation List
  - » g-LIMIT ICD
  - » Control System Architecture and Algorithms for g-LIMIT
- **Riddable Documentation**
  - » Design Drawings
  - » Analyses
  - » Material Identification Usage List (MIUL)
  - » Mass Properties Report
  - » Software Design
  - » Software Verification
  - » Stowage List
  - » g-LIMIT User's Manual
  - » g-LIMIT Verification Plan



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## **g-LIMIT PR4 RID Guidelines**



- A Valid Rid identifies the following discrepancies:
  - » Design does not meet a requirement
  - » g-LIMIT subsystems are not compatible
  - » Required information consistent with this milestone has been omitted
- Non-RIDs include:
  - » Comments
  - » Grammatical or spelling changes
  - » Product improvements or alternate design approaches
  - » Deficiencies noted in Reference or Baseline Documents



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## **g-LIMIT PR4 Review Approach**



- **PR4 Lead:**
  - » Serves as the Coordinator for the overall review
  - » Acts as the Facilitator for the Screening Group
- **PR4 Review Data Base Administrator:**
  - » Responsible for tracking all RIDs
  - » Coordinates with the g-LIMIT Design Team to obtain Developers comments (Block 14)
  - » Maintains minutes of the Screening Group meetings



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## **g-LIMIT PR4 Review Approach**



- **RID Initiator:**

- » Identify issue and coordinate with the designer and/or document author to clarify
- » If issue is not resolved, then generate RID that meets RID criteria using the automated MSFC RID system
  - Once RID is entered into the tracking system, RID flow and initiator responsibilities are described in the CM portion of this presentation



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## **g-LIMIT PR4 Review Approach**



- **Screening Group:**

- » Consists of the PR4 Review and Subteam Leads
- » Review all RIDs for Completeness, Clarity and determine if meets criteria for valid RID
- » Screens for Duplicate RIDs
- » Assign Subteam responsibility for each RID



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## **g-LIMIT PR4 Review Approach**



- **Screening Group:**

- » Determines which RIDs must be presented to the Preboard based on following criteria:
  - Cost and/or Schedule impact
  - Disapproved RIDs or RIDs recommended for Study
  - Controversial RIDs, including RIDs that the initiator disagrees with the team recommendation



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## **g-LIMIT PR4 Review Approach**



- **Subteam Leads:**

- » Review RIDs assigned from the Screening Group
- » Determine Team Recommendation
- » Present subteam RIDs to the Screening Group with Team recommendation
- » Present impact, disapproved, and/or controversial RIDs from respective subteam to Preboard