NASA/GSFC Safety & Mission Assurance Directorate

GSFC Supplier Surveillance

Presented by:
Michael P. Kelly
Acting Chief, Mission Support Division, Code 320

October 19, 2011

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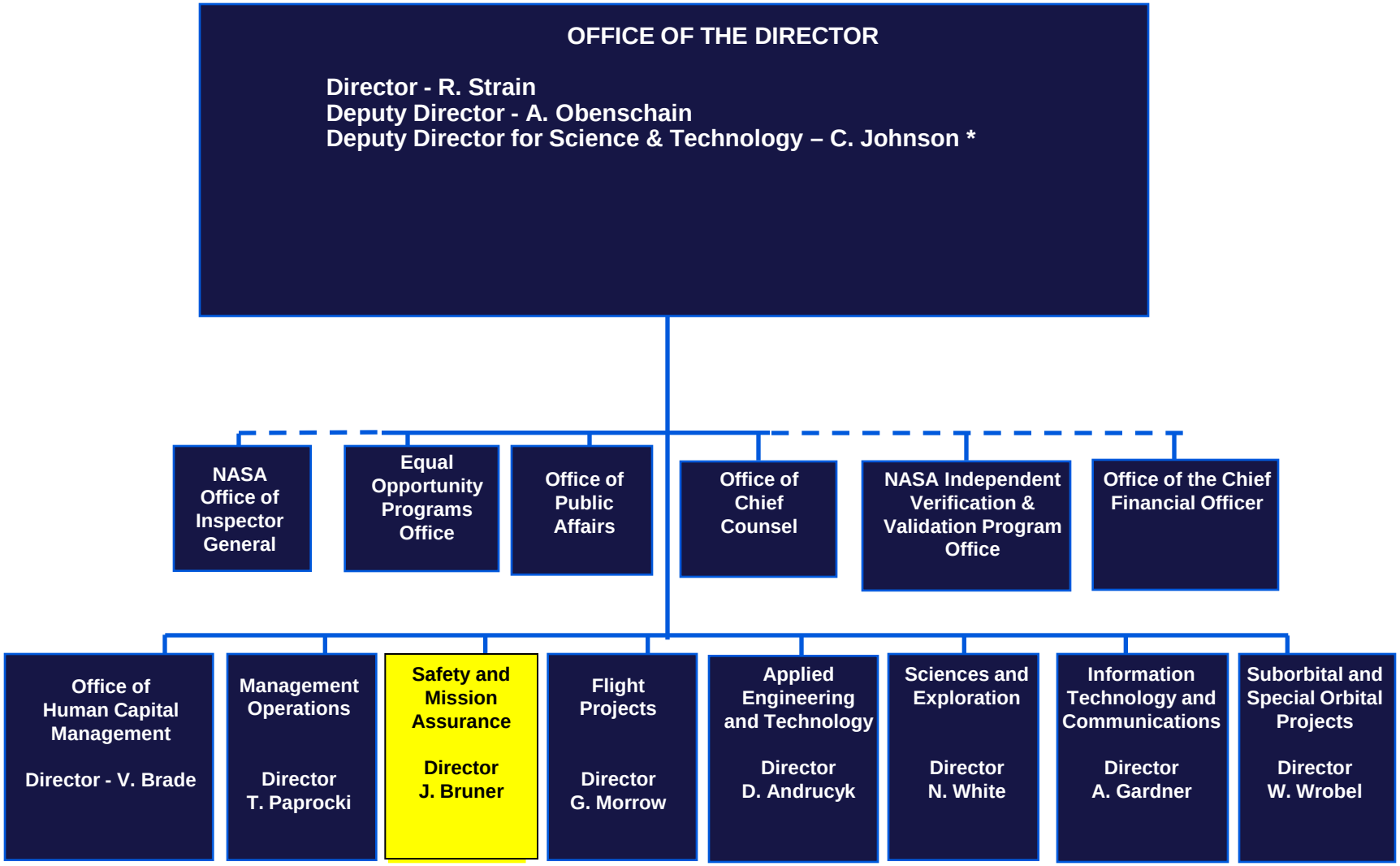
NASA GSFC Organization



* 12/03/2010 Christyl Johnson recently assumed position

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(Director)

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Systems Review Office (SRO) Scope

The Systems Review Office (SRO) supports Center and Agency leadership in the independent review and assessment of projects per NASA and GSFC directives and standards.

Independent reviews are performed at critical milestones during the life cycle of flight and flight support systems.

The SRO conducts and/or participates in the review of the overall mission design and operations, integrated payloads, spacecraft, instruments, flight support-ground based systems, and launch vehicle systems for projects implemented by the GSFC.

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GSFC Supplier Assessments
Code 302

- Conduct independent assessments of suppliers for mission programs/projects and operations to promote and assure the provision of quality products and services for NASA mission projects
  - Assess conformance with contractual requirements and quality management standards (i.e., ISO 9001, AS9100) and the effectiveness of supporting processes
  - Report and share assessment findings with GSFC mission projects, across NASA and other agencies
  - Monitor / verify supplier corrective actions and improvements
- Perform ~50 assessments per year throughout the supplier base for GSFC mission projects
  - Primes and lower tiers: systems integrators/developers, and suppliers of subsystems, components and parts
- Completed assessments of 115 unique suppliers since 2007

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Software Assurance Staffing

- Code 300 Software Assurance (SA) is performed by Software Assurance Engineers (SAEs), Project Safety Managers (PSMs), and Software Reliability Engineers in the Mission Assurance Division
- SA personnel are matrixed to projects
- IV&V is performed by personnel from the NASA IV&V Facility (Code 180) in Fairmont, WV
- The Chief Safety and Mission Assurance Officers (CSOs) and/or SA Lead determine the amount of software assurance to be applied to each project commensurate with the software's size, complexity, classification and safety criticality assessment
- Currently 22 Software Assurance personnel supporting 26 GSFC projects with Class B software
  - 4 Civil Servants – includes a Software Safety Lead and Software Reliability Lead
  - 18 Contractors

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Code 321 Systems Safety Branch Charter

- Support implementation of systems safety over the program life cycle for GSFC managed space flight missions.
  - Life cycle for system safety analysis is Phase A up through safe separation from launch vehicle – after that it's mission success
  - Early identification and resolution of safety related issues.
  - The Branch provides Project Safety Managers to each project to assist in
    - defining and interpreting safety requirements
    - developing solutions to safety issues to enhance the likelihood of safely achieving mission success.

- The Branch works to policy guidelines set by NASA Headquarters and the Center, and to safety implementation requirements set by the Agency, OSHA, the ISS Program Office and the various launch range authorities (AF, ESA, JAXA, etc.).

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Code 322
Reliability & Risk Analysis Branch
Key Responsibilities

Reliability Requirements Planning:
- Proposal
- Contract
- SOW
- Mission Assurance Requirement (MAR)
- Reliability Program Planning (RPP)*
- Data Collection
- Test Planning and Assessment

*includes PRA Planning

Surveillance:
- Internal and external surveys/audits
- Analyses/assessment report approval
- Reviews (e.g., Peer, Mishap Investigation, etc.)
- Reliability and PRA working group leadership
- Technical Interchange Meetings (TIMs)

Assessments/Analyses:
- Reliability Modeling, Simulation, and Predictions
- Failure Modes & Effects Analyses (FMECA/FMEA)
- Probabilistic Risk Assessment (PRA)
- Fault Tree Analysis (FTA)
- Trade Studies/Evaluations
- Limited-Life Analysis
- Lifetime/Trending Analysis
- Parts Stress and Derating Analysis
- Worst Case Analysis
- Fault Management

Consultation:
- Training
- Failure Investigations/Root Cause Analysis
- Problem and/or risk resolution

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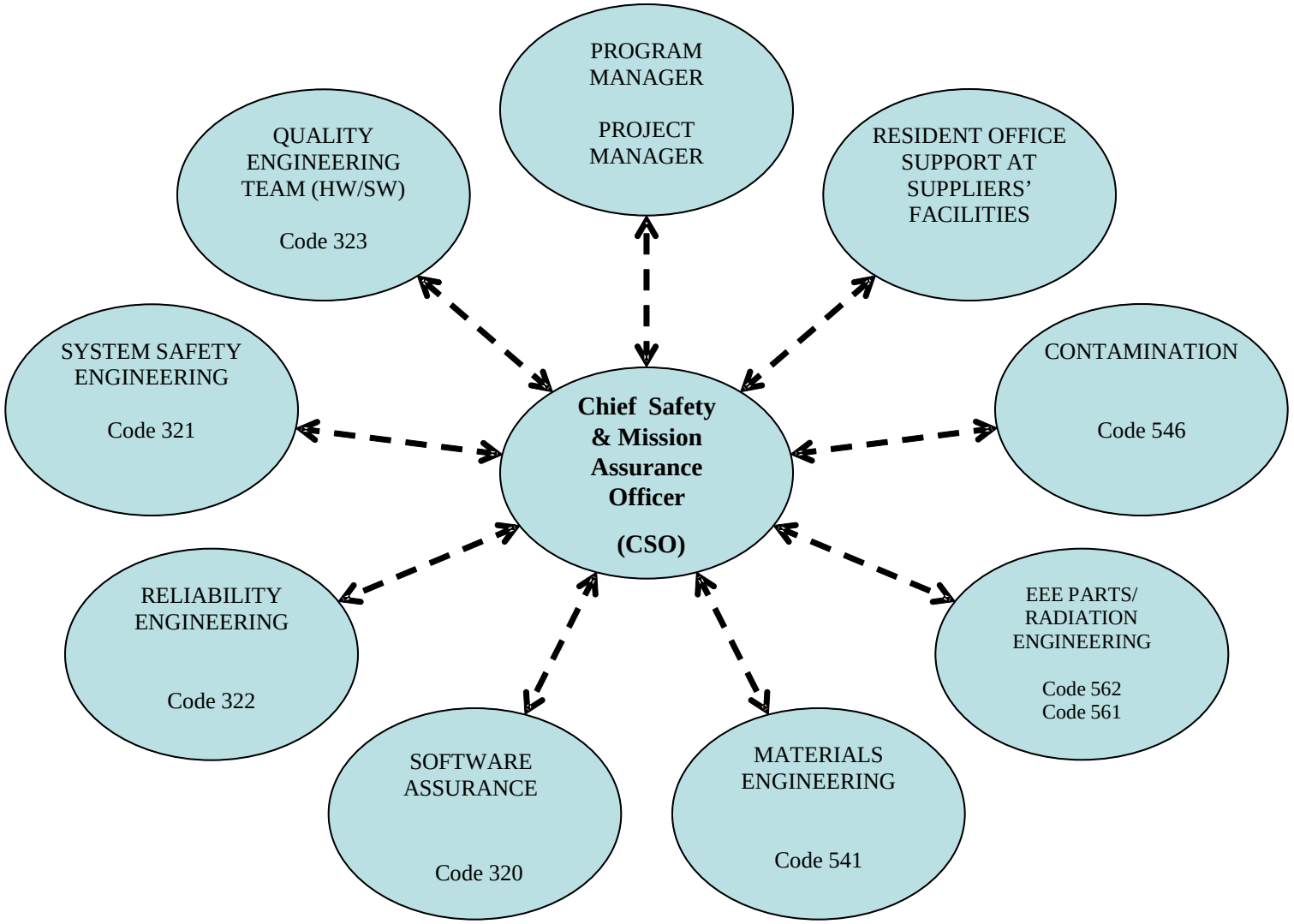
How Code 300 Organization Interacts With GSFC Projects



Code 323 Mission Assurance Branch Organization Functions

Chief Safety and Mission Assurance Officer CSO

- CSOs assigned to Projects
  - Co-located with Projects
  - Reports to Project Manager (dotted line)
  - Assurance program includes Quality Assurance, S/W assurance, Safety, Reliability, Workmanship, Risk Management, Parts, Materials
- Reports independently back to Code 300
- Works Project for the full life-cycle from Concept through Launch
- Manages assurance program for both in-house and out-of-house Projects
- Generates and implements Mission Assurance Requirements (MAR)

Organization Functions

CSOs cont'd

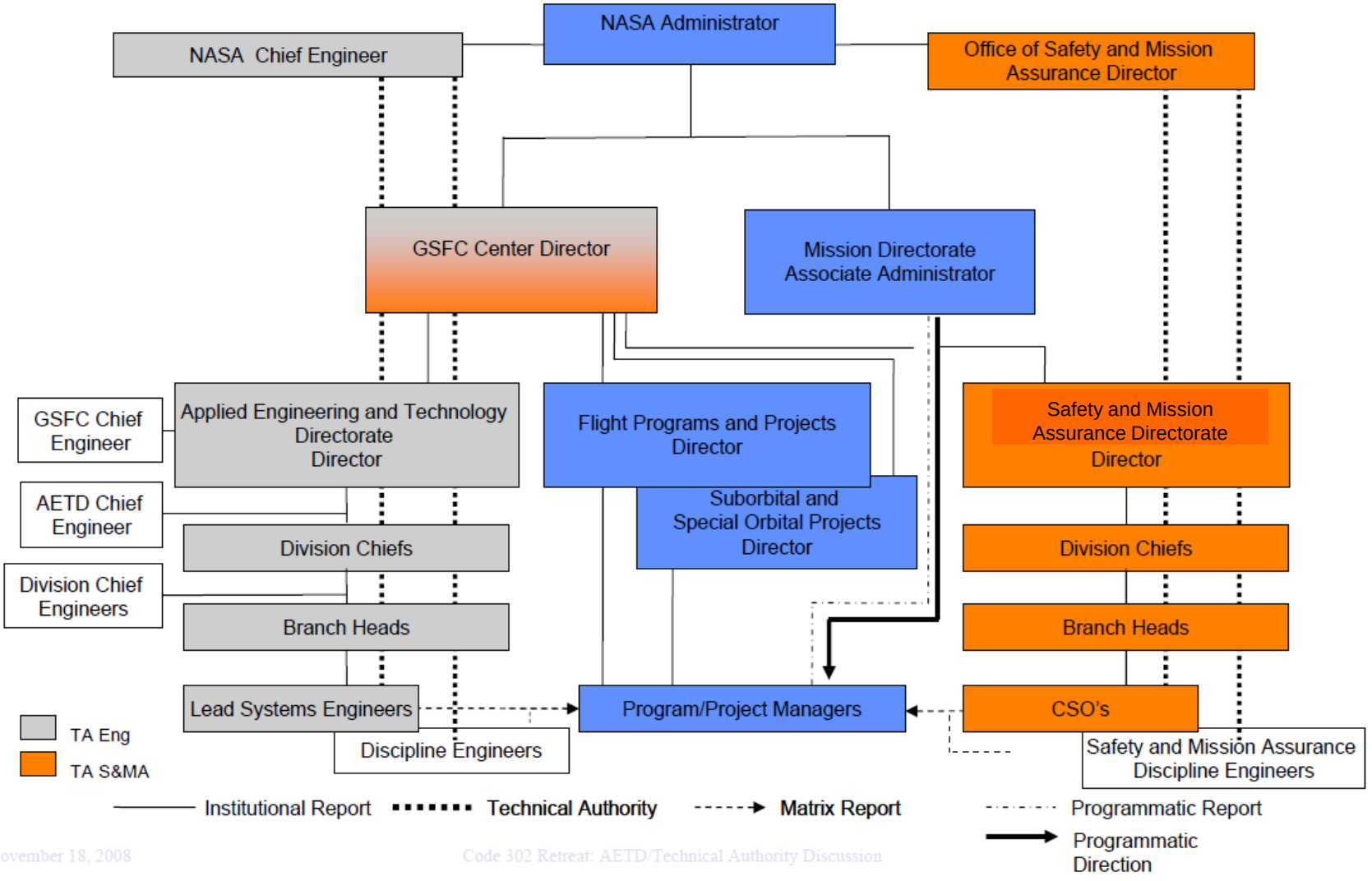
- Lead for Problem Report/Problem Failure Report (PR/PFR) System
- Lead for Work Order Authorization (WOA) implementation (IAB)
- Responsible for manufacturing and QA oversight of Project contractors by utilizing:
  - Defense Contracts Management Agency (DCMA)
  - NASA Contractor Assurance Services (NCAS)
  - Code 300 Support Contractors
  - Audits
- Works with Systems Safety Engineers to implement project safety program
- Works with Reliability engineering to implement project reliability program

Organization Functions

CSOs cont'd

- Member of Parts Control Board. Works closely with Code 562 Parts Engineers.
- Implements Government-Industry Data Exchange Program (GIDEP) compliance and dispositions
- Works with Code 541 Materials to determine acceptability of printed wiring boards by coupon evaluation
- Ensures parts and materials lists are thoroughly reviewed and acceptable for use.
- Coordinates radiation requirements and implementation with Code 561 (Radiation Effects)
- Implements Workmanship Standards such as soldering, cabling, harnessing, conformal coating

SMA Operates To
NASA Governance Model



Support at Suppliers

- Develop Program/Project Quality Assurance Surveillance Plans
- The work activities performed by the developer and/or his suppliers are subject to evaluation and audit by government-designated representatives.
- CSO supports project by selecting on-site supplier representative's by one of several methods:
  - (1) a Defense Contract Management Agency (DCMA) person via a Letter Of Delegation (LOD),
  - (2) an independent assurance contractor (IAC) via a contract
    - Audits, Assessments, and Assurance (A3) Contract
    - Code 300 Mission Assurance Support Contract (MASC)

Code 300 Watch list

- Code 300 maintains a “Watch list” of mission assurance items that have potential application across Projects (sample below).
- “Recommended Actions” are provided.
- CSOs have responsibility to log in to application and respond to each item prior to launch. Currently there are 26 items in the list.
- CSO determines impact, disposition and status and submits a “closure rationale” to the system administrator. The administrator officially closes the item for each Project.

Item No.	Title	Status	Description
1	Circuit Card Assemblies (CCA) have failed during testing due to incorrect part values being installed	Closed	Small surface mount components that do not have any part markings or identifiers makes it possible for incorrect part/values to be installed and go undetected during visual inspection. Improperly installed component values could potential lead to latent failure(s) due to part/circuit degradation over the missions lifetime or during the test cycle when expose to thermal conditions. How are unmarked parts being verified (part values and locations)? Note: Old Watch List ID # 03/07-01
2	Cracked capacitors post hand soldering	Closed	Cracks have been found post visual inspection on capacitors (CDR35, 100V, 0.1 / 55681 package) that have been hand soldered, using solder iron. Cracks may be the result of thermal shock (including cool down)/handling. Sample Image of Cracked Capacitor is attached for reference. Note: Old Watch List ID# 03/07-02
3	Floating Inputs	Closed	All devices should have properly terminated floating inputs (Ref. 500-PG-8700.2.7). Also, need to verify requirement is being flowed down to subcontractors. Note: Old Watch List ID# 04/07-01

Standard MAR – Used to Develop SMA Requirements

- The CSO uses as a guide the Standard MAR as a tailoring tool and consults with functional disciplines in Codes 301, 302, 320 and other GSFC organizations to develop the MAR for their Instrument, Spacecraft, and Ground System.
- Missions are classified as “A” (high priority, minimized risk level) through “D” (low priority, higher risk level is tolerated). – see next slide
- The Standard MAR, including the requirements narrative and DIDs, are available on the Agency's PBMA web site in a community work area called "Goddard Mission Assurance Guide.“
- 320-MAR-1001 version C was released 03/14/2011 and is under CM. Version D will be released shortly.
- 320-WI-7120.1.1B, Project Mission Assurance Requirements (MAR) Preparation establishes relevant procedures and processes for its use.

NPR 8705.4 Appendix A: Subject: Risk Classification for NASA Payloads

Characterization	Class A	Class B	Class C	Class D
Priority (Criticality to Agency Strategic Plan) and Acceptable Risk Level	High priority, very low (minimized) risk	High priority, low risk	Medium priority, medium risk	Low priority, high risk
National significance	Very high	High	Medium	Low to medium
Complexity	Very high to high	High to medium	Medium to low	Medium to low
Mission Lifetime (Primary Baseline Mission	Long, >5years	Medium, 2-5 years	Short, <2 years	Short < 2 years
Cost	High	High to medium	Medium to low	Low
Launch Constraints	Critical	Medium	Few	Few to none
In-Flight Maintenance	N/A	Not feasible or difficult	Maybe feasible	May be feasible and planned
Alternative Research Opportunities or Re-flight Opportunities	No alternative or re-flight opportunities	Few or no alternative or re-flight opportunities	Some or few alternative or re-flight opportunities	Significant alternative or re-flight opportunities
Achievement of Mission Success Criteria	All practical measures are taken to achieve minimum risk to mission success. The highest assurance standards are used.	Stringent assurance standards with only minor compromises in application to maintain a low risk to mission success.	Medium risk of not achieving mission success may be acceptable. Reduced assurance standards are permitted.	Medium or significant risk of not achieving mission success is permitted. Minimal assurance standards are permitted.
Examples	HST, Cassini, JIMO, JWST	MER, MRO, Discovery payloads, ISS Facility Class Payloads, Attached ISS payloads	ESSP, Explorer Payloads, MIDEX, ISS complex subrack payloads	SPARTAN, GAS Can, technology demonstrators, simple ISS, express middeck and subrack payloads, SMEX

NOTES:

1. Mission impact; i.e., loss of function effect on other payloads or ISS operations may also be a characterization factor. For example, loss of the function of freezers and centrifuges may impact other payloads and increase the overall level of risk.
2. The safety risk to crew inherent in the operation of a human-crewed vehicle may be a factor in payload classification determinations. Class C and D payloads that have a medium or high risk of not achieving mission success may be considered unsuitable for launch on a crewed vehicle, unless they are secondary payloads making use of available launch capacity that would otherwise go unused.
3. Other situation-dependent payload classification considerations may include human-rating environment, logistics support, and interoperability interfaces.

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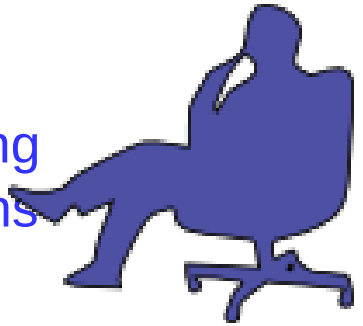
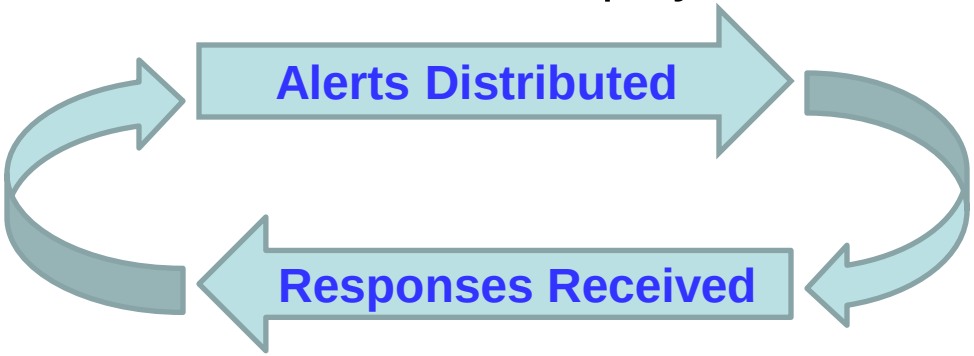
Incoming GIDEP Document Process

- Per NPR and GPG requirements, an engineering review of the following documents is performed: Alerts, Safe-Alerts, Problem Advisories, and Agency Action Notices. In addition, NASA Advisories (NASA document for exchanging significant parts, materials and safety problems or concerns among NASA activities) are reviewed.



- Based on review, the documents are distributed as appropriate by the project CSO.
- Project (or affected Code) responses are required and documented in GSFC closed loop system.



Organization Charter

Provide engineering and assurance expertise for printed wiring assembly and cable harness assembly processes that are used in the manufacturing of electronic hardware for space flight application.

Provide support to NASA HQ

- Maintain five **NASA-STD-8739 requirements documents**.
- Help resolve Agency-level waiver requests
- Help resolve Agency-level audit findings
- Keep Western and Eastern Training Centers aligned with policy

GSFC Project Support

- Help resolve non-compliances in flight hardware
- Resolve assurance rules for new and non-standard assembly methods
- Manage GSFC ESD Control Program
- Capture and share GSFC Packaging Rules and Best Practices

YOU ARE INVITED TO ATTEND!





GSFC 300 Safety and Mission Assurance Directorate (SMA-D) Overview

When: November 9, 2011

Where: Goddard Space Flight Center

Who may attend? Anyone who needs/wants insight as to what SMA-D does for the Center and the Agency.

Interested? Send email to Catherine Bower to be added to future notifications: catherine.e.bower@nasa.gov

Go to: http://sma.gsfc.nasa.gov/ for more information

Backup Slides to list NASA Policy

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- CHAPTER 1. Introduction
  - 1.1.3 NASA may perform Government contract quality assurance functions directly, may delegate these functions to non-NASA Federal agencies, or assign these functions to quality assurance support contractors.
  - 1.2.4 Program and/or project managers are responsible for the quality of their assigned products and services. To that end, they shall:
    - c. Develop Program/Project Quality Assurance Surveillance Plans (PQASP) per Chapter 3 of this NPR using input/support provided by the Center SMA office.

continued on next slide

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- 1.2.7 The NASA SMA Lead appointed by the program/project manager or the Center SMA Director shall...
  - b. Support the program/project manager and contracting officer in the development of the PQASP, LODs, and/or quality assurance support contracts

Note: For GSFC, GPR 5100.4D, "Supplier Quality Audits", section P.1: "This procedure defines the GSFC supplier quality audit process, including use of the on-line tool for audit process management."

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- CHAPTER 2. Government Contract Quality Assurance Requirements
  - 2.4.1 Contractor hardware products shall be assured by product examination, process evaluation, and record review...
  - 2.5 Quality System Evaluation
    - 2.5.1 The contractor's quality system shall be reviewed to ensure compliance with invoked quality program requirements, including internally developed procedures. …

continued on next slide

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- Chapter 3. Program/Project Quality Assurance Surveillance Plan (PQASP)
  - 3.2.1 The PQASP shall...
    - b. Be a consolidated and integrated document (i.e., not divided among various/separate documents) . The PQASP may be a part of a larger program/project safety and mission assurance plan or may be a stand-alone document.
    - d. Be initially prepared in conjunction with preparation of the Statement of Work...

continued on next slide

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- 3.2.2 The PQASP shall contain: ... *(examples)*
  - 3.2.2.4 Surveillance Functions. Identify the quality assurance surveillance functions to be performed for the program/project in accordance with Chapter 2 of this NPR and the following... *(examples)*
    - Identify specific product examinations to be performed
    - Identify specific processes to be witnessed
    - Identify contractor records to be reviewed
    - List all required GMIPs

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- Chapter 5. NASA Letters of Delegation
  - ...LODs ...identify specific delegated Government contract quality assurance functions. LODs are the authoritative link between NASA and the delegated agency.

Note: For GSFC, GPR 5100.3F, "Quality Assurance Letter of Delegation", section P.1: "This procedure defines how to prepare and issue requests for quality assurance support to agencies authorized to represent the GSFC at supplier facilities..."

NASA Policy - NPR 8735.2 A

Management of Government Quality Assurance Functions for NASA Contracts (w/change 1, dated 8/9/2010)

- Chapter 8. Government Mandatory Inspection Points (GMIPs)
  - 8.2.1 Program/project Offices, with NASA SMA Lead and SMA office support, shall define GMIPs based on an analysis of risks related to contract noncompliance.
  - 8.4 d. Contracting officers shall include in contracts a statement expressly prohibiting the contractor from continuing work operations planned subsequent to the performance of designated safety-critical GMIPs until Government accomplishment of the mandatory inspection point.

Note: For GSFC, see 320-PG-5330.1.4B, "Guidelines for Establishment and Management of Mandatory Inspection Points"

Code 320: 320-MAR-1001C

Standard Mission Assurance Requirements

- 1.6 (General) Surveillance: The developer shall grant access for NASA and NASA assurance representatives to conduct an audit, assessment, or survey upon notice.

  The developer shall supply documents, records, equipment, and a work area within the developer's facilities.

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- 2.2 Supplemental Quality Management System Requirements

  – 2.2.1 Control of Nonconforming Product: Control of Nonconforming Product – The developer shall have a documented closed loop system for identifying, reporting, and correcting nonconformances.

  – 2.2.2 Tailoring note: Consideration should be given to whether GSFC membership is required on MRBs.

  – 2.2.3 Reporting of Anomalies: The developer shall have a documented process for reporting anomalies. The developer shall report hardware anomalies beginning with the first application of power at the component level, software anomalies beginning with flight software acceptance testing and when interfacing with flight hardware, and mechanical system anomalies beginning with the first operation.

    Tailoring note: Consideration should be given to whether GSFC membership is required on FRBs.