

# Overview of Strategic Changes to NPD 8730.5 and NPR 8735.2 NASQ Quality Assurance Policies

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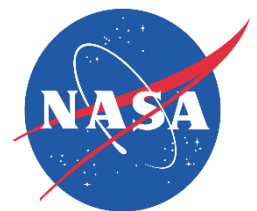
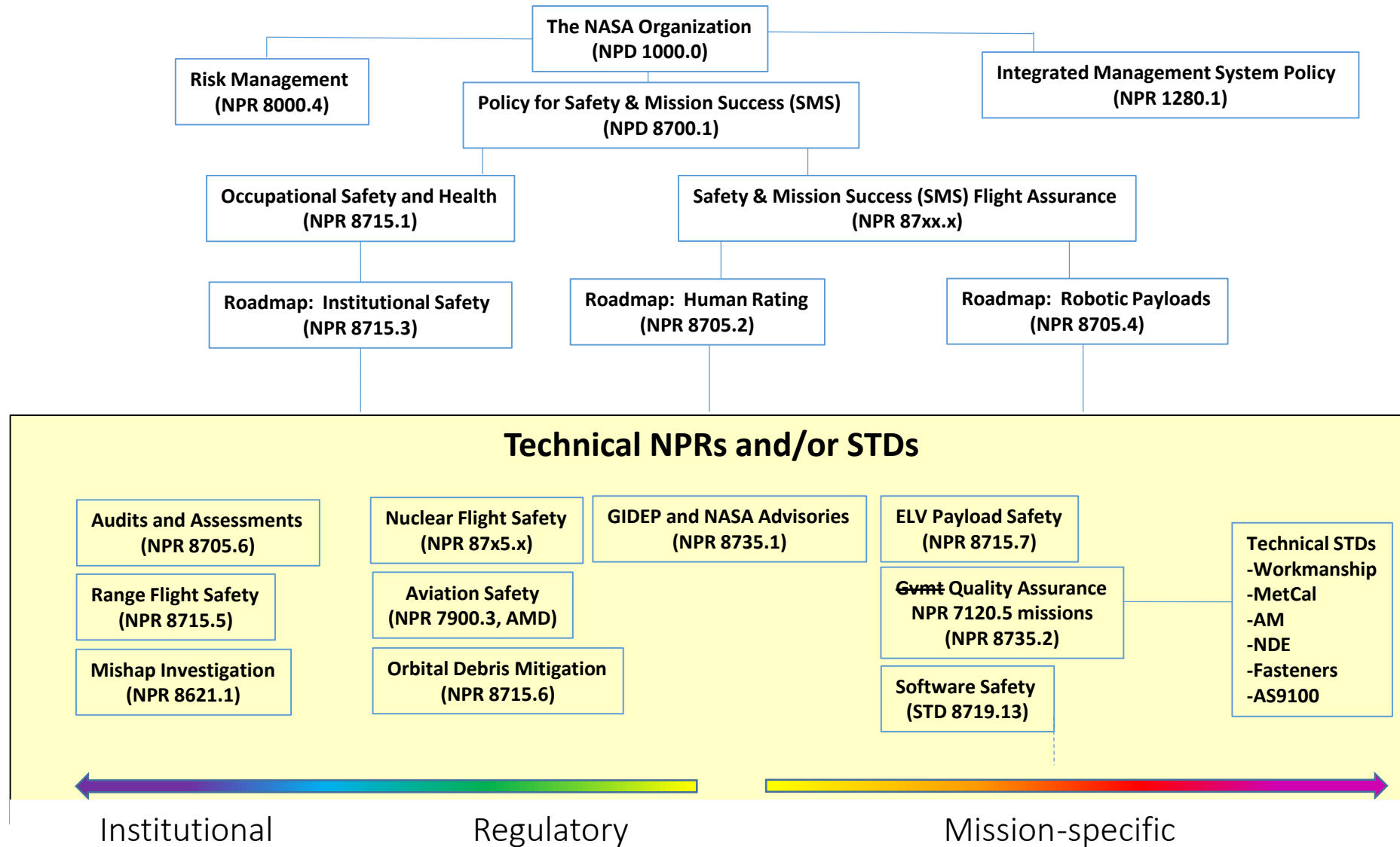
NASA Quality Engineering Technical Fellow

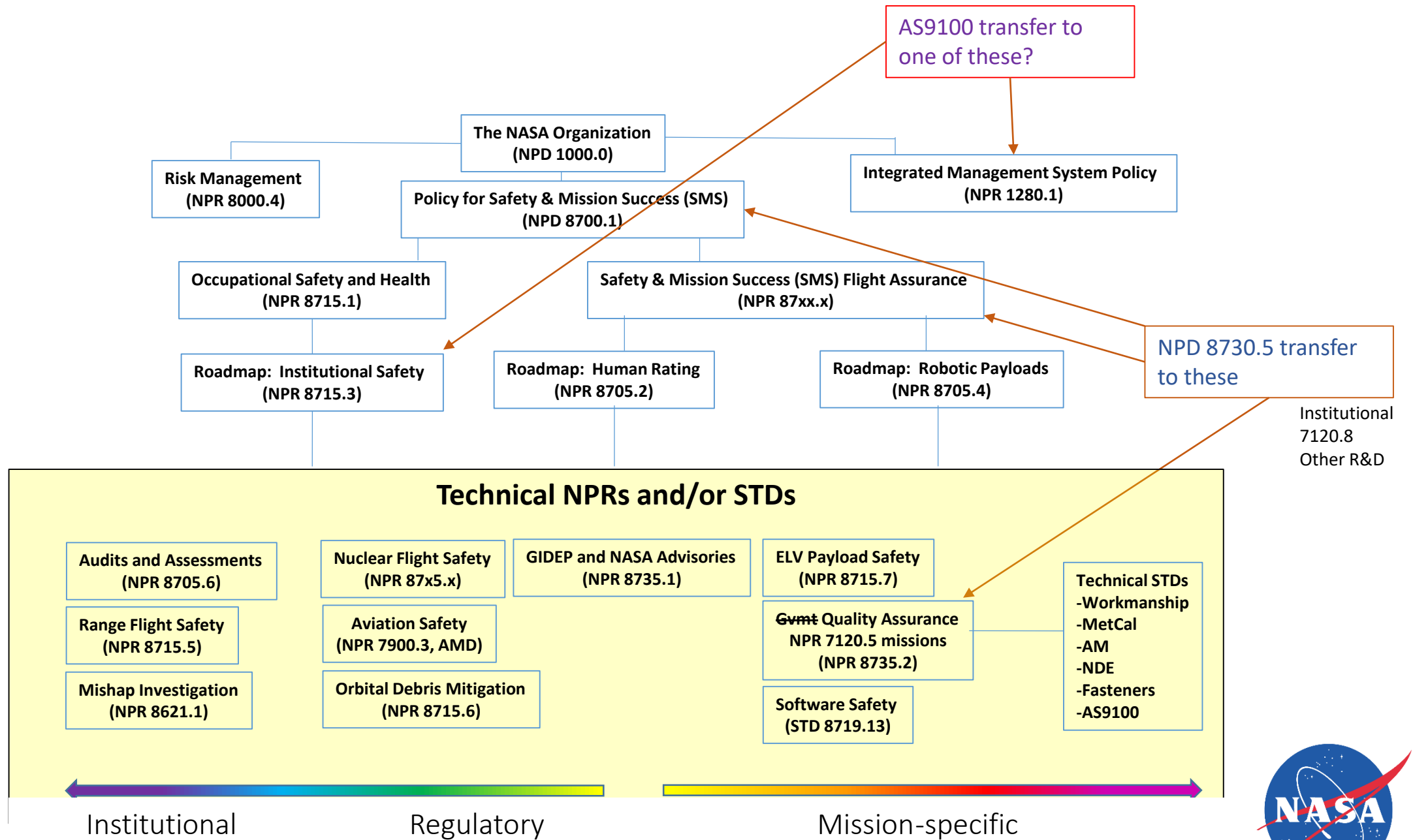
Quality Leadership Forum

March 13-14, 2019

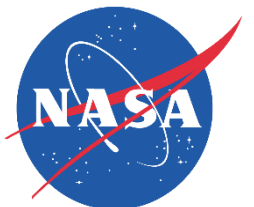
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# New (evolving) SMS / SMA Document Structure Proposal





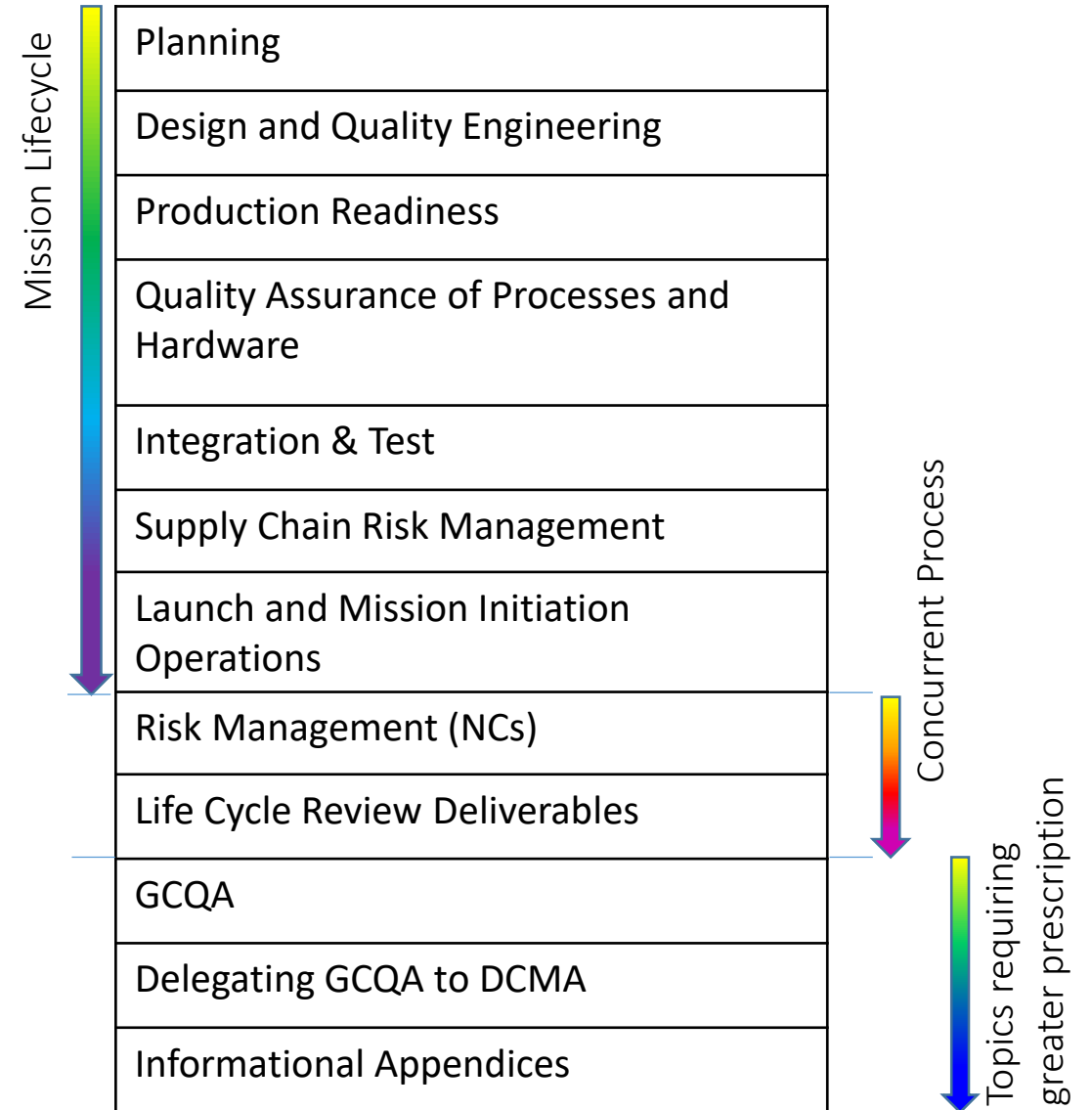
Institutional  
7120.8  
Other R&D



## (Notional) Simplified AS9100 Model for NASA Quality Assurance

Plan	Quality Assurance Surveillance Planning
Analysis	Cross-Discipline Design Considerations
	Critical Items, Critical Processes
	Key Characteristics
	Process Controls
	Verifications & Tests
	Supplier Risk Management
Manufacturing Readiness	Traceability & Configuration Control
	Documentation & Records Control
	Process Change Control
	Special Process Qualification
	Metrology and Calibration
	Personnel Competency & Training
Supply Chain Management	CI/CP Assurance Flow-down
Production	Incoming Part and Material Certification
	Preservation of Product
	Verification of Process Controls Realized
	Product Quality Inspection
	As-built Hardware Certification
Risk Management	Risk Management Processes
	Self Audit, 2nd and 3rd Party Audits

## (Notional) Simplified 7123.1 Lifecycle Model for NASA Quality Assurance Programs



# Purpose

Ensure **consistent implementation** of NPD 8700.1 (SMS) and NPD 8730.5 (QA)

by **NPR 7120.5** managed Programs and Projects (Prog/Proj) and

*Companion with the 7120.5 lifecycle review and risk management processes*

Not applicable to: NPR 7120.8 managed Projects, aeronautics activities outside of 7120.5 system, R&D, Do No Harm

by **Suppliers:** NASA Centers and External Suppliers

# Scope

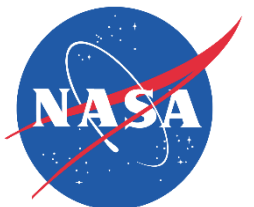
Boilerplate: NASA Centers, JPL, when specified in Space Act Agreements, etc.

All mission phases defined in NPR 7123.1, *NASA Systems Engineering Processes and Requirements*

Quality Engineering processes: controls, verifications, limits

Quality Assurance processes: evaluating supplier capabilities, risks, and production results

Not: Software or IT services



# Primary Audience

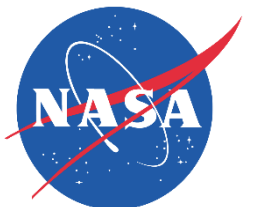
**Program and Project managers:** Responsible for establishing and executing the QA program; and for managing risk.

**Prog/Proj Chief Safety and Mission Assurance Officer (CSO):** Responsible for continuous evaluation of the sufficiency of the QA program and risk management for meeting Prog/Proj safety and mission objectives (i.e., SMA Technical Authority)

**SMA Directors:** Responsible for establishing the Center's standards for implementing QA policy for all Progs/Projs assigned to the Center.

*Tailoring approval by SMA Director required*

**Prog/Proj QA Manager:** **New role** proposed in this revision. Shall not be the CSO (conflict of interest).



# Applicability

This standard applies to critical work as defined by: **Criticality**

**Critical Item**

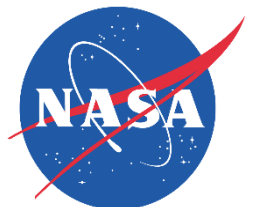
**Mission Critical** (Harm to mission success)

**Critical Process**

**Safety Critical** (Harm to humans only, used for requirements unique to human rated missions )

Retired: “non-critical”, “complex”, “non-complex”

Criticality Assessment used for focusing QA resources



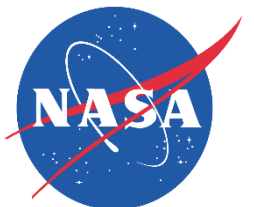
# Tailoring

NPD 1000, para 3.4.1.2.2 REQUIREMENT TAILORING, states:

*Tailoring is both an expected and accepted part of establishing proper requirements. All tailoring authorizations are approved and concurred by the appropriate Programmatic and Institutional Authorities.*

*It is NASA policy that all prescribed requirements (requirements levied on a lower organizational level by a higher organizational level) are complied with unless relief is formally granted.*

NPR 8705.4 will provide roadmap for tailoring – ***Draft in Process***






# Center Quality Management System

QMS that is tailored for Center's processes, includes component facilities, customer is assumed to be 7120.5 Prog/Proj

- Compliant with AS9100
- GIDEP and NASA Advisory prescreening of procurements
- Counterfeit avoidance
- ESD program
- MetCal program
- NASA-STD-6008 fastener controls
- Collect and use quality data in a crosscutting manner
- Pb-free [tin and tin alloys] and metal whisker controls



Quality Assurance Infrastructure  
of Center as *supplier* to  
Prog/Proj *customer*

These may lie within Prog/Proj domain *or* QMS

- Supplier risk management program
- Data management and records
- Preservation of product
- Storage, packaging, shipping

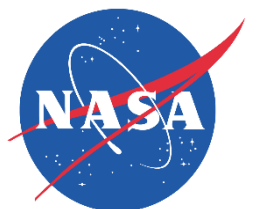
## 7120.5 Programmatic vs Institutional

1.2.3.1: Programmatic flows from Agency's strategic [mission] planning

1.2.3.2: Institutional focuses on how NASA does business, see NPDs, NPRs, NSTDs, Center policies.

# Quality Assurance Requirements in the Mission Lifecycle Sequence

Planning
Design and Quality Engineering
Production Readiness
Quality Assurance of Processes and Hardware
Integration & Test
Supply Chain Risk Management
Launch and Mission Initiation Operations
Risk Management (NCs)
Life Cycle Review Deliverables



# Project QA Program: Planning

QA Program strategy

SMAP

QA Manager and QA Personnel  
Budget

FAR clause strategy

Data and records management

Criticality: List or Method

- Prog/Proj QA Program Requirements
  - Documented in a SMAP
  - Enable flow down
  - Realize safety objectives
  - Considers quality criteria when evaluating TRL and manufacturability
  - Tailoring approval by SMA Director, concurrence by CSO (SMA TA)
- Adequate resources
- **Assign a QA Manager**
- **Supplier risk management strategy** (availability and quality risks)
- QA strategy drives selection of FAR and NFS clauses.
- **Define method for identifying Safety-critical and Mission-critical**, personnel can identify critical items
- **QA data management approach**
- Quality documents and records included in Prog/Proj CM system
- System for traceability of QA inspection records (to inspector, date, requirements, marking, etc.)
- Training or certifications defined by applicable technical standards held by:
  - supplier personnel: operators and inspectors
  - project personnel: inspectors
- The FAR defines GCQA as a second party activity (no supplier-performed GCQA)
- Inspectors shall not check their own work

# Procurement Strategy

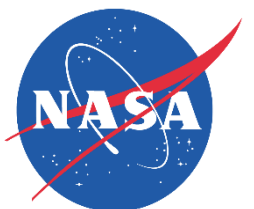
Progs/Projs must decide **strategy for contract clauses and contract administration**.

The Prog/Proj makes risk-based decisions about **when and how to execute government contract quality assurance (GCQA) activities and acceptance at source**.

NF 1707 form changes planned.

Development of STEP Training Course being considered

QMS is appropriate place to store standard uses of FAR clauses for QA.



# Project QA Program: Design and Quality Engineering

Key attributes

Verification methods

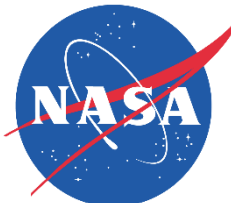
Pass/Fail criteria

Risk: manufacturability,  
availability, supplier

Parts, Materials Certification  
criteria

Supplier QE/QA Implementation  
Plans

- Critical items shall be identified
- Design process shall produce quality specifications and requirements (QE):
  - Key attributes
  - Verification methods to be used
  - Pass/fail criteria for verifications
    - *Default are those in NASA and adopted VCS technical stds.*
    - *Project must fill needs not met by default stds*
    - *CSO concurrence required for use of alternate technical stds.*
  - Certification and/or acceptance requirements (e.g., EIDP, ADP)
- Required implementation plans:
  - QA Plan (for system integrators)
  - PQASP
  - Manufacturing, verification and test
  - Contamination control
  - Pb-free control
- Supplier assessment and risks mitigations (SAS, GIDEP, SCRM section)
- Design Review Criteria
  - Key attributes and verifications defined and documented
  - Specifications:
    - *Are complimentary across systems and manufacturing approaches*
    - *Sustain traceability to qualification conditions*
    - *Support safety and reliability objectives*
  - High likelihood of manufacturability
  - High likelihood of robustness with handling and test stresses
  - High confidence in parts, materials, subassembly availability



# Project QA Program: Production Readiness

Supplier use of CM

Document & data controls

Hardware item controls

Rapid management of emerging quality issues

Process qualification

MetCal program

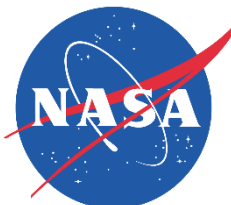
Preservation of Product

ESD Control Program

PRRs

- PRRs used at Prog/Proj discretion
- Require suppliers to:
  - Implement CM per SAE EIA-649
  - QA record-keeping that enables rapid management of crosscutting quality issues (GIDEP, test fails, other projects)
  - Prog/Proj-compatible identification and marking systems
  - Segregate nonconforming items
  - Document critical technical requirements, specs, instructions, etc.
  - Qualify special processes based on programmatic or technical risk
  - Meet NS 8739.12 MetCal program requirements
- Preservation of Product.
  - Prevent:
    - *Unapproved operations, failure to follow procedures*
    - *Contamination*
    - *FOD*
    - *Lack of tool, fixture, equipment controls*
    - *Lack of environmental controls; both ambient and test*
    - *Nonconforming packaging, handling, shipping materials and processes*
  - ESD Control per NS 8739.6 and ANSI/ESDA S20.20
  - Personnel empowered to stop work for imminent safety threat

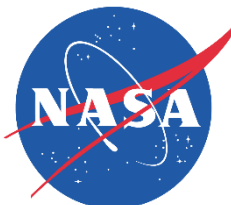
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# Project QA Program: Production Readiness (cont.)

Table 6-1 Additional Entrance and Success Criteria Applicable for PRRs

Entrance Criteria	Success Criteria
<p>3a. Critical process controls and control limits are identified in procedures and production instructions.</p> <p>10a. Applicable government mandatory inspections (GMIPs), pre-production, in-process, and post production, have been identified</p> <p>10b. Schedules are identified for GMIPs</p> <p>12. The contents of the acceptance data package (ADP) is agreed to by the acquirer and the supplier.</p> <p>13. The schedule is identified for review of the ADP and product acceptance.</p> <p>14. The schedule and logistics, including government oversight of operations, is defined for transfers of items out of, and return to, the plant for processing or test in subcontractor or government facilities prior to final acceptance.</p>	<p>4a. There is high confidence that there are sufficient manufacturing controls to eliminate the risk of installing latent defects.</p> <p>13a. Documentation and data systems are adequately prepared to capture conditions and results unique to the production run.</p> <p>13b. The produced item will have traceability to constituent material lots and the production run's processes and conditions.</p>



# Project QA Program: Quality Assurance of Processes and Hardware

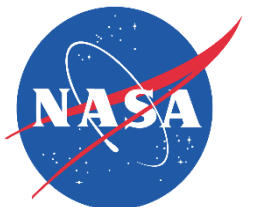
Manufacturing, verification and test plans

Materials, parts, subassembly quality certification

In-process QA: Surveillance

ADP contents and review

- Manufacturing, verification and test plans
- GCQA does not replace 1<sup>st</sup> Party required verifications and inspections
- Parts, materials, subassembly certification before installation
- In-process QA when end-of-line verifications are insufficient
  - Type and sample rate determined based on risk
  - PQASP(s) required
  - Types are:
    - *Document Review*
    - *Process and test witnessing*
    - *Records review*
    - *Inspection*
    - *Test or NDE prior to acceptance*
  - Procedures required for surveillance method when complex
- Minimum criteria for an Acceptance Data Package (ADP)
- Perform ADP review commensurate with complexity and risk





# Project QA Program: Integration and Test

QA surveillance

Test anomaly reporting

Test readiness review

Configuration audit

- In-process QA surveillance for I&T activities
  - Include in PQASP
  - Nine recommended areas for surveillance
- Test anomaly reporting
- Test Readiness Review (TRR) process
- Configuration audits

# Project QA Program: Launch and Mission Initiation Operations

Process quality controls

QA surveillance

Test readiness review

Configuration audit

- Strategy and requirements for:
  - Establishing process quality controls
  - Executing quality control surveillance
    - *Process qualification for new or non-standard processes*
    - *Procedures*
    - *Personnel training*
    - *Process rehearsals*
- The identified activities shall be documented in the PQASP(s).

# Project QA Program: Risk Management

QA risks managed as Prog/Proj risks

Technology risks

Quality risks

Supplier risks

MRB, ARB, FRB criteria

Controls for rework, repair, replace, UAI

Report crosscutting issues to OSMA

Report fraud & malpractice to NASA IG

- NPR 8400.1 for QA risk management
- Rapid notification for safety, high-impact NCs, failures, discrepancies
- System to identify and mitigate manufacturability risks
- Minimum criteria for NC review boards.
  - Participant mix
  - Investigation considerations
  - Prog/proj TA shall concur before implementing solution
  - Prog/proj shall define reporting and records requirements.
  - Traceability to design, requirements, and qualification shall be determined
- Procedures required for rework and repair. Process qual and training may be necessary.
- **NCs that may be program crosscutting shall be reported to OSMA QETF.**
- Pointer to GIDEP requirements for reporting and closed-loop resolution of impacts.
- Report fraud and malpractice to NASA IG
- Prog/proj self-auditing required
  - Led by Prog/proj, Center QMS, QAAR, 3<sup>rd</sup> Party Registrar audit
- Risk management for design and process changes:
  - Supplier notification to prog/proj
  - Determine if requalification is needed
  - Ensure continued traceability to requirements and mission system qualification

# Life Cycle Review (LCR) and Key Decision Point (KDP) Deliverables

Requirements limited to reviews presided over by a Center or Agency review board.

Deliverables:

- Developed by the prog/proj
- Concurrence by SMA TA
- Delivered for Center/Agency review

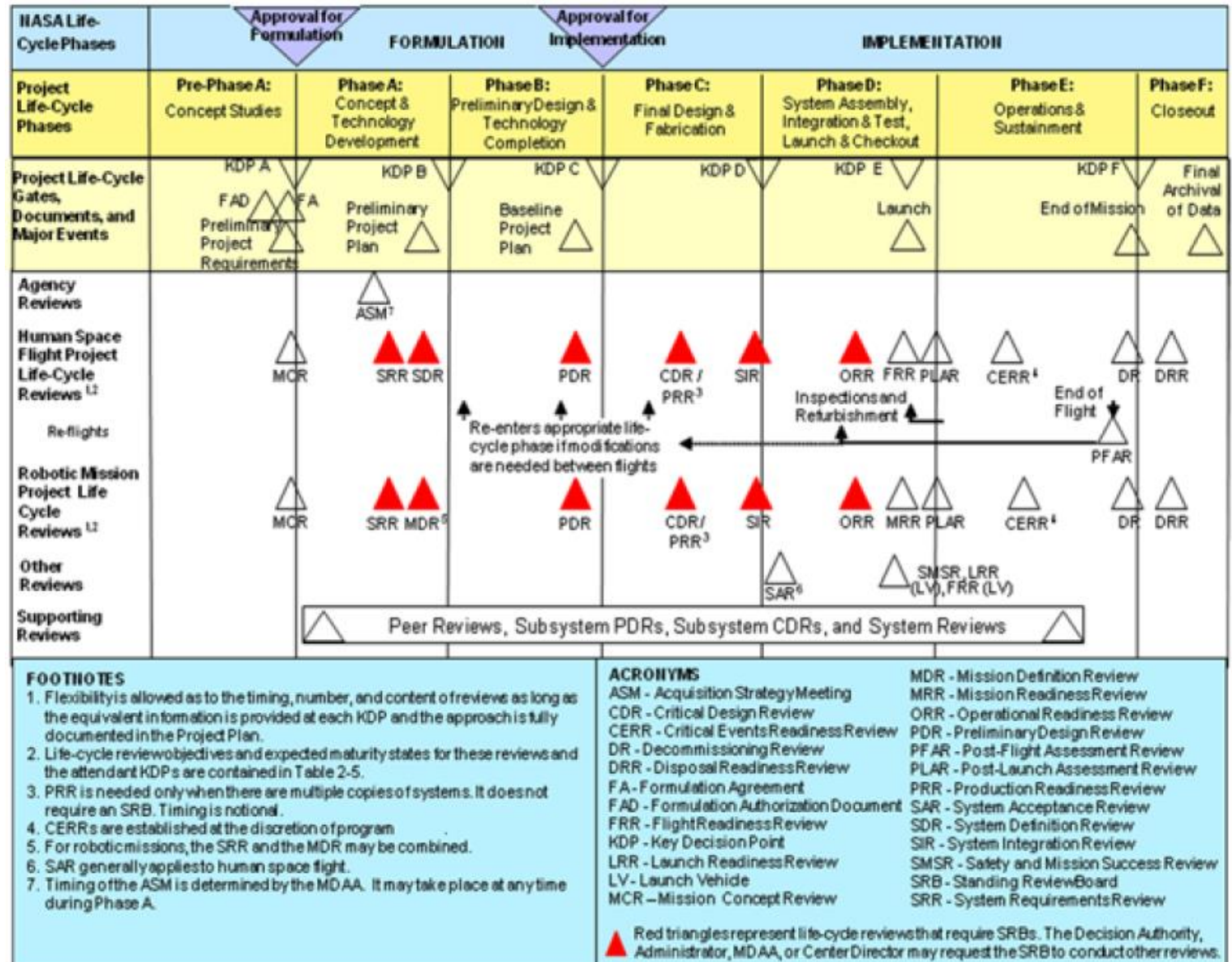
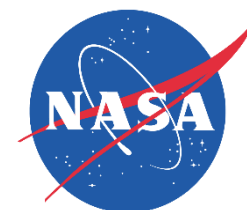


Figure 2-5 NASA Project Life Cycle NPR 7120.5E -- Chapter 2

# Supplier Risk Management



# Project QA Program: Supply Chain Risk Management

## Translating QE/QA Requirements for Procurements

Closing flow-down gaps

QMS Standards and certifications

Counterfeit controls

Fastener quality controls

Supplier's QA implementation plan

Audits and Assessments

GIDEP and NASA Advisories

Government acceptance

- Requirements flow down
  - Written to flow down to lowest level of supply chain
  - MetCal standard applies to suppliers and calibration service providers
  - NF1707 shall be used to strategize approach with procurement officer
  - QE/QA processes and criteria shall be designed for items where flow-down not available
    - *Inherited items*
    - *COTS*
    - *International partners*
- QMS for external suppliers of
  - Payloads and launch systems: AS9100 certified
  - Critical items, special processes, services<sup>1</sup>:
    - *Compliance with or certification to AS9100*
    - *Compliance with or certification to ISO 9001*
    - *Compliance with or certification to AS9003*
    - *Certification by Nadcap*
    - *Certification by IPC for soldered assemblies or for printed circuit board manufacturing*
    - *Qualified by the Defense Logistics Agency (DLA) as indicated by listing on a DoD managed qualified manufacturer list*

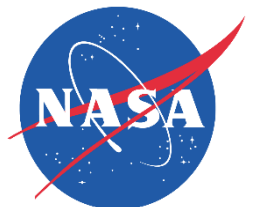
1. critical special process execution: e.g., plating, polishing, soldering, brazing  
critical services: e.g., laboratory testing, transportation and storage, launch preparation

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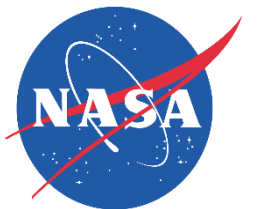
# Project QA Program: Supply Chain Risk Management (cont.)

- QMS for external suppliers .....*continued*
  - System developer's<sup>2</sup> QMS shall provide risk management for suppliers with insufficient QMS including brokers and distributors.
  - Suppliers shall have a counterfeit control program (included in AS9100)
  - NS 6008 required for fastener acquisitions and certification
  - A QA plan is required for integrators (suppliers of payloads, launch systems, components)
- Supplier risk management activities shall include:
  - Use of supplier audit and assessment results to understand risks
    - *Prog/proj determines when 3<sup>rd</sup> party certifications or other 2<sup>nd</sup> party audit or assessment results are substitute for a NASA assessment*
    - *Prog/proj determines when other data sources can be used in lieu of audit or assessment results*
    - *Prog/proj audit or assessment findings shared with supplier*
    - *Critical findings from audits or assessments addressed by prog/proj risk management system*
    - *Audit and assessment results shall be entered into SAS*
- GIDEP and NASA Advisories shall influence selection, requirements, and procurement processes
- GMIPS: sections discussed below for this topic
- Government Acceptance of Product (how to use FAR/NFS clauses)

2. System developer: i.e., NASA Center, grantee, JPL, prime contractor



# Government Contract Quality Assurance (GCQA)



# Government Contract Quality Assurance: GCQA

*a subset of government contract administration*

*see FAR part 46*

## In-process quality assurance functions (“GMIPs”, surveillance at source)

- Performed by NASA or their delegate
- Is not performed by the supplier
- Is not a substitute for inspections and tests required of the supplier (e.g., Workmanship)
- Volume of government surveillance is determined by prog/proj based on risk, programmatic resources, heritage data

## Government acceptance at source or destination

- Performed by CS only, NASA or their delegate
- May involve direct inspection, may be a data package review, may involve a formal project acceptance review
- Options to use DoD acceptance form DD 250



# Government Contract Quality Assurance: GCQA cont.

*a subset of government contract administration*

*see FAR part 46*

## In-process quality assurance functions (“GMIPs”, Surveillance at source)

Prog/proj must provide inspector information, engineering documentation and instructions:

Surveillance plan

Schedule

QE and QA technical requirements:

- *Technical standards, engineering documentation*
- *Key attributes of control, form/fit/function*

Previously approved waivers

Relevant data already acquired

Reporting instructions

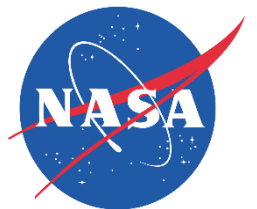
- *Results and data*
- *NCs, concerns and issues*

Records management requirements

Instructions for recommending requirement changes

Instructions for managing risk associated with a missed surveillance task

# Protocols for Working with DCMA



# Delegating GCQA to the Defense Contract Management Agency (DCMA)

GCQA is one of several Contract Administration functions performed by DCMA for NASA

NASA and DCMA creating a charter to lay out process, reflect in internal policies as appropriate

NASA Contract Officer	N-CO
NASA Office of Procurement	N-OP
NASA Office of Chief Financial Officer	N-OCFO
NASA Property Integrator	N-Prop
NASA Technical Fellow for Quality Engineering	N-TF
NASA OSMA-DCMA Technical Liaison	N-TL
NASA QA POC	N-QA
NASA Management Office lead at Supplier	N-NMO
DCMA HQ Policy Lead	D-HQ
DCMA Deputy Director	D-DD
DCMA NASA Program Office Lead	D-NPO
DCMA NASA Center Integrator	D-CI
DCMA Place of Performance Prime Command Management Office	D-PCMO
DCMA Delegated Place of Performance Command Management Office	D-DCMO
DCMA Program Integrator	D-PI
DCMA Functional Specialist	D-FS
Supplier POC	S-POC

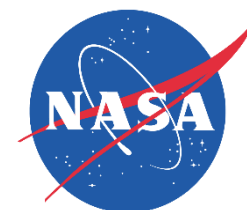
## NASA Quality Lead (N-QA)

- o Defines SOW (Letter of Delegation)
- o Defines applicability of LOD down into the supply chain
- o Coordinates LOD with NASA Center DCMA Integrator (D-CI)
- o Coordinates cost commitment with project
- o Acts as POC and technical oversight for work in LOD
- o Provides surveillance plans and instructions defined above for all GCQA inspectors
- o Updates surveillance plans and schedule as they evolve
- o Yearly LOD and budget update

## NASA OSMA-DCMA Technical Liaison (N-TL)

- o Holds monthly technical and programmatic reviews
- o Facilitates technical concern and issue resolution between N-QA and DCMA
- o Facilitates resolution of budget concerns between DCMA, NASA HQ Office of Procurement, Office of Chief Financial Officer
- o Facilitates yearly budget call response from N-QAs

# Informational Appendices



# FOR GUIDENCE ONLY.....

## **Appendix A: Counterfeit Avoidance Control Plan Contents**

Was in NPD 8730.2, EEE Parts, Appendix C

## **Appendix B: Recommended Requirements Scope for Procurement of Critical Parts**

List a. through bb. items to consider when writing mission assurance sections in statements of work

## **Appendix C: Suggested Criteria for Supplier Records and Data Delivery Requirements**

List of data that may be requested; annotated where data is a acceptance data package requirement:

- Formal multidiscipline level hardware acceptance review as part of item or system acceptance and certification
- Items below payload level: subassemblies, components, subsystems
- Payloads
- Review board assessment of a nonconformance

## Lifecycle-based -- AS9100 Model

Criticality as a tailoring enabler

Quality Assurance Manager

Design risks: PM&P availability, Technology Readiness, Manufacturability

Completeness of engineering specifications

Data Management

Uses standard quality control processes and standards;  
Quality Engineering fills gaps

Supplier Risk Management

Quality Assurance Surveillance and Product Acceptance

Risk Management for NCs

Lifecycle Review entrance and success criteria

## (Notional) Simplified 7123.1 Lifecycle Model for NASA Quality Assurance Programs

