

The background features the NASA logo, which is a blue circle containing the word "NASA" in white, a white orbital path, and a white spacecraft. A red diagonal slash is drawn across the logo from the bottom-left to the top-right.

Overview of Strategic Changes to NPR 8735.2 for NASA Quality Assurance

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Improvement Goals for NPR 8735.2

1. Influencing project earlier in the life cycle:

- Better requirements tailoring
- COTS risk mitigation
- Supplier risk mitigation
- Clarity and engineering basis for non-standard quality criteria

2. Stronger connection to accountable parties: Project Managers, Suppliers

- Align with mission lifecycle model
- Align with AS9100 model

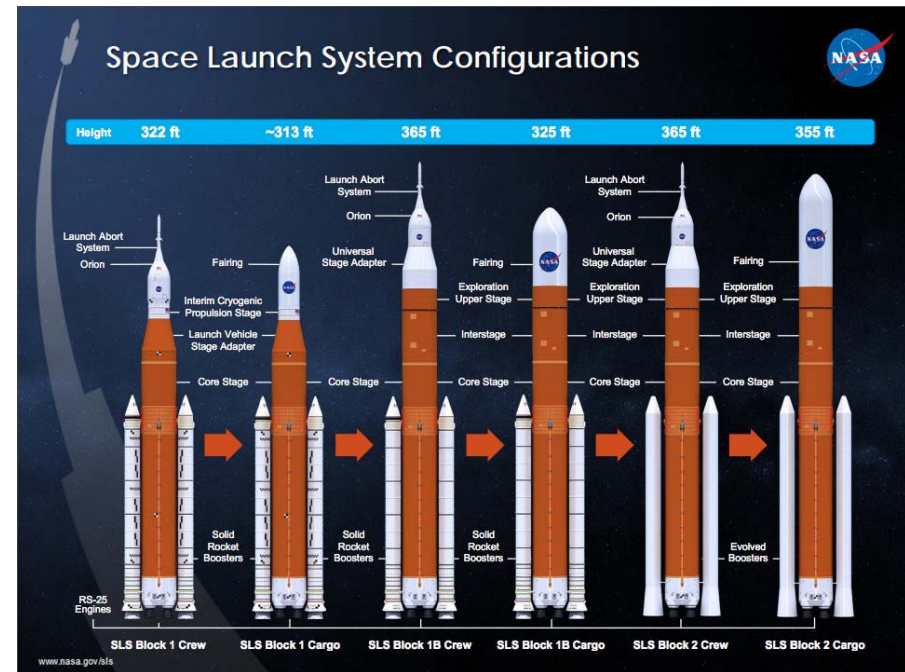
3. Clarity for Project Managers:

- LCR deliverables
- QE Lead

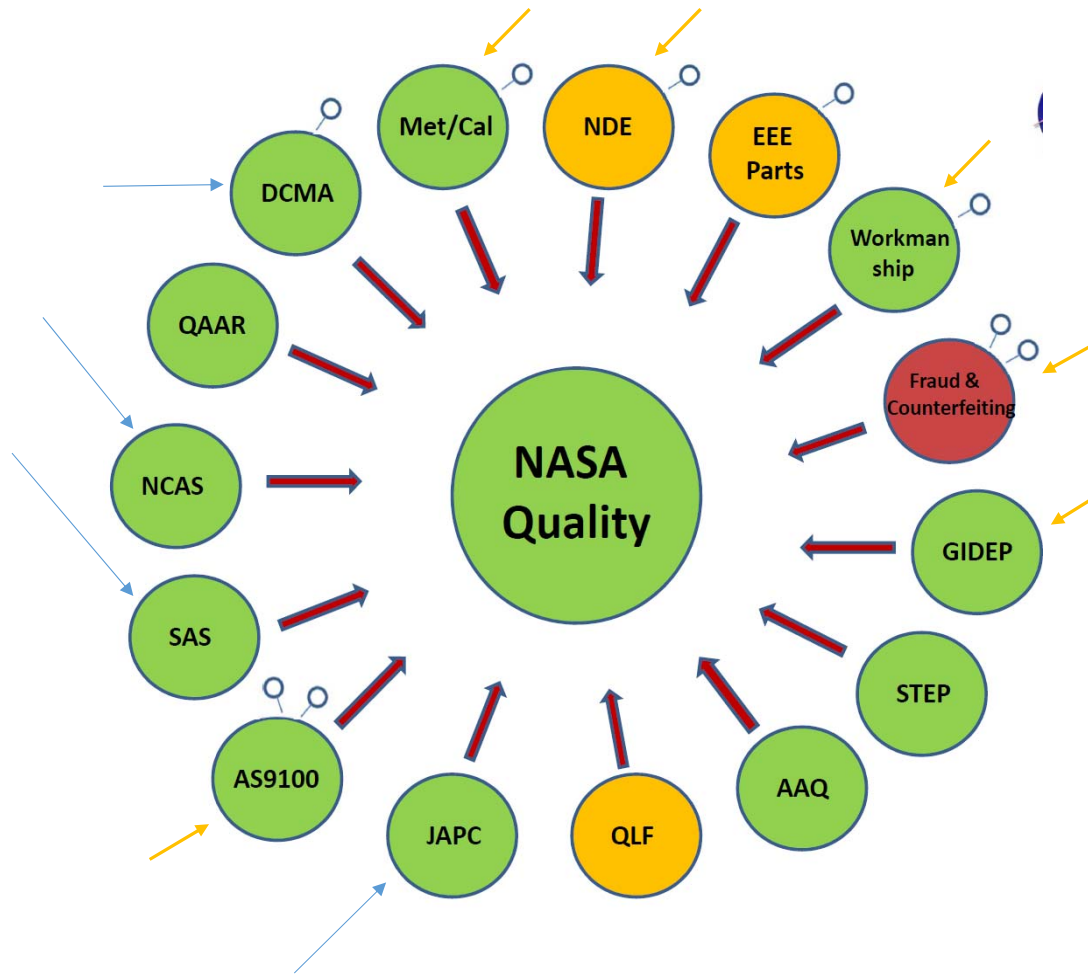
4. OIG Actions:

- Better surveillance planning
- Better data management
- Better Supply Chain Risk Management

5. Unburden R&D programs, scalable for Class A – D.



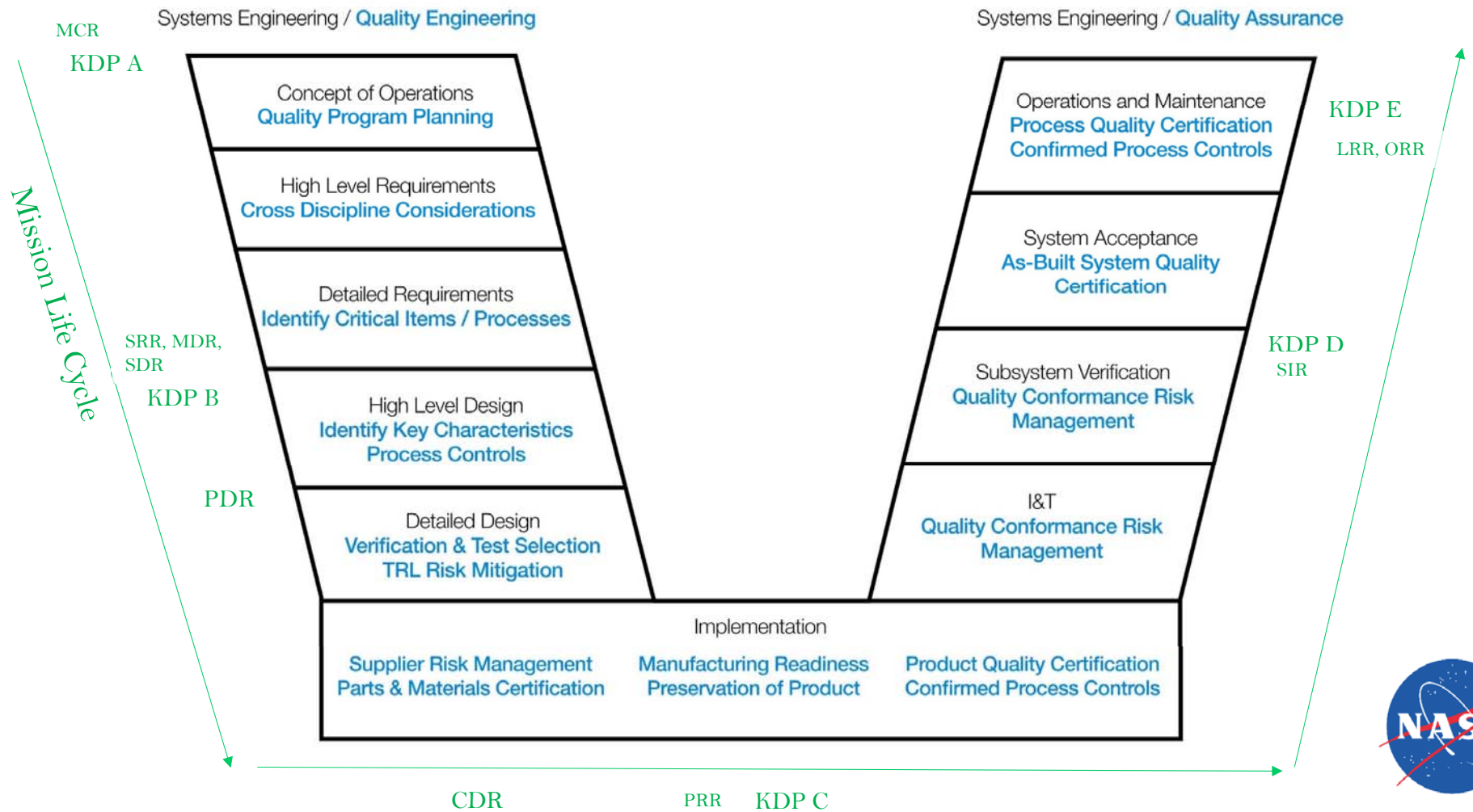
NPR 8735.2B



NPD 8730.5B



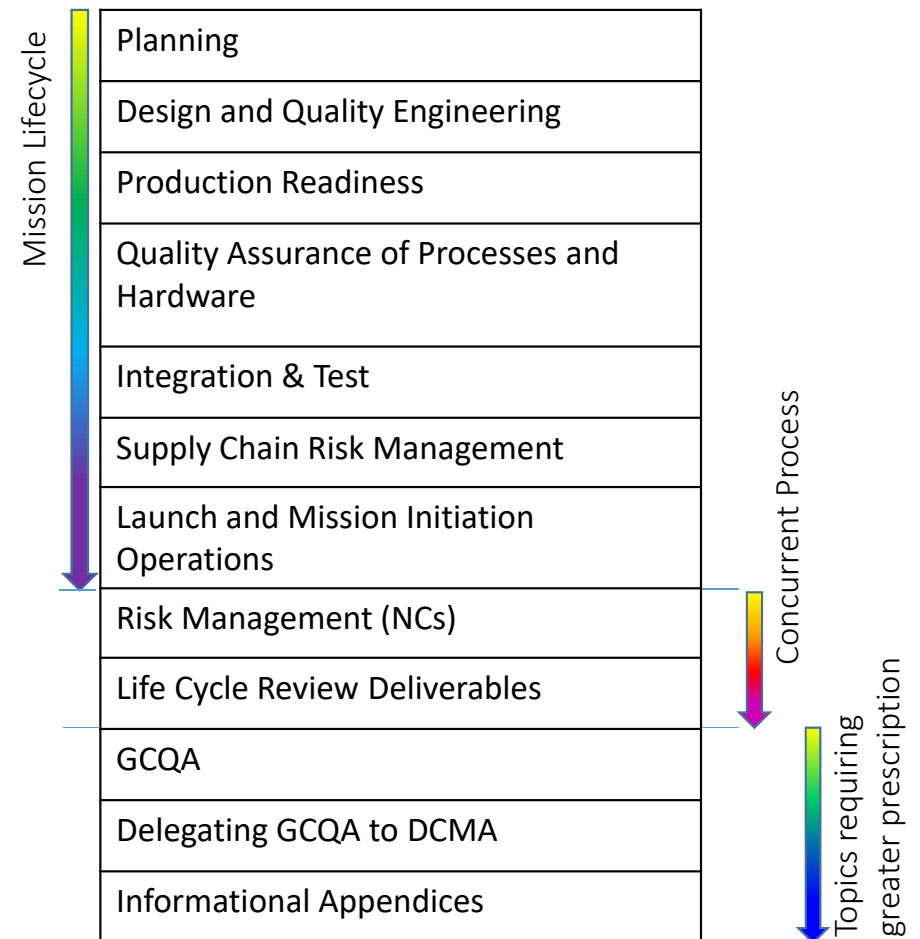
NPR 8735.2B ← ~~NPD 8730.5B~~ → NPD 8700.1F



(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

Establish **accepted standard** for QA program implementation: *“The best we know how”*

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

Companion with the 7120.5 program management, 7123.1 life cycle review (LCR) process

Not applicable to: NPR 7120.8 R&D projects, NPD 7900.3 aircraft operations and maintenance

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 the safety and mission objectives (i.e., SMA Technical Authority)

SMA Directors: Responsible for establishing the Center's accepted QA standard that is embedded in the QMS.

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

How about quality SMEs?
How about designers?
How about external suppliers?



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)

Phasing out: “non-critical”, “complex”, “non-complex”

Criticality Assessment used for focusing QA resources

4.1.5.1 NASA Program Managers shall develop and document the method that will be used to identify safety-critical and mission-critical items and processes.

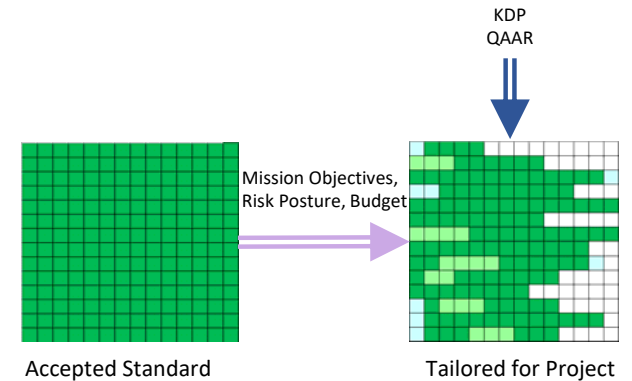


Tailoring

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, expected to use a Safety and Mission Assurance Plan (SMAP) and high-level compliance matrix approach

4.1.2 NASA Program Managers shall establish quality assurance requirements that are traceable to the minimum requirements herein and documented in a SMA plan (SMAP).

4.1.4 NASA Program Managers shall obtain approval by the Center's SMA Director, or their delegate, and concurrence by the Center-level SMA TA for the QE and QA requirements prior to their use on the program or project.

7.1.3.a [KDP A Deliverable] Compliance Matrix. The alignment of the program's or project's QE/QA strategy with this document described using a compliance matrix accompanied by descriptions of any alternative equivalent approaches that will be used to satisfy the requirements herein.

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**.

NF 1707 Form

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

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: 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, spacecraft, launch vehicles, launch services, components, subassemblies: AS9100 certified
 - Parts, materials, special processes, critical services¹:
 - *Compliance with or certification to AS9100*
 - *Compliance with or certification to ISO 9001*
 - *Compliance with or certification to AS9003*

Consider as alternate:

 - > *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. special processes: e.g., plating, polishing, soldering, brazing
critical services: e.g., laboratory testing, transportation and storage, launch preparation

Continued.....

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



- QMS for external supplierscontinued
 - System developer's² 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 3rd party certifications or other 2nd 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



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

Continued.....



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>13. The contents of the acceptance data package (ADP) is agreed to by the acquirer and the supplier.</p> <p>14. The schedule is identified for review of the ADP and product acceptance.</p> <p>15. 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



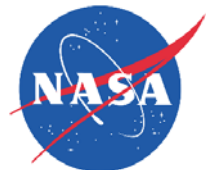
Manufacturing, verification and test plans

Materials, parts, subassembly quality certification

In-process QA: Surveillance

ADP contents and review

- Manufacturing, verification and test plans
- GCQA does not replace 1st 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).

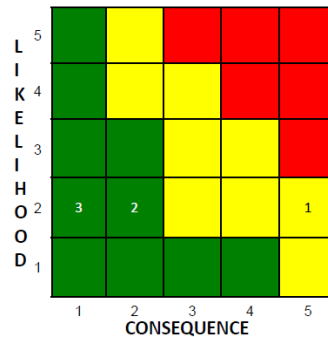
Project QA Program: Risk Management

QA risks managed as Prog/Proj risks

Technology risks

Quality risks

Supplier risks

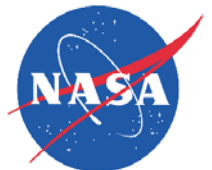


MRB, ARB, FRB criteria

Controls for rework, repair, replace, UAI

Report 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.
- 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, 3rd 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

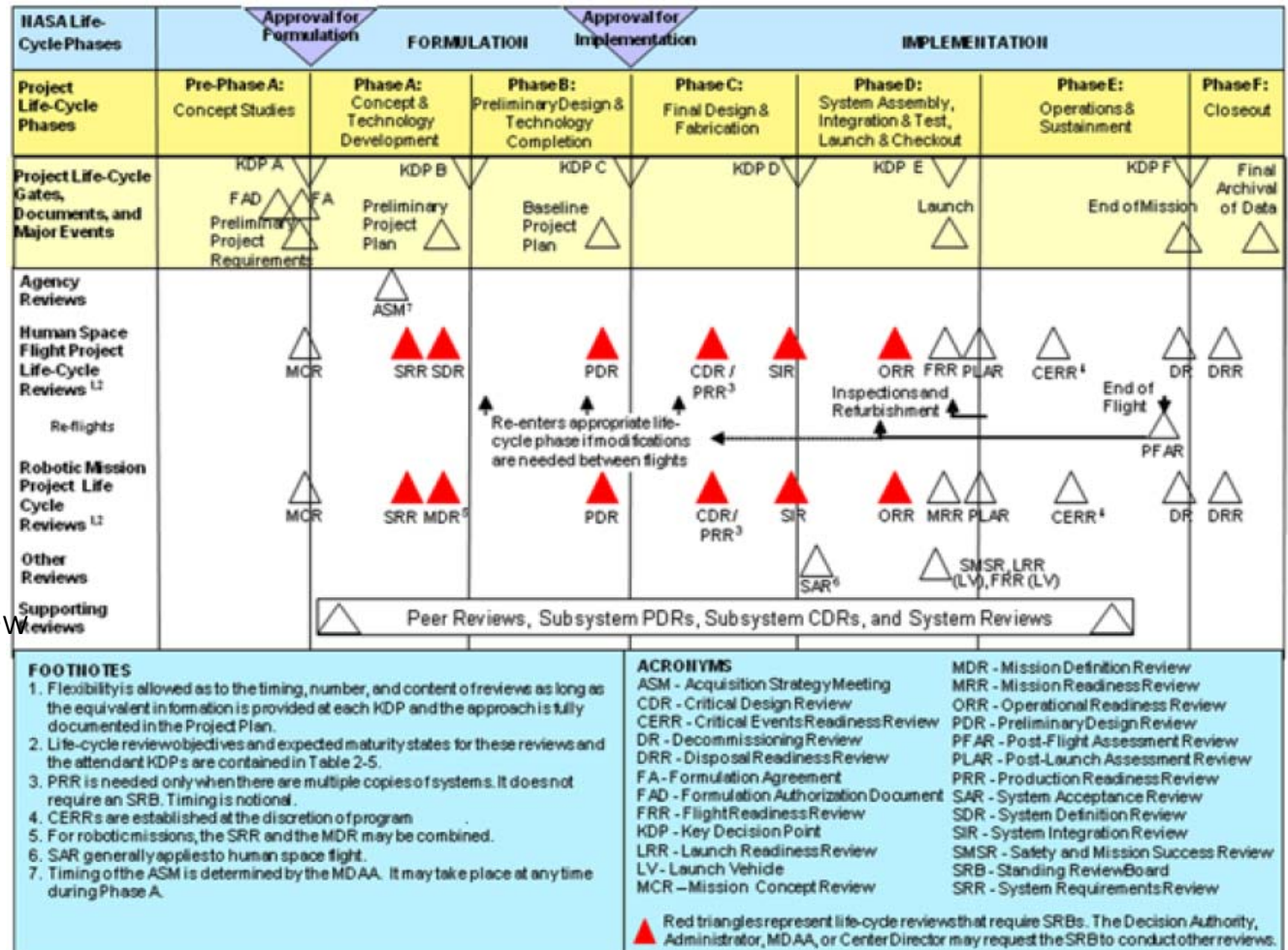


Figure 2-5 NASA Project Life Cycle NPR 7120.5E -- Chapter 2

QA Program Strategy
Waivers; Evidence of SMA TA concurrence
Budget allocation for QA Lead
QE/QA staffing overview
Budget consideration; development plan; COTS usage list; QA requirements maturity for low TRL items
Compliance Matrix; SMAP status; SMAP/strategy update for launch ops
Overview of approach to ensure requirements flow down
SMAP status
CIL method; CIL
Plan for certified or specialty-trained personnel

I&T QA
TRR plan/status
PQASP update status for I&T
Configuration audit plan/status
PQASP update status for launch

Risk Management
Technology risks overview; Supplier risks overview; Quality risks overview
Manufacturability risks; availability risks
Overview of NCs, Review board results, and UAI decisions
Review board process dev status
Report of crosscutting concerns/NCs encountered
Process Qual status
Self audit plan and status

Product Acceptance
Acceptance requirements status; Acceptance completion status
Overview of where destructive test and NDE are used as conditions of acceptance

Data Management
Data System overview
CM program overview

Design
Design review results
Budget consideration
Data System overview
Design review results
Budget consideration
Data System overview

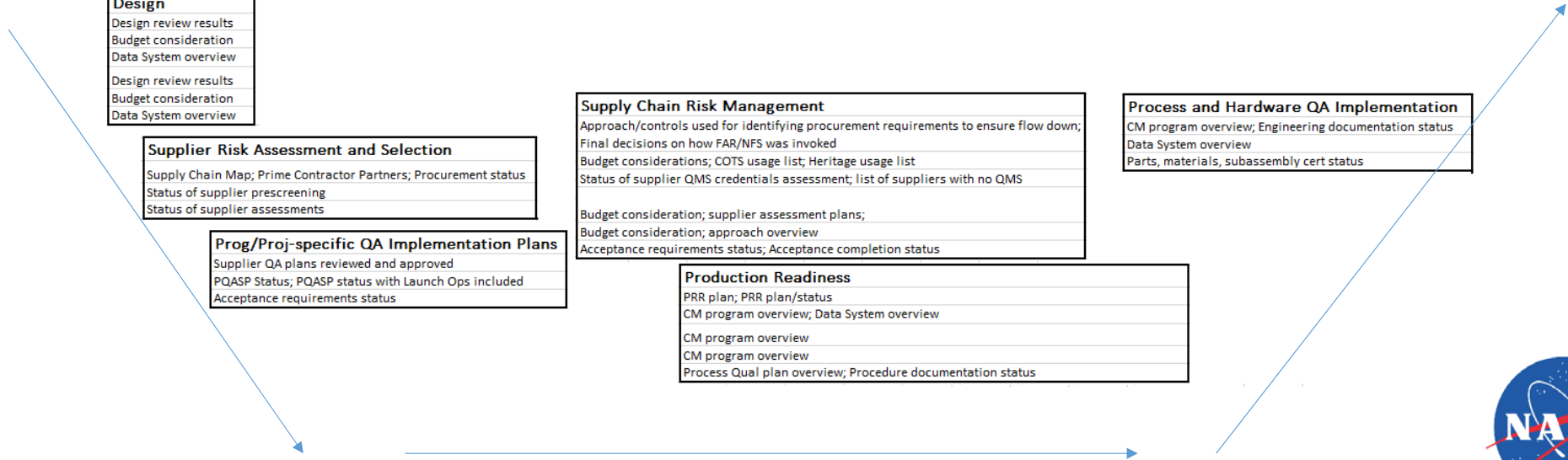
Supplier Risk Assessment and Selection
Supply Chain Map; Prime Contractor Partners; Procurement status
Status of supplier prescreening
Status of supplier assessments

Prog/Proj-specific QA Implementation Plans
Supplier QA plans reviewed and approved
PQASP Status; PQASP status with Launch Ops included
Acceptance requirements status

Supply Chain Risk Management
Approach/controls used for identifying procurement requirements to ensure flow down;
Final decisions on how FAR/NFS was invoked
Budget considerations; COTS usage list; Heritage usage list
Status of supplier QMS credentials assessment; list of suppliers with no QMS
Budget consideration; supplier assessment plans;
Budget consideration; approach overview
Acceptance requirements status; Acceptance completion status

Process and Hardware QA Implementation
CM program overview; Engineering documentation status
Data System overview
Parts, materials, subassembly cert status

Production Readiness
PRR plan; PRR plan/status
CM program overview; Data System overview
CM program overview
CM program overview
Process Qual plan overview; Procedure documentation status





Source: Northrop Grumman Aerospace Systems. | GAO-19-189

Government Contract Quality Assurance (GCQA)



Government Contract Quality Assurance: GCQA

a subset of government contract administration

see FAR part 46

Can affect contract price/agreements

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.

Minimum data and information provided to the GCQA inspector

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



Delegating GCQA to DCMA

Creating the statement of work (“letter of delegation”)

Information supplied to DCMA:

- QA and contracting strategy
- Schedule and milestones
- Surveillance plans
- Information named above due GCQA Inspector
- Training and certifications required
- Work flow or shift requirements
- Copy of the contract

Using the NF 1430 series, submittal by Office of Procurement, acceptance by DCMA

Changes to an LOD within an FY

Annual budget call and LOD update

Executing an LOD:

- Communicating risk management protocols, strategies
- POCs
- Status and data reporting
- How DCMA recommends changes to the surveillance plan

Working with the OSMA Technical Liaison to DCMA, DCMA Center Integrator



FOR GUIDENCE ONLY.....Informational Appendices

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 Lead

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

