NASA QUALITY POLICY FOR RESEARCH & TECHNOLOGY MISSIONS

2022 Adapting Mission Assurance Conference

Sponsored by the Aerospace Corporation, the Air Force Research Laboratory, and the Space Dynamics Laboratory
October 19-20, 2022
Aerospace Innovation Lab Rotunda, Albuquerque, NM

Donald R. Mendoza, Ph.D.
Senior Systems Engineer & Chief Knowledge Officer
Office of the Chief Engineer
NASA Ames Research Center

Welcome

This presentation will provide some observations of how the **National Aeronautics & Space Administration's (NASA)** quality [1]policy has been applied to [2]research and technology (risk tolerant) missions

[1]NPR 8735.2 - *Hardware Quality Assurance Program Requirements for Programs & Projects*

[2]NPR 7120.8 – *NASA Research and Technology Program and Project Management Requirements*
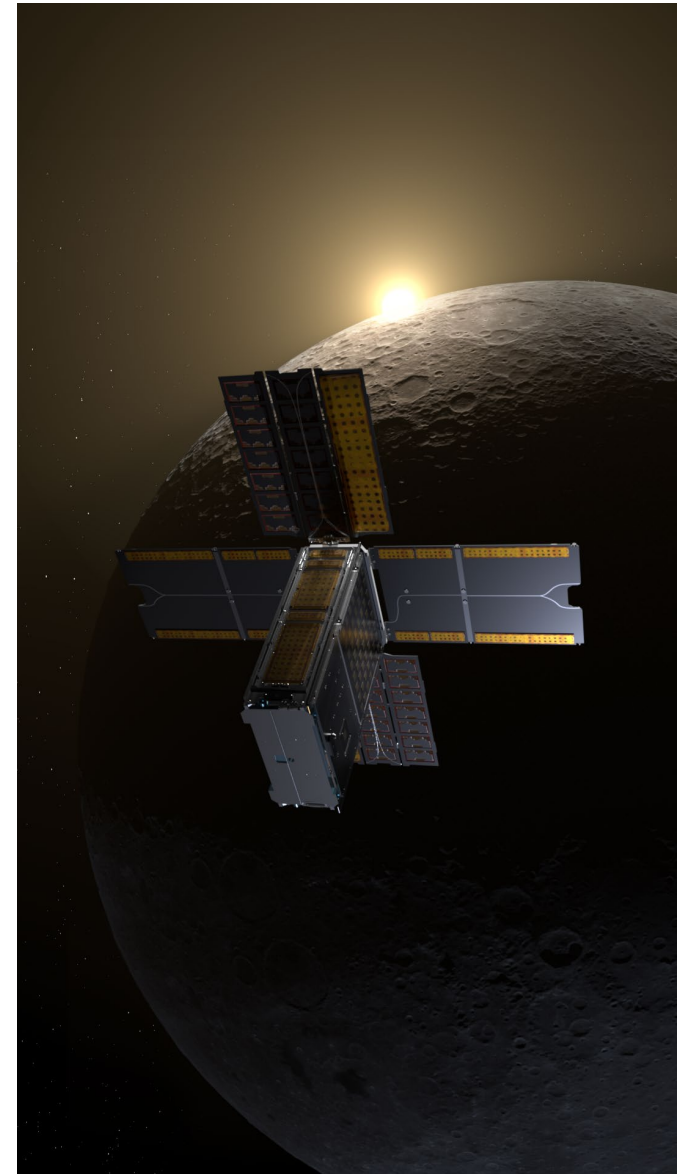
Agenda

Welcome

NASA quality policy: space flight vs. research & technology missions

Observations after one year of implementation
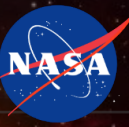
Key questions going forward

Summary

NPR 8735.2: Space Flight vs. Research & Technology (R&T) Missions

- The most significant differences between how NPR 8735.2 quality programs are envisioned for space flight and R&T missions include:

• : NPR 7120.5: "Space Flight" 2 or 3 σ Quality	NPR 7120.8 "Research & Technology" 1 σ Quality	NPR 7120.8 Implications for Quality
Prescriptive adherence to Agency technical standards & requirements (i.e., **tailor out**)	Discretionary application of Agency technical standards & requirements (i.e., **tailor in**) combined with alternative standards & supplier best practices	Quality must be highly experienced & symbiotic with engineering – roles & responsibilities should be cross-cutting (quality is everyone's job)
Numerous critical items: "Mother may I" Safety	Minimal critical items: "Tell me about it later" Mission Assurance	Quality must have intimate knowledge of the mission ConOps & system architecture (GMIPs should be avoided)
In-situ oversight & invasive implementation of Agency Technical Authority (TA)	Ex-situ insight & limited implementation of Agency TA (suppliers are empowered & encouraged to be creative)	Quality must focus on upfront PQA & apply strategic SCRM throughout the life-cycle (reviews & data products should be minimal)
Closed-loop "make it meet requirements" corrective action system (RCA & closure necessary prior to continuing work)	Open-loop "make-it-work" corrective action system (closure as convenient, even post flight)	Quality must partner with engineering, apply "yes, if" & keep records without stopping work to close paper

Note: NPR 7120.5 Class D missions are in-between resulting in perhaps the most challenging of environments to formulate & execute a quality program: stakeholders want 2 Sigma Assurance but fund & empower it @ 1

PQA – Procurement Quality Assurance   SCRM – Supply Chain Risk Management   RCA – Root Cause Analysis

NPR 8735.2 for NPR 7120.8 (dot8) Missions: Observations thus far & Recommendations

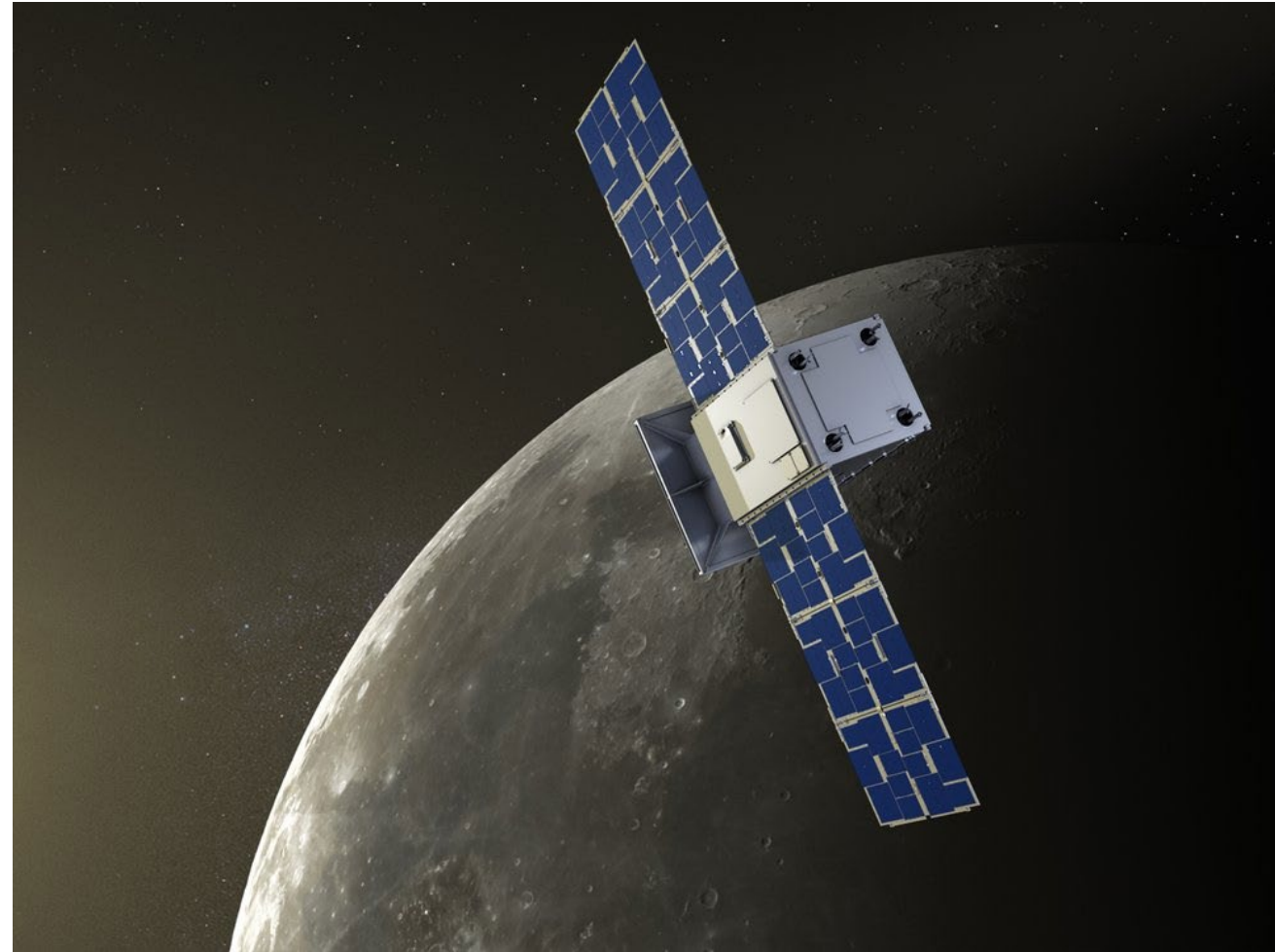| NPR 7120.8 "Research & Technology" 1 σ Quality	Observations thus Far	Recommendations

Discretionary application of Agency technical standards & requirements (i.e., **tailor in**) combined with alternative standards & supplier best practices	Quality:
	• Struggles to give up the "old ways" or let go of their checklists or ISO9001/AS9100
	• Forms adversarial relationship w/engineering & project management
		• Performing Centers/institutions should develop separate command media for dot8 missions or provide off-ramps in their existing requirements for dot8 (mirror the "tailor-in" approach that NPR 8735.2 allows)
		  ➢ Limit the use of "higher level quality standards" to AS9003 and/or appropriate sections of NPR 8735.2 for safety critical items
		• dot8 Projects should emphasize up front command media/quality:
		  ➢ ConOPs
		  ➢ Critical items/events/process list
		  ➢ PQA/SCRM
		• Projects teams should be cross-trained in quality & allowed to verify each other's work – especially below the system level
		• Non-safety critical problems/nonconformances should be addressed using an expedited process & resolved @ the lowest level

Minimal critical items: "Tell me about it later" Mission Assurance	• Projects late in identifying critical items • Quality forced to exercise unnecessary levels of oversight	
Ex-situ insight & limited implementation of Agency TA (suppliers are empowered & encouraged to be creative)	• Quality hesitant to trust suppliers & lack the PQA & SCRM mechanisms to base that trust on • Reviews & Data Requirement Deliverables (DRD)s overwhelm the Project/suppliers	
Open-loop "make-it-work" corrective action system (closure as convenient, even post flight)	Local processes & "old ways" require or encourage quality into delaying work unnecessarily	

Key Questions Going Forward for NASA QA Policy (i.e., NPR 8735.2) as applied to NPR 7120.8 Missions

1. Does the policy need more prescription?

2. Does the policy establish the roles & responsibilities (especially between the Programmatic and Tech Authorities) sufficiently to eliminate conflicts, especially when it comes to tailoring the QA plan?

3. Does the policy provide sufficient technical guidance towards tailoring in QA? If not, how should this information be provided (e.g., left up to the Centers or an Agency Guide/Handbook)?

4. What should the quality community be focused on?

5. What if anything should be added to, revised, or deleted from NPR 8735.2?

Summary

- NASA's quality policy allows research & technology missions to apply quality as a function of risk – absent any prescription, all quality is discretionary

- After a year of implementation, the transition to this new paradigm has presented opportunities for improvement

- These opportunities include increasing quality's:

  - Partnership with engineering

  - Upfront PQA/SCRM work

  - Trust/confidence in supplier processes & quality management

  - Reach by cross training & deputizing other members of the project team to verify work

NASA QUALITY POLICY FOR RESEARCH & TECHNOLOGY MISSIONS

2022 Adapting Mission Assurance Conference

Sponsored by the Aerospace Corporation, the Air Force Research Laboratory, and the Space Dynamics Laboratory
October 19-20, 2022
Aerospace Innovation Lab Rotunda, Albuquerque, NM

Donald R. Mendoza, Ph.D.
Senior Systems Engineer & Chief Knowledge Officer
Office of the Chief Engineer
NASA Ames Research Center