Respective Roles of Mission Assurance and Quality Assurance in Mission Success

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Bottom Line Up Front (BLUF)

- Introduction:
- Mission Assurance professionals are often asked:
  - ‘What is the difference between Mission Assurance and Quality Assurance?’
  - ‘Why do we need Mission Assurance when we already have Quality Assurance?’
- Abstract:
- This presentation details the relationship shared by Mission Assurance and Quality Assurance. It describes how:
  - Quality Assurance is a foundational subset to Mission Assurance covering the verification aspects of the MA mandate as defined by TOR-2011(8591)-9; ensuring the finished product matches the command media and was produced in accordance with required procedures.
  - Mission Assurance is a parallel organization to Systems Engineering and follows the Systems Engineering “V” in the mission lifecycle by validating/verifying key analyses, performing requirements validation and compliance, providing supplier management, providing integration and test inspection oversight, and Product build plan review, along with other program mission support taskings driving toward mission compliance.
  - Quality Assurance ensures the product. Mission Assurance ensures the mission.
  - The overall Mission Assurance focus on validation and verification shifts depending on several factors including Mission Risk, TRL/MRL, and Product Life Cycle. As the product becomes more mature, the comparative emphasis on mission assurance changes from validation to the verification elements described as quality.

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What is Quality Assurance?

- **Quality Assurance (QA)** is the systematic process of ensuring products, services, or processes consistently meet defined quality standards and customer expectations by proactively preventing defects through planning, monitoring, and improving all stages of development and delivery. (Tempo, n.d.).
  - Focus on meeting product/service standards (the "what"), preventing defects, and ensuring processes are sound. Think of QA as ensuring the parts are right.

Quality Assurance is essential for a reliable product

Quality Assurance Roles/Responsibilities

- **Quality Assurance (QA)** is a rigorous discipline with crucial processes, roles and responsibilities
  - Focus is ultimately on product assurance

Quality Management	Process
	Hardware Quality Assurance
	Software Assurance
	Supplier Quality Assurance
	Alerts and Information Bulletins

(Juranek, 2023)

Hardware Quality Assurance

Objective: Ensure that hardware products used in deliverable products …meet the level of quality for their intended application.

Description: The Hardware QA process includes quality procedures/quality work instructions specific to the program as the primary means of defining quality controls (Bjorndahl, 2010).

Limitations of Quality Assurance in High Stake Systems (Square Wheel Paradigm)

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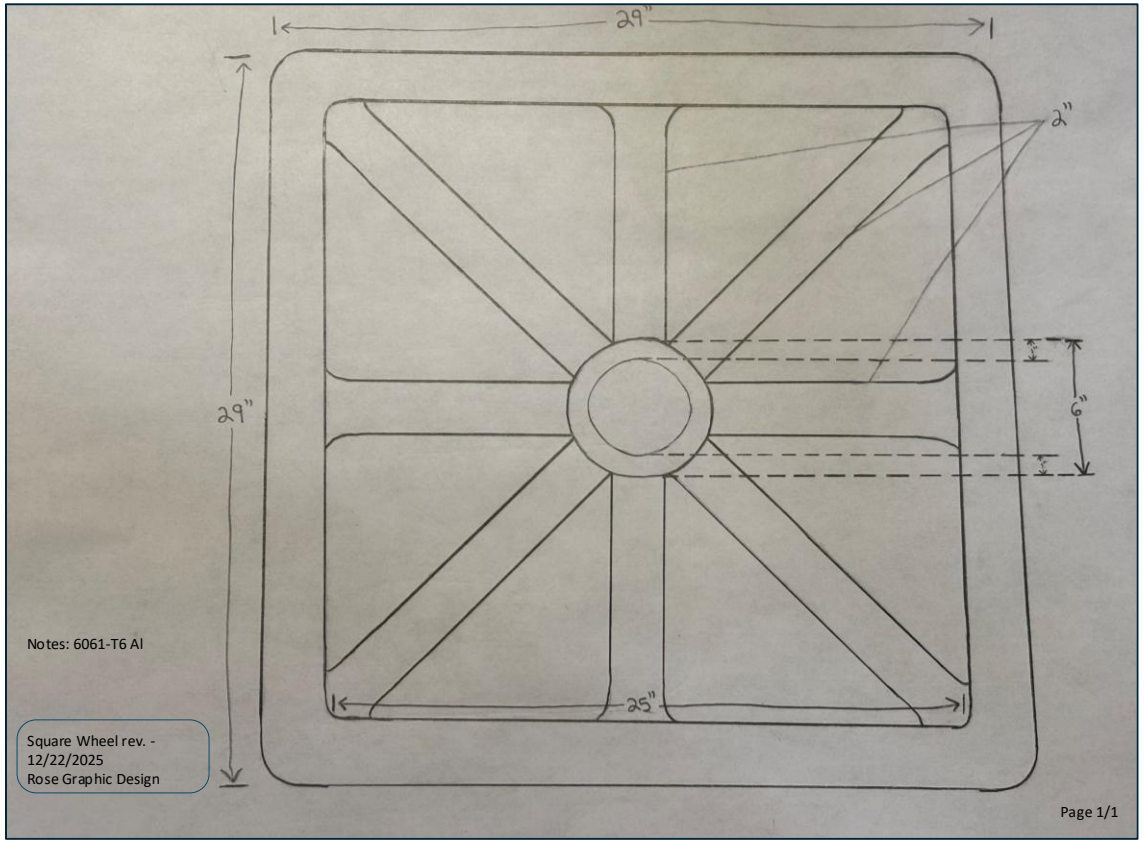
- Manufacturers eventually reach the limits of what Quality Assurance can provide.

  - "The ANSI/ISO/ASQ definition for quality **is indifferent to whether fulfillment of requirements would result in mission success** ….(Hughitt, 2011)

Built correctly… but is it right?

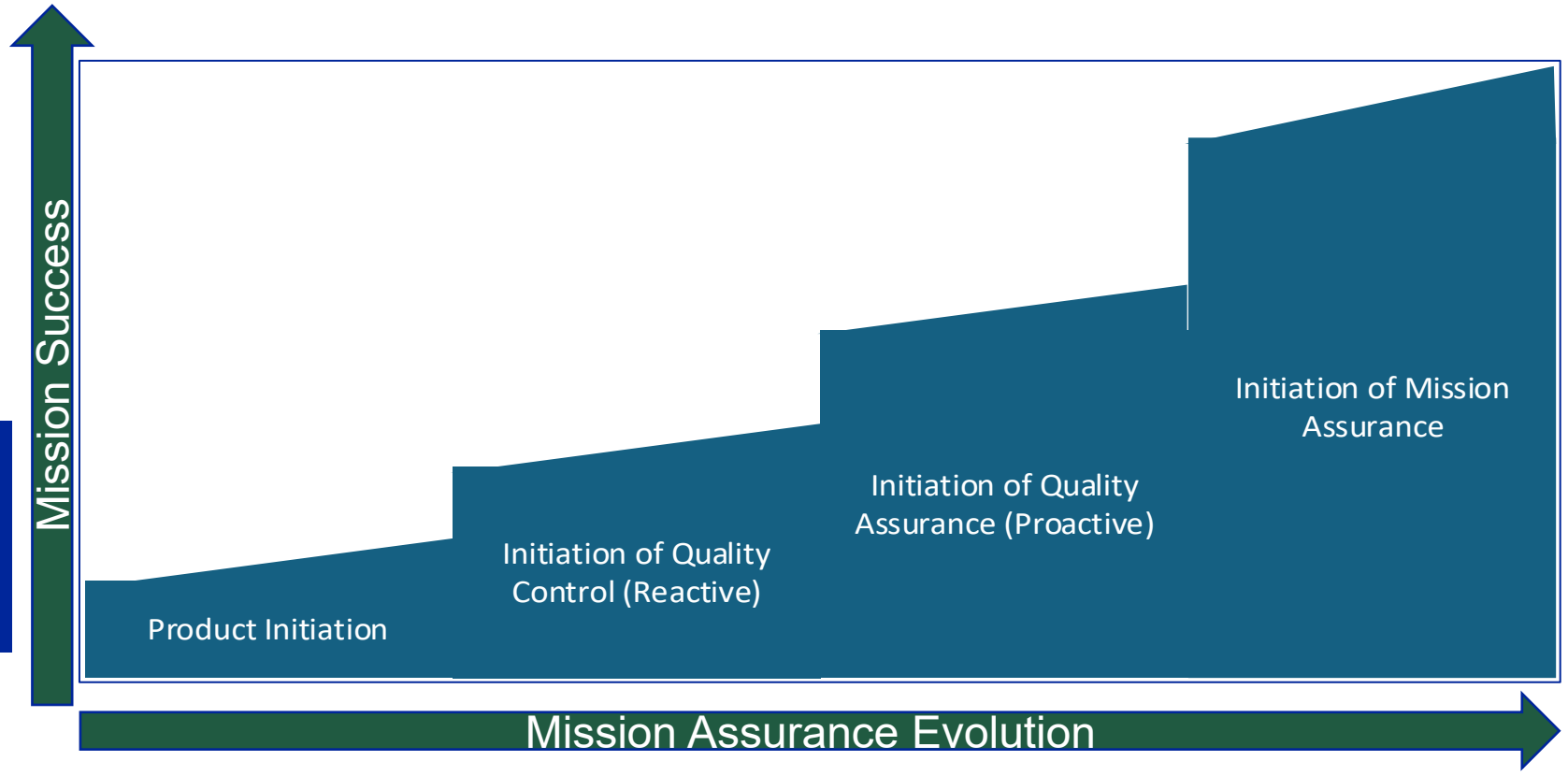


Organizational Mission Assurance Evolution

- **Mission Assurance (MA)** integrates QA with Systems Engineering, Specialty Engineering, Risk, Security, and Management to ensure the entire mission successfully achieves its mission (the "why"), mitigating threats and ensuring resilience across the entire

lifecycle, from concept to operation.

Focus on continuous improvement drives evolution



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Relative Focus of MA vs. QA

Quality Assurance (QA)
- **Focus:** Product/Service conformance to specified requirements and standards.
- **Scope:** Specific processes, components, documentation, and testing.
- **Goal:** Prevent defects, ensure consistency, build confidence in quality.
- **Activities:** Audits, inspections, validation, documentation review, process control.

Mission Assurance (MA)
- **Focus:** Overall success of the mission/program, including safety, security, and resilience.
- **Scope:** Entire system lifecycle, from design to operations, across all threats (all-hazards).
- **Goal:** Achieve 100% customer success by mitigating risks and ensuring function under all conditions.
- **Activities:** Integrates QA, risk management, security, system engineering, and management principles

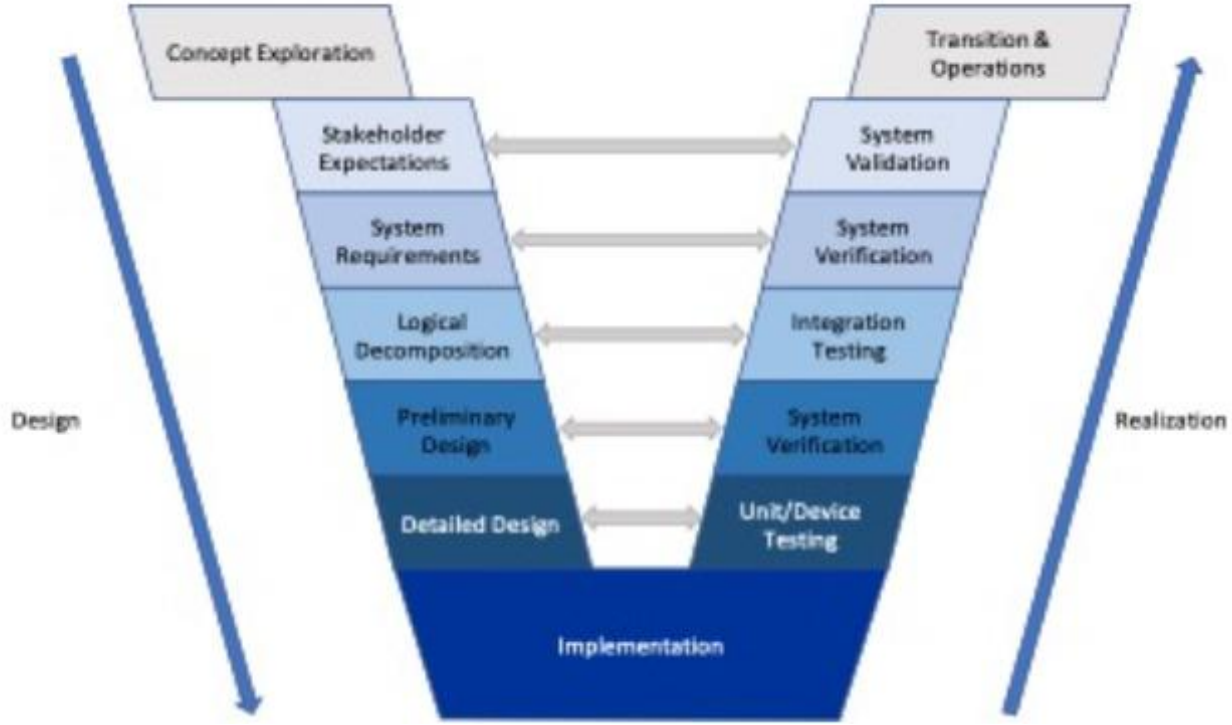
Key Distinctions
- **Breadth:** MA is broader, encompassing QA as a key component, but adding layers of system-level risk, security, and operational readiness.
- **Perspective:** QA ensures the ***product*** **is right**; MA **ensures the *mission*** (which uses the product**)** is successful.
- **Independence:** In high-stakes environments, Mission Assurance often has independence, reporting to top management to provide unbiased oversight, whereas QA might be embedded within a production team.

MA is the strategic umbrella that leverages QA and other disciplines to guarantee mission success, particularly when failure has severe consequences.

QA ensures the product, MA ensures the mission

Mission Assurance as Systems Engineering

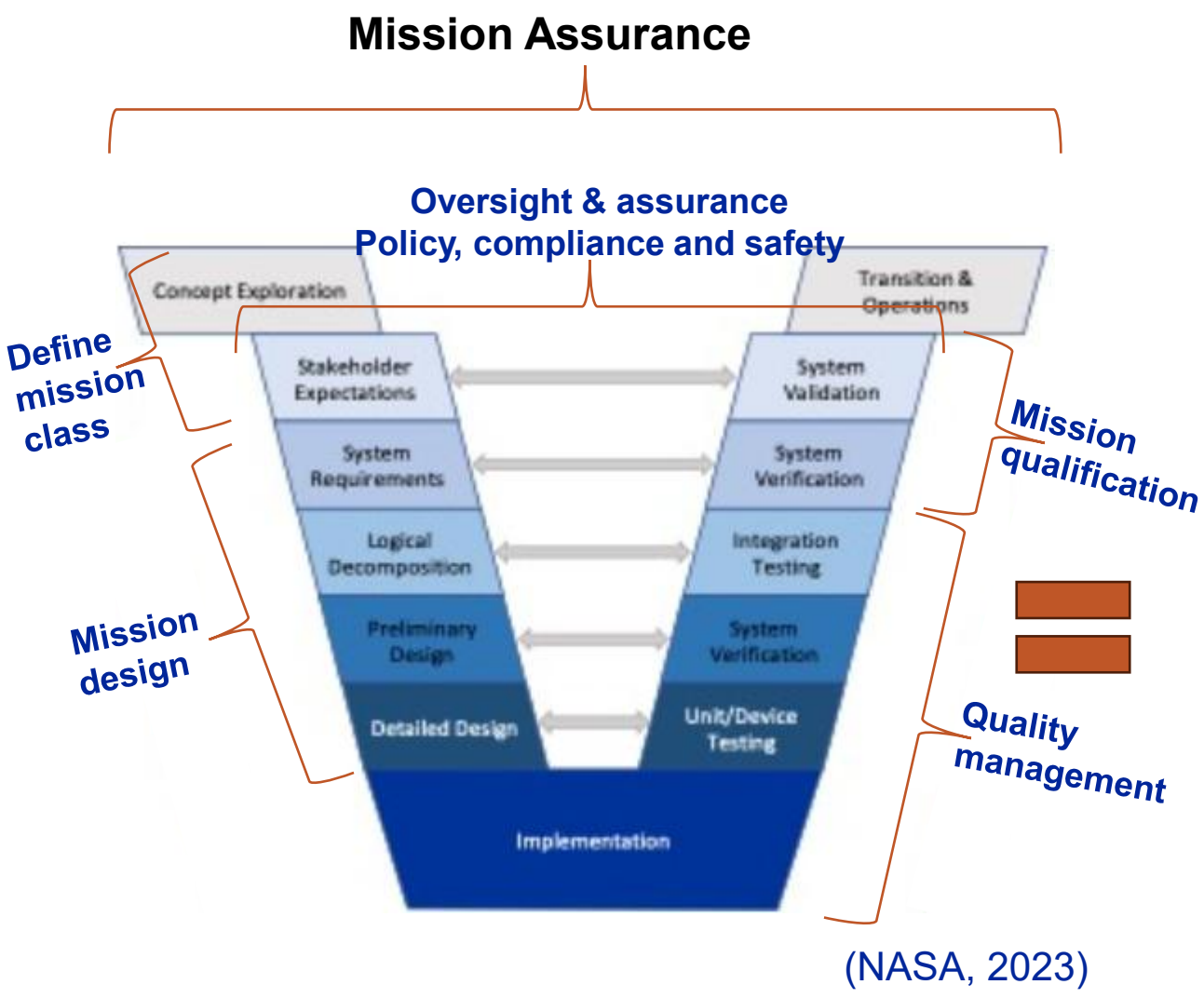
- Mission Assurance is a disciplined application of proven scientific, engineering, quality, and program management principles toward the goal of achieving mission success. **We follow a general Systems Engineering framework** and use risk management and independent assessment as cornerstones throughout the program life cycle (Johnson-Roth, 2011).



(NASA, 2023)

MA is Systems Engineering w/ a Mission Success mandate

Quality, Mission Assurance and Systems Engineering



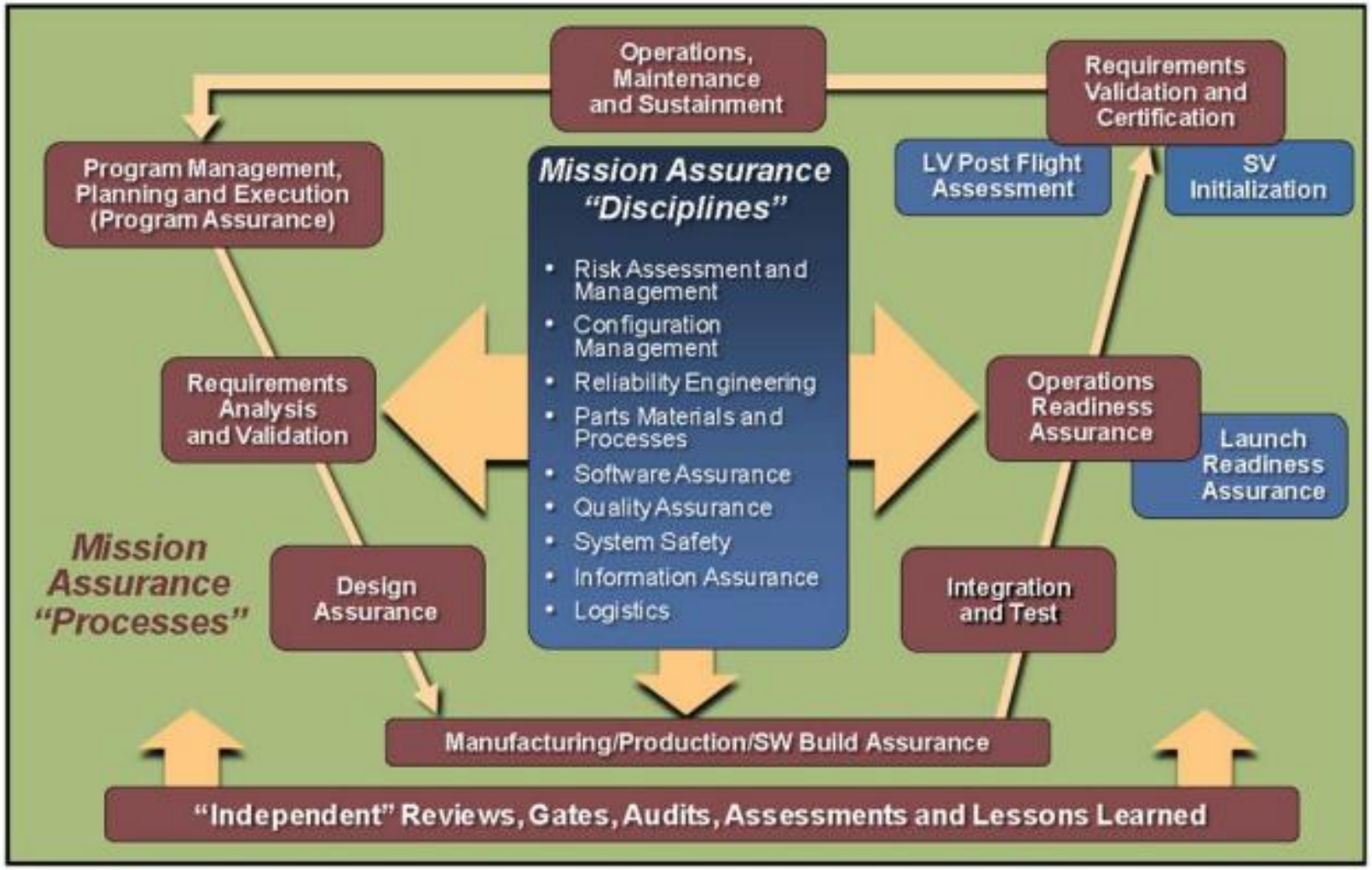
(NASA, 2023)

Mission Success Framework Category	Process
Policy, compliance and safety	System safety
Mission design and qualification	Reliability Engineering Parts, materials and processes Environmental compatibility analysis Integration, test and evaluation
Oversight and assurance	Independent reviews Failure review board Corrective/preventative action board Configuration/change management Requirements analysis and validation Risk
Quality management	Hardware quality assurance Software assurance Supplier quality assurance Alerts and information bulletins

(Juranek, 2023)

The Mission Assurance "V"

- The mission success mandate applied to the Systems Engineering "V" results in the Mission Assurance "V"

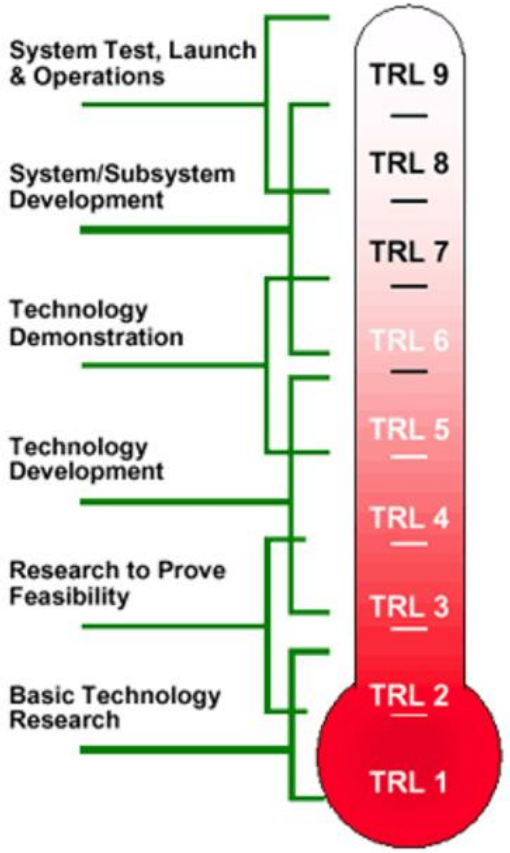


(Wheaton, 2017)

Mission Risk, TRL/MRL, and Product Life Cycle

- As the product becomes more mature, comparative emphasis on mission assurance changes from **validation** to **verification**

- A high Technical Readiness Level (TRL)/Manufacturing Readiness Level (MRL) combined with a well-defined environment
  - Requirements are validated
  - Environmental analyses/models are complete
  - Key parameters are defined
  - Risks are known and mitigated



(K, 2024)

Production mindset can change the emphasis back to quality control

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Conclusion

- Mission Assurance is a parallel organization to Systems Engineering and follows the Systems Engineering “V” in the mission lifecycle by
  - Performing MA requirements validation and compliance
  - Validating/verifying key analyses
  - Providing supplier management
  - Providing integration and test inspection oversight
  - Product build plan reviews
- Quality Assurance is a foundational subset to Mission Assurance covering the verification aspects of the MA mandate; ensuring the finished product matches the command media and was produced in accordance with required procedures
- The overall Mission Assurance focus on validation/verification shifts with the Systems Engineering “V” depending on several factors (Mission Risk, TRL/MRL, and Product Life Cycle, etc.)
  - As the product becomes more mature, the comparative emphasis on mission assurance changes from validation to the verification elements described as quality

Mission Assurance mandate is to ensure mission success

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