Presented at the ICEAA 2024 Professional Development & Training Workshop - www.iceaaonline.com/min2024

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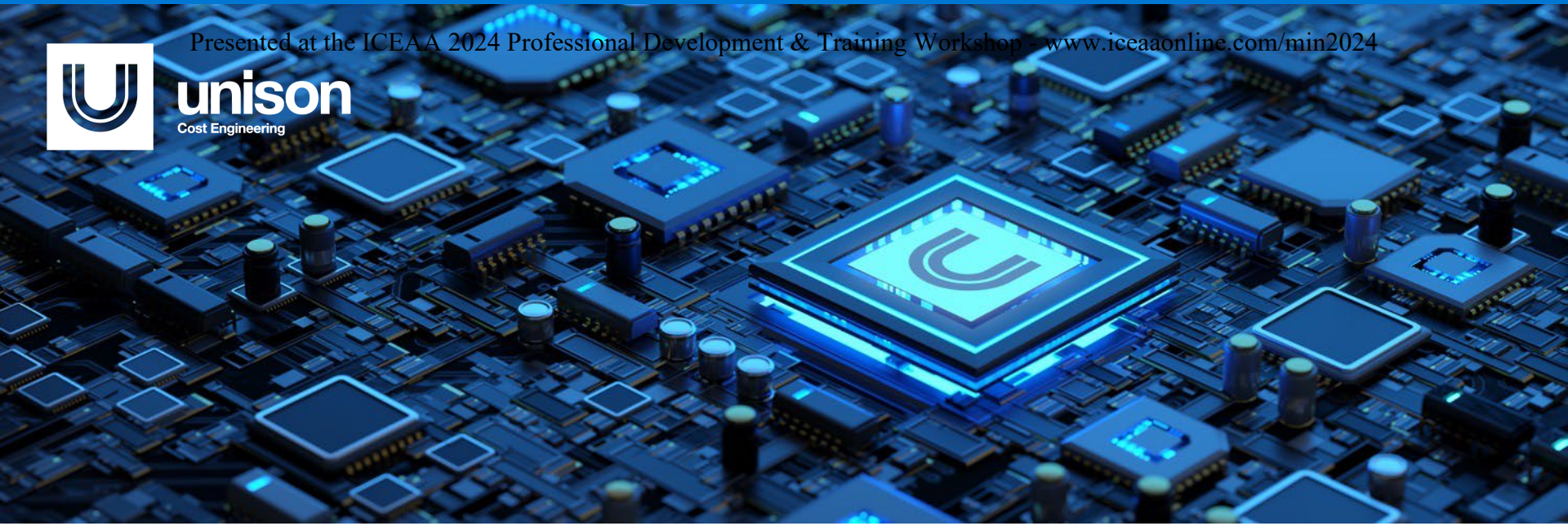

Mission Class in Unmanned Space Estimating

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Situation & Idea

- The cost engineering community needs consistent guidelines in addressing **Mission Assurance processes** for a given space vehicle
- Latter is typically addressed via Mission Risk Class (A, B, C or D), based on programmatic constraints and mission needs.
- Current best practice typically relates mission class to an operational environment that conveys quality information based upon requirements.
- This presentation reviews current considerations and research for capturing mission assurance requirements.

Mission Class Profiles

Characteristic	Class A	Class B	Class C	Class D
Risk Acceptance	Minimum Practical	Low Risk	Moderate Risk	Higher Risk
National Significance	Extremely Critical	Critical	Less Critical	Not Critical
Payload type	Operational	Operational or Demo Op	Exploratory or Experimental	Experimental
Acquisition costs	Highest Lifecycle Cost (LCC)	High LCC	Medium LCC	Lowest, LCC
Complexity	Very high – High	High – Medium	Medium – Low	Low - Medium
Mission Life	>7 years	≤7 years	≤4 years	< 1 yrs
Cost	High	High to Medium	Medium - Low	Low
Launch Constraints	Critical	Medium	Few	Few - None
Alternatives	None	Few	Some	Significant
Mission Success	All practical measures	Stringent/minor compromises	Reduced mission assurance standards	Few mission assurance standards
Typical Contract Type	Cost Plus Award Fee (CPAF)*	CPAF-Firm Fixed Price (FFP)	Cost Plus (CP)-FFP	FFP

* Note that CPAF for Class A is for first of fleet, not once a production program is in-place.

The cost engineering community needs consistent guidelines in addressing mission assurance processes for a given space vehicle mission risk class (A, B, C, or D) based on programmatic constraints and mission needs.

Currently, estimators will consider combinations of assessments via Technology Readiness Level (TRL), Evaluation Assurance Level (EAL), Manufacturing Readiness Level (MRL), etc.

Source: Aerospace Corp.

Parametric Modeling Variables

- Specific end-item maintenance accessibility, reliability, structuring, testing and documentation requirements are driven by mission operating environment.
- Modeling operational complexity *should reflect* specification flow-down, validation and documentation, as well as modification/ integration of subcontracted material items.
- Operational complexity also *should affect* subcontracted material, e.g., NSA cyber-security.
- Current parametric models do not show clear delineation between mission classes.
- Need to factor in parts quality, test-sampling, orbit-ranges, subcontractor-production volumes/ #units and mission duration.
- Need to tailor component-level part quality as well as also affect “informed” higher-level assembly and system charges.

Research Artifacts

- NASA: GSFC-STD-7000B General Environmental Verifications Standard (GEVS)
- NASA: NPR 8735.2C Hardware Quality Assurance Program Requirements for Programs and Projects (Updated w/Change 2)
- NASA: NPR 8705.4 Risk Classification for NASA Payloads
- Aerospace Corp: TOR-2007(8546)-6018 Mission Assurance Guide
- Aerospace Corp: TOR-20118591-21 Mission Assurance Risk Classes
- Aerospace Corp: TOR-2006(8583)-5235 Parts, Materials, and Processes Control Program for Space and Launch Vehicles

Findings - Observations

- Mission duration-orbit is a discriminator that manifests itself in a need for higher parts quality and more attention to detail
- Operational environment quality-complexity *should allow* for modification of subcontracted material items.
- Components may be purchased with rating pre-assigned to indicate compliance while others are procured to source control drawings for compliance.
- More resolution is needed for understanding how requirements for parts quality, test-sampling, orbit-ranges and mission duration impact reliability.

Brainstorming Session

- Data has not (yet) supported Mission Class as a sole discriminator for mission assurance
- Need evaluation (& data!) for Operating Environment complexity-adjustments
- Live discussion for follow-on research:
  - Testing
  - Design-Life
  - Competed (AO) vs Directed
  - Fixed-Price Contracting
  - Leveraging within an existing product line
  - RSDO: NASA Rapid SC Development Office
  - SC Bus vs PL Instrument(s)
  - Schedule Phase C/D Duration
  - Affect of Continuing Resolution(s)