Technical Risk Identification at Program Inception Product Overview

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Technical Risk Identification at Program Inception

Product Overview

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Agenda

- Motivation for "product"
- Product Overview
- Topic Details
- Workshop Objectives
- Team Membership and Recognition

Motivation for "Product"

"Risks identified are rarely realized, risks realized were rarely identified."

"All unidentified risks are accepted risks."

- Program cost and schedule overruns can be traced to unrealistic risk profile at program inception.

- Aerospace industry have experienced critical mission failures that could have been avoided if the failure was identified as a risk early in the program life cycle and properly managed.

Unrealistic Risk Profile at Program Inception

Space Systems Development Growth Analysis[*]

Development Growth Causes
(Quantitative Framework)

Pie chart values: 25%, 8%, 11%, 11%, 9%, 25%, 11%

Legend:
- REQUIREMENTS GENERATION & TRANSLATION
- BUDGET/FUNDING
- COST ESTIMATION
- UNDERESTIMATION OF RISK
- SCHEDULE SLIPS (GOVT & CONTRACTOR)
- PRICE INCREASES
- OTHER
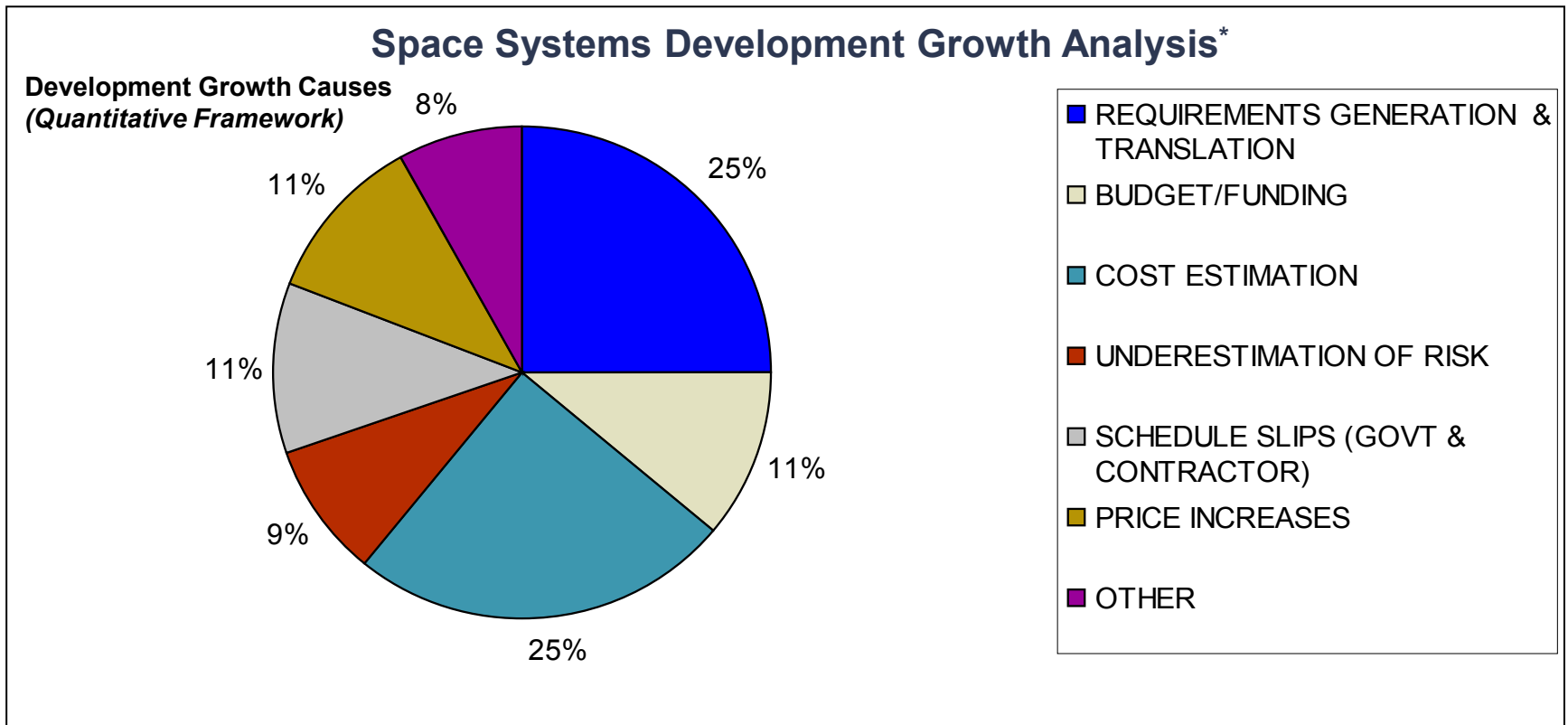
Comparison of total dollars growth by category for two space programs at a point in time

Underestimation of risk accounts for at least 9% of space systems development cost growth.

[*] Booz Allen Hamilton. (2002) Moorman, T. S., et.al., *Space Systems Development Growth Analysis, Space R&D Industrial Base, and Conclusions from the Space Industrial Base Study*

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Unrealistic Risk Profile at Program Inception

Development Growth Causes
(Stakeholder Analysis)
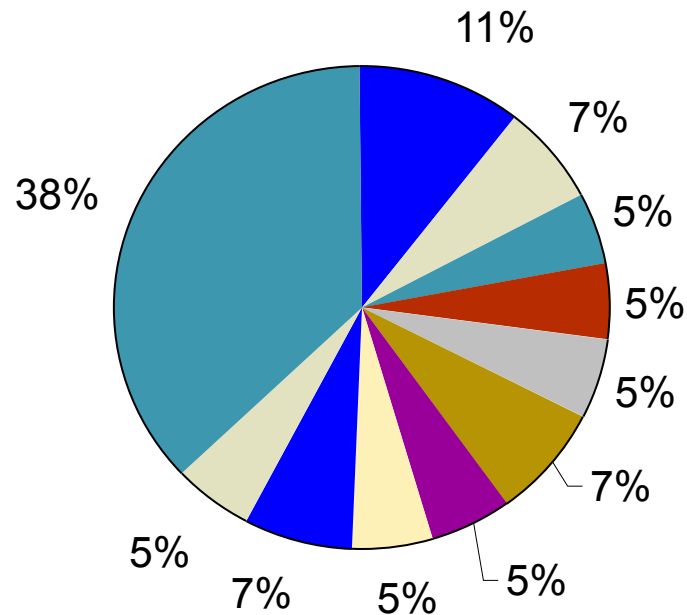
Legend:
- ■ Requirements Immaturity
- □ Requirements Creep
- ■ Programs Budgeted Too Early
- ■ Software and Integration Underestimated
- ■ Budget Instability
- ■ Competitive Process Over optimism
- ■ Inadequate Pre-Acquisition Planning & Risk Reduction
- □ Optimistic and Extrapolated Estimates
- ■ Lack of Systems Engineers
- □ Program Director Turnover & Experience
- ■ All Other Causes

Other:
- Acquisition Reform
- Program Length
- Too Many KPPs
- No Mgt Reserve
- Program Management Optimism

Source: 77 surveys, 67 Organizations, frequency of mention versus total mentions

The highlighted causes are directly related to risk identification activities at program inception.

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Product Overview

A guidance document was chosen to capture the most common risk ID barriers and to offer strategies to break down the barriers to improve the risk ID process.

- Overview of risk identification methods
- Risk Identification Barriers
  - *Describes common and pervasive barriers that act to obscure risks*
- Recommended actions
  - *Describes approaches in addressing the barriers*
- Risk identification measures of completeness
  - *Check list for assessing the quality of the risk ID process*
- Research into other industries
  - *Summary of findings*

Intended Product Use

- *Who is the target audience?*
  - *Risk process owners*
  - *Risk/program managers*
  - *Customers*
- *How should / could it be used?*
  - *Provide guidance to improve corporate risk identification processes*
  - *Helps practitioners avoid pitfalls in conducting risk identification*
  - *Provide a means to judge effectiveness of their risk ID process*
- *How should the product be maintained?*
  - *Product should be reviewed periodically (every few years) to include new barriers or methods to overcome/compensate for barriers.*

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Technical Risk Identification Product Traceability

Deliverable Requested	Location Covered in Product
Risk Identification Method/Process	Section 2: Current State of Risk Identification in the Aerospace Industry Table 2: Risk Identification Methods
Recommended program resource engagement	Section 4: Barriers to Risk Identification and Mitigation Approaches (discussions within subsections cover recommendations to program resource engagement) Section 5: Recommended Actions
Risk ID checklist	Section 5: Recommended Actions
Risk ID quantitative and/or qualitative assessment	Section 4: Measure of Risk Identification Completeness Table 4: Barrier Mitigation Scorecard
Process, tool, format for risk summary/aggregation	Section 3.2: Barrier 2: Artificial Constraints and Biases
Risk ID best practices	Section 4: Barriers to Risk Identification and Mitigation Approaches (discussions within subsections cover recommendations to program resource engagement) Section 5: Recommended Actions
How to assess contractor technical risks during source selection	Section 4: Barriers to Risk Identification and Mitigation Approaches (discussions within subsections cover recommendations to program resource engagement)
Risk ID for oversight, audit, and review	Section 4: Measure of Risk Identification Completeness Table 4: Barrier Mitigation Scorecard

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Topic Details: Risk Identification Methods

- *Summary of Risk Identification Methods*

Risk ID Method	Description	Strengths	Weaknesses
Experiential Methods			
Review previous program risks, issues, and lessons learned	Review of risks and issues identified on prior programs of similar scope, complexity, and use of technologies to see if any are applicable to the current program	Leverages relevant knowledge from similar programs.	May not include risks outside of prior programs' experiences. Differences between programs may not be understood.
Checklists and questionnaires	Structured method to identify known potential risk areas based on past experience, and to have responders assess the applicability of those potential risks to the current program.	Leverages institutional and organizational lessons learned	May not identify risks outside of the group's prior experiences. Requires organization repository and maintenance.
Brainstorming	Utilizes social interaction to enhance the risk identification process. It requires a competent and unbiased facilitator to help keep the discussion on topic.	Provides a structured method to leverage the knowledge breadth of a diverse group of experts	Dominating individuals may attempt to push their ideas onto the rest of the group, and weaker personalities might not get a chance to air their views. Only as good as the experience breadth of the group.
Personal knowledge/ experience of risks	Collect risks based on one or more individual's personal knowledge and expertise.	Beneficial within each individual's experience range	Individuals generally lack the full breadth of understanding of the entire program and may inadvertently filter out credible risks from their identification process.

Experiential: Methods based on personal experience and knowledge.

Analytical: Methods based on analysis of data.

Analytical			
Key Performance Parameters (KPPs) -- technical, programmatic	Review of the KPPs to identify the specific risks to achieving the key program objectives.	Provides risk identification that is targeted on the design's ability to meet the program's KPPs	Assumes the Program's identified KPPs fully represent the parameters that best represent the required system performance.
Review Project Work Breakdown Structure (WBS)	A critical review of the WBS can expose risks inherent in the interdependency of the project work	Provides a structured approach for risk identification in the context of how the program's work is structured, including entities external to the program (suppliers, teammates, governmental entities, etc.)	Risk identification using the WBS is only as good as the WBS itself, and the expertise of the risk identifiers reviewing the WBS.
Risk Breakdown Structure	Risks are stated and assessed at each level of architectural assembly: system, subsystem, unit, component and part. Higher level risk assessments are informed largely by historical data. Middle level risks also include the risk of interface and interaction. Component and part level risks are only assessed for very high unit-level risks.	Comprehensive, structured, and intuitive for the reviewer. Aggregate risks include the probabilistic sum of all of the constituent elements.	Aggregation is subjective, and typically not statistical or mathematical – resulting in decreased confidence. Low aggregate risks may mask high concentrations of risk in certain components or parts. Effective mitigation is sometimes best performed at a different level than the level being reviewed.
Inception Risk Standardization	Each program assesses and dispositions a list of pre-defined standard risks based on the experience and data collected from historical programs and missions	This method requires programs to assess likely risks which may be overlooked.	Pre-defined standardized risk lists are not likely to be insightful to mission and program peculiar risks.
Review Requirements, Design Documents	Review of these documents can reveal perceived gaps in the design, or over-constraints that could adversely affect design	Provides a structured approach for risk identification in the context of the program's requirements and design	Risk identification using the requirements and design documentation is only as good as

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Topic Details: Risk Identification Barriers

- *Major Risk Identification Barriers*
  - *Barrier 1: Over-Reliance on a Single Method*
  - *Barrier 2: Artificial Constraints and Biases*
  - *Barrier 3: Dismissing a Risk as a Normal Program Challenge*
  - *Barrier 4: Compliance Reliance*
  - *Barrier 5: Program Acquisition Attributes*
  - *Barrier 6: Scope Boundaries*
  - *Barrier 7: Normalization of Deviance*

"There are many barriers to risk identification commonly encountered within the space community. Some of these barriers are intrinsic to an organization's processes and others are inherent in human psychology. These barriers impact the ability of customers, contractors, and risk practitioners to effectively identify risks."

Topic Details: Measure of Risk ID Completeness

- *Utilization of Barrier Mitigation Scorecard*

Risk ID Area	Barrier Mitigation Assessment Criteria	Assessment
General: Barriers	1 None of the identified barriers have been addressed 3 Some of the identified barriers have been addressed 6 The most significant barriers have been addressed 9 All barriers have been addressed, or are not applicable	
Barrier 1: Over-Reliance on Personal Experience	1 The program has no method other than personal experience to identify risk 3 The program has access to many of the risk ID methods,, but choice of method is at individual discretion 6 The program has access to many of the risk ID methods, and provides guidance on the appropriate usage 9 The program requires application of multiple risk ID methods	
Barrier 2: Application of Artificial Constraints and Biases	1 The program has explicitly established an artificial barrier (e.g., a Top N risk list) 4 The program has no risks above a certain level and does not challenge this 9 Risk identification process does not have limits placed on the number and/or magnitude of risks. The program actively challenges assumptions that may constrain risk identification, such as a low risk program having no medium or high risks.	
Barrier 6: Separating Risk from Planned Work in Development Programs	1 Risk ID is completely dependent on individual perspective, and risks are inconsistent with respect to future development 3 Development risk is filtered during risk review to consistently discriminate between risks within and outside of plan 6 Development risks are consistently identified by using multiple risk ID methods 9 Risk ID specifically solicits development risk by using multiple risk ID methods during all program development activity	
Barrier 7: Risks Confused with Issues	1 No consistent and integrated risk and issue management training of program team 3 Risk and issue training in place and conducted regularly with program personnel 6 Risk Manager actively engages when candidate risks are identified to ensure issues are identified and immediately elevated	

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Topic Details: Recommended Actions

- A set of recommended actions for organizations to implement improved technical risk identification at program inception

ID	Recommended Action	Barrier Mitigated	Action Taken By:
1	Review list of risk identification methods and provide processes, tools, templates, and training to program risk managers	Barrier 1	Risk Management Process Owner
2	Plan to use several methods of risk identification at each program milestone and document it in the risk management plan (or equivalent).	Barrier 1	Program Risk Manager
3	Require at least two risk identification methods for each program milestone or event, using at least one experiential method and one analytical method.	Barrier 1	Risk Management Process Owner and Program Risk Manager
4	Monitor risk identification process for barriers and implementation of recommended solutions. This *independent* review should focus on the *process*, and be separate from the review of risks.	Barriers 1-7	Risk Management Process Owner
5	Streamline process for candidate risks to minimize the investment in initial capture and review. If not accepted, candidate risks should be revisited periodically to assure that their state has not change.	Barriers 2, 7	Risk Management Process Owner, Program Risk Manager
6	Streamline process for risk monitoring. Do not reject or close risks that have not been realized or completely mitigated, but require only periodic review.	Barriers 2, 7	Risk Management Process Owner
7	Normalize risks to the unit or interface level. Consolidate risks that are narrower than unit function, and separate large aggregate risks.	Barrier 2	Program Risk Manager
8	Add risk identification as a discrete activity throughout the life cycle (program milestones, design/readiness/peer reviews, of technical products (code reviews, modeling and simulation, rehearsals, and	Barriers 1-4	Program Risk Manager; Risk Management Process Owner
	brokers, and key technology suppliers.		
21	Candidate risks should be processed prior to Risk Management review. Filtering may include screening, combining, interpreting, equalizing, and re-framing original ideas. This initial risk list has substantial value-added and is much more useful/actionable than raw list of candidate issues	Barrier 2, 4, 7	Program Risk Manager

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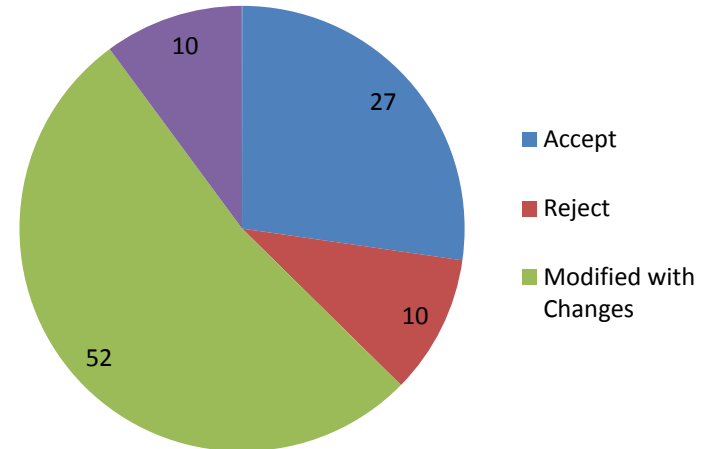Mission Assurance
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Topic Details: Other Industries

- Industries Researched:
  - *Auto Insurance*
  - *Supply Chain*
  - *Highway Transportation*
  - *Medical Industry*
  - *Nuclear Reactor Safety*
  - *Oil and Gas Industry*
  - *Commercial Launch and Space Insurance*
  - *US Government Intelligence Analysis*

- The industry research reinforced common risk identification practices
  - *Checklists and databases are commonly accepted tools for risk identification*
  - *Cognitive barriers exist and need recognition and time to overcome*
  - *Industry working groups and communities of practice are valuable resources for risk identification*

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Workshop Objectives and Accomplishments

- *Incoming objectives of workshop*
  - *Obtain consensus on the adjudicated SME Comments, resolve any non-concurrences*
  - *Clarify and disposition all remaining (To Be Resolved) SME Comments*
  - *Incorporate any new SME changes and recommendations into final Silver Version or into Gold Version*
- *Workshop Accomplishments*
  - *Adjudicated all outstanding SME comments*
  - *Incorporated SME-motivated changes*
  - *Performed document clean-up*

Total SME Comments 99
Status entering the Workshop

Pie chart values: 27, 10, 52, 10

Legend:
- Accept
- Reject
- Modified with Changes

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Future Work

- 2014 MAIW product: Risk Identification at Program Inception guidance
  - *Recommend introduction of this product to PMI, INCOSE communities*
  - *Recommend incorporation of this guidance document into the existing Aerospace family of risk management TORs and handbooks.*
- Future MAIW topics
  - *Look beyond risk identification to include risk management process improvement*
    - Several barriers cannot be overcome without the modification of the overall risk management process
  - *Approaches to changing the cultural perception of risk management*
    - Program managers may not perceive an immediate value to a formal risk management process.
    - Risk management resources may be challenged in a budget-constrained environment

Team Introductions

Core Team		SMEs	
Company	Participant	Company	Participant
The Aerospace Corporation	Andrew Hsu (co-lead) Amy Weir (co-lead)	The Aerospace Corporation	Anh Dang Sergio Guarro
Ball Aerospace & Technologies Corp	Bill Frazier (co-lead)	Ball Aerospace & Technologies Corp	David Pinkley
The Boeing Company	Robert Ellsworth	Booz Allen Hamilton	Brian Weir
Lockheed Martin Corporation	Jerome Sobetski	Aerojet Rocketdyne	Alexis Burkevics
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Orbital	John McBride (co-lead)	Orbital	Ben Hoang Jaclyn Decker
Raytheon Space and Airborne Systems	Robert Jennings		
SMC	Dave Davis (Government)		
SSL	Larry Rubin		

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Final Thoughts

Two risks walked into a bar and one was kicked out because he became an issue.

A risk, a concern, and an issue were heading to a bar.
> *The risk couldn't get in because he was using a fake ID.*
> *The concern argued with the bouncer and was man-handled.*
> *The issue snuck in unnoticed.*

Why did the risk cross the road? To get to greener pastures.

Why did the issue cross the road? To get to the root cause.

Knock, knock. Who's there? Concern. Concern who? Concerns you if you don't mitigate this risk!

If a risk turns into an issue and no one is around to see it, will it still cause a failure?

Technical Risk Identification at Program Inception Product Overview

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SK0667

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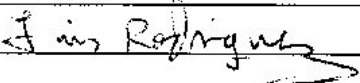craig.wesser@ngc.com
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