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Effective System Engineering Peer Reviews

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Outline

- Business Background
- Purpose
- Process Elements
- Process Steps
- Tool
- Benefits
- Conclusion

Business Background

- Large, complex business with proprietary design constraints
  - Limited independent technical resources
- Currently, 3 major programs are underway to develop and produce high consequence system and components.
- Corporate strategic milestone was defined to establish an engineering peer review process to support successful execution of the engineering mission space

Background

- Confusion exists between design & peer reviews
  - Absence of a clear defined peer review process adds to this confusion
- Deep technical focus required for high consequence products are needed to assure successful engineering execution
  - Evidence shows shortcuts have been taken
  - Lack of independence and follow through result in box checking
  - True benefits for a “peer review” have not been realized

Purpose

- Create a consistent process for which designs teams can benefit to improve their designs
  - Define the attributes needed for a peer review
  - Define a process to support and encourage deep technical dives
  - Propose that Peer Reviews precede Design Reviews
- Developing a systematic approach that considers independence, scope, and rigor, all tied to technical risk
  - Thorough and Repeatable Process
  - Graded Approach
  - Process to ensure observations are resolved

Risk-based tool to facilitate structure and focus of the review

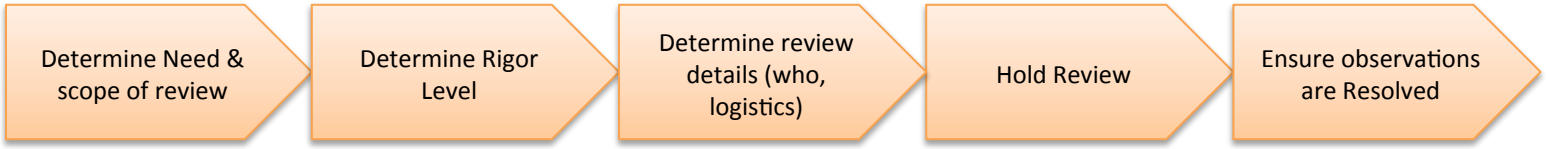
Approach

- Conduct lessons learned
- Benchmark process elements
- Define process attributes
- Socialize process
- Conduct “pilot”
- Evaluate results
- Implement new process

Proposed Process Elements

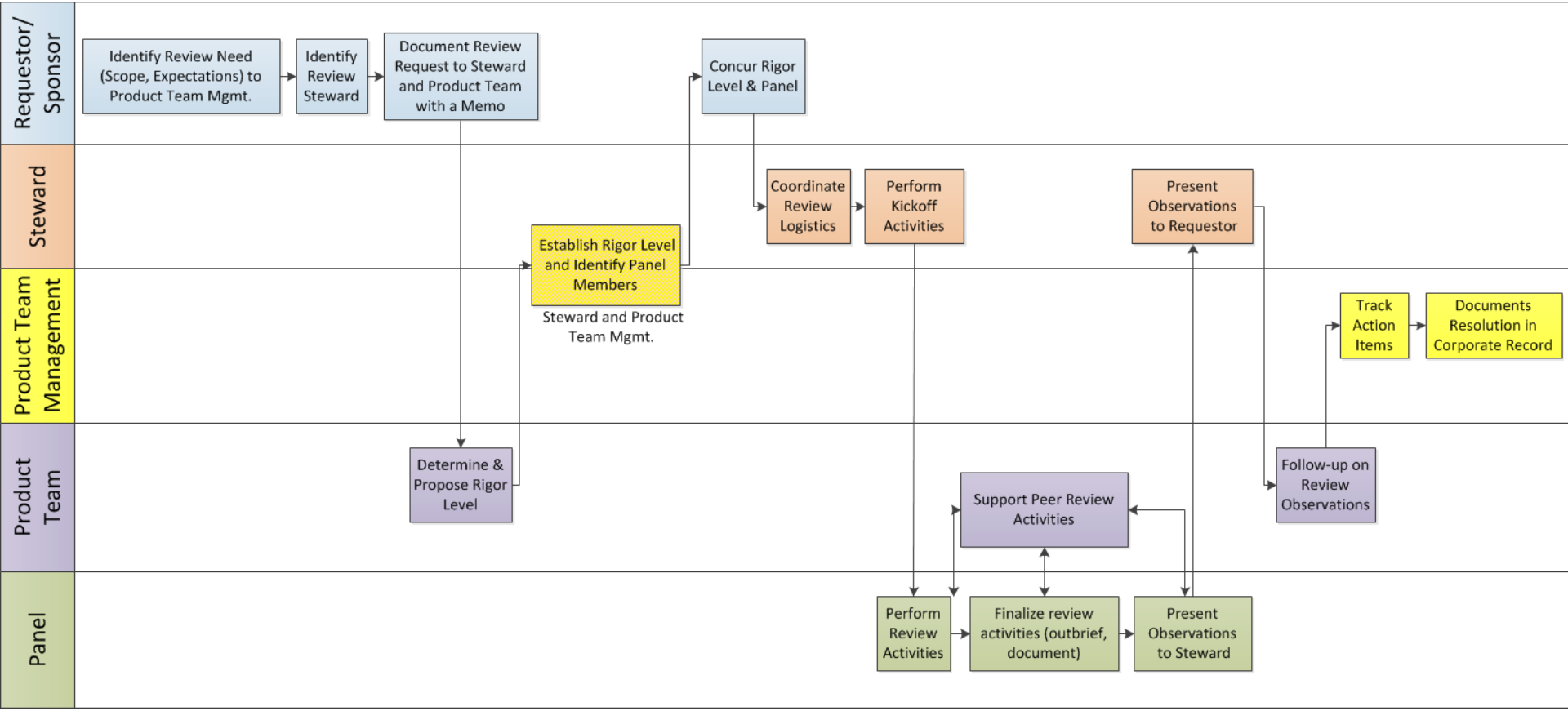
- Independence
- Rigor
- External Engagement
- Resolution
- Identification of Peers
- Systematic Process/Structure

Peer Review Process Steps



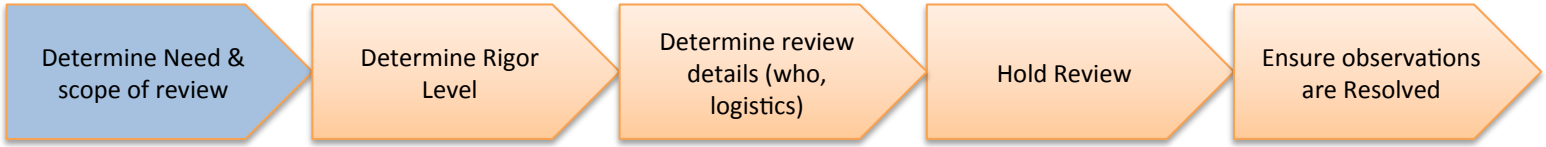
- Identify peer review is needed & determine scope of review
- Determine rigor level by evaluating criticality (likelihood indicator) and consequence
- Determine review details
  - Establish constraints on execution of peer review (time, $, classification, etc...)
  - Determine what knobs can be turned to execute the review (depth, who, ...)
- Hold the review
- Ensure review results get acted on

Peer Review Process



Cleared Defined Roles and Responsibilities is key to review execution

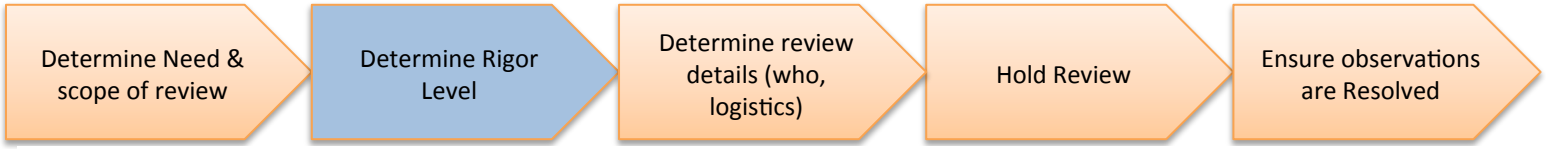
Determine Scope of Review



- Is the design approach new?
- Is there a new technology or material that is being used?
- Are there safety architecture concerns?
- Are there functional performance areas that are of concern?
- Are there areas of margin/uncertainty that need review?
- Are there high risk sub-components included in the design?
- Are there Nonconformance reports or field returns on legacy components that may lead to further review by a peer team?

Peer Reviews can be initiated at any time in the life-cycle

Likelihood / Consequence Tool



Step 2: Utilize the Likelihood and Consequence Tool to assess Rigor Level for Review

Technical Issues (Click Cell to Obtain More Information)	Please Enter Answer/Concern Level by Clicking on Cell and Using Dropdown List
Are there requirements of concern? Are there functional or performance areas of concern?	Yes/High Concern
Is there new technology that is being used? Is the design approach new? Is there a history of issues on legacy design or process?	Minor Concern
Are there any new process approaches? Are there major process changes? Have there been materials changes?	No/No Concern
Is the necessary information for the design or process difficult to obtain?	No/No Concern
Is the design or process highly complex?	Yes/High Concern
Are there qualification concerns?	No/No Concern
Are there high-risk components included in the design?	No/No Concern
Is the design or process highly dependent on other things being achieved?	

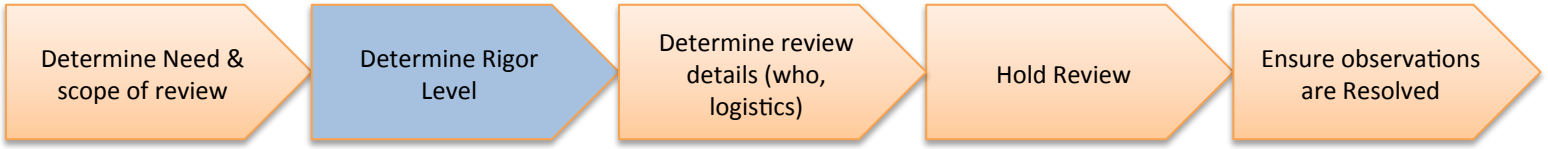
Programmatic Issues (Click Cell to Obtain More Information)	Please Enter Answer/Concern Level by Clicking on Cell and Using Dropdown List
Is the level of experience of design team of concern?	No/No Concern
Is anything on a critical path?	No/No Concern
Is the funding or funding profile of concern?	No/No Concern
Are there conditions of Program, program obstacles, or program constraints (i.e., use COTS, provide commonality, really long lifetime....) that are of concern?	No/No Concern
Is the program sufficiently ready?	No/No Concern

System Impact* (Click Cell to Obtain More Information)	Please Enter Answer/ Concern Level by Clicking on Cell and Using Dropdown List
Are there concerns about stakeholder perceptions, political and/or social factors, if the design does fails or does not meet its performance requirements?	High/Critical
What is the time impact if design cannot be realized when needed?	Moderate/Major
What is the cost impact if design cannot be realized when needed?	Low/Minor

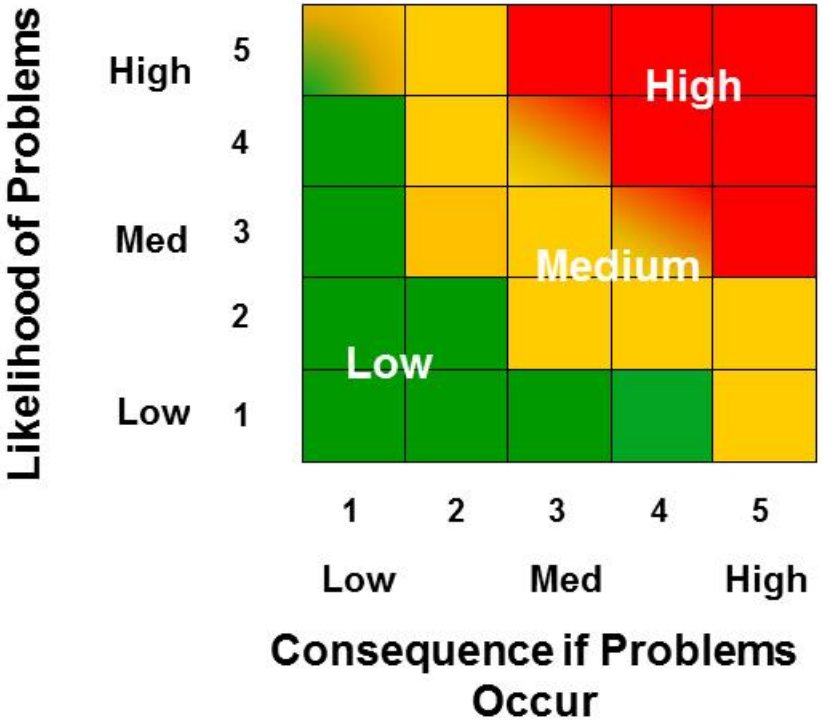
*Note: If design in used in multiple systems, please consult with all system owners.

Likelihood for Problems	4
Consequence	3

Determine review rigor level

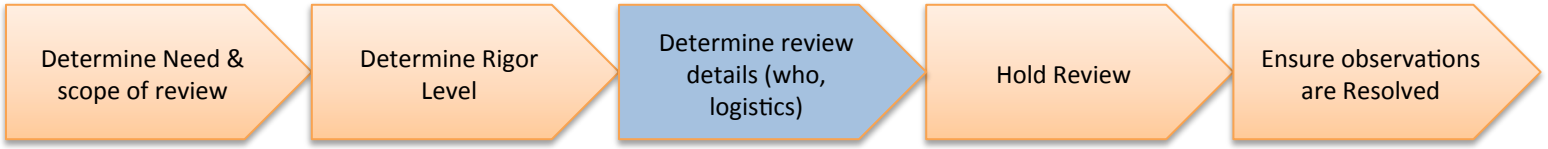


- **Use Tool to evaluate:**
  - Level of likelihood of problems
  - Level of consequence if problems occur
  - Resulting level of rigor for peer review
    - Red = high
    - Yellow = medium
    - Green = low



Tool

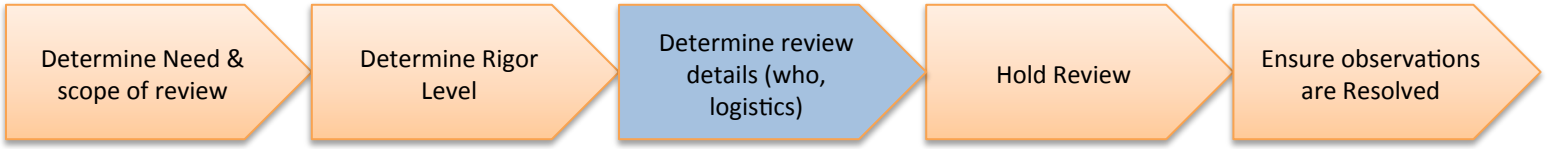
Peer review roles



Function	Roles	Tasks
Requests review	Requestor	Requestor
Ensures accountability	Product Team Mgmt	Management
Presents at review	Product Team	Product Design
Performs review	Peer Review Panel	Panel Chair
		SMEs
		Facilitator (optional)
		Tech. Writer (optional)
		Note Taker (optional)
Administers review	Steward	Steward
		Coordinator (optional)

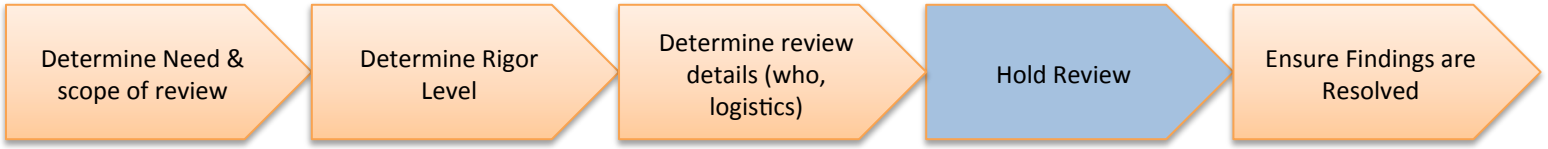
A person may have multiple roles. Important for high rigor peer review is that the steward is independent.

Panel Membership Based on Rigor Level



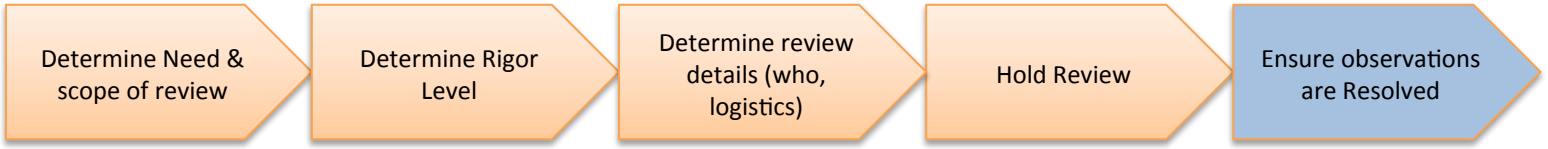
Rigor Level	Panel Size	Depth	Reviewers
High	6-8	• Review process may take time (Weeks to Months) • Homework for review team before on-site focused review • Primary Interaction is an on-site focused review • Review panel may perform their own analysis/investigation or ask for additional analysis to be performed	External Required
Medium	4-6	• Interaction is likely a >1 day meeting • Tutorial in advance of meeting • Homework for review team before meeting • Opportunity for review team to ask for additional analysis • Review panel takes time to form their opinion (weeks)	External Recommended
Low	2-4	• Interaction is likely a <1 day meeting • Project team provides information to review team • Review team is not expected to perform homework or assign design team homework • Review panel takes time to form their opinion (hours to days)	External Optional
All			• Lead from similar product • Science subject matter expert • Mod/Sim subject matter expert

Hold Review



- Conduct Review with Management Team, Panel of Subject Matter Experts, Panel Chair, Presenters, Facilitator, and Coordinator present as appropriate to the review needs
  - Conduct formal Opening Briefing
  - Presentations explaining the issue
  - Conduct interviews
  - Review work documents
  - Review computer models
  - Review parts designs
  - Perform independent tests & analyses
  - Conduct Formal Closeout Briefing

Ensure Observations Are Addressed



- Following up on the recommendations and observations of a review is critical to realizing the benefit of the review
- Action items from the review shall be tracked by the product team
- Review product team management is responsible for tasking the appropriate people to perform the follow-up
- Product team management signs-off on resolution of observations with a memo to the requestor
- Resolution memo called out as a topic for required design reviews

Benefits

- Likelihood and consequence tool helped to focus the review on critical technical areas
  - Complex designs are difficult to provide the focus needed
  - Subject Matter Experts were identified for focus areas
- Focusing on high risk areas if there are cost and schedule constraints
- Flexibility in approach and execution if the review has high visibility to customers

Conclusions

- 3 successful pilots were conducted critical development programs
  - The tool was integral to scoping the review by providing a risk based approach
  - Methodology to tailor parameters to meet key design needs
- Risk-based approach that considers fundamental elements of a product life cycle and highlights key technical issues
- Instituting rigorous peer review process is essential to delivering confident design and product to maintaining the nation's nuclear deterrence