Conducting Technical Studies

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Motivation

Good studies are relevant and facilitate good decisions
Customer Tasking

- Can come in many ways ....
  - Formal Tasking Letter
  - Email
  - Hand written memo or sketch
  - Orally
- May or may not come with a source of funds
- Usually does not provide sufficient information to plan and execute a technical study

Need to spend time properly defining the problem
Study Guide “THE QUESTION”

• One or a few specific questions
  – If answered accurately ….
  – Will satisfy the customer

• Advantages of defining “THE QUESTION”
  – Focuses work to answer “THE QUESTION”
  – Enables conducting the study more quickly
    • Unneeded work eliminated
    • Speed improves relevance
      (Good Answers …. Fast!)
  – Enables discriminating between in-scope and new-scope work

Getting “THE QUESTION” right is key to a good study
Study Guide Preparation

- Align study to Customer expectations
  - Define “THE QUESTION”
  - Identify general approach
  - Identify key participants
  - List key assumptions
  - List design and analysis tools and methods
  - Provide high level schedule
  - Document resource requirements
  - Identify deliverables

- Level of detail depends on magnitude of the study

- Must have stakeholder concurrence

Study Guide content is more important than format
Study Guide Guidelines

- Clearly articulate “THE QUESTION”
- Keep the objective in mind
- Understand what pieces are missing
- Dig to the right depth
- Parse the study into logical chunks (tasks)
- Highlight task relationships
- Be clear about who will do what
- Budget plenty of time for documentation

Define the path for answering “THE QUESTION”
Prior Work Evaluation

- Once you know “THE QUESTION” see if someone has already answered all or part of it.
- Where to go ….
  - Document Management Systems
  - Technical Libraries
  - Other Engineers
  - Web
    - Defense Technical Information Center (DTIC)
    - Professional Societies
- Aka Market Research

Customers like fast and cheap answers to “THE QUESTION”
Work Planning
(Defining the work)

- **Activity Modeling**
  - Process Modeling
  - Design Structure Matrix
- **Define Activities**
  - Inputs
  - Outputs
  - Controls
  - Mechanisms
- **Define activities ...**
  - To be accomplished by one organization
  - Using a defined process
  - And well defined artifacts for inputs and outputs
Work Planning (Cost & Schedule)

- Use the process model
- Considerations:
  - Part time work
  - Fully Burdened Cost
  - Iterations
  - Stakeholder involvement
  - Resource availability
  - New tools
  - Coordination meetings and reviews
  - Holidays and vacations
  - Contracting Process
Work Planning (Study Techniques)

- Design Space Exploration & Design of Experiments
  - Systematically explore the trade-space
- Set Based Design
  - Systematically eliminate what is NOT the answer
  - Allows for semi-independent teams
- Decision Oriented Systems Engineering
  - Plan work to support the scheduling of decisions.


Work Planning
(other considerations)

- Study Phasing
- Classified, Sensitive and Proprietary Data
- Dealing with Uncertainty
- Concept Cost Estimates
- Risk Evaluation and Readiness Metrics
- Data Certification
- Organizational Structure Considerations
- Dispersed Workforce
- Verification, Validation, and Accreditation
- Generalizing Results
- Intermediate Final Products

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Work Tasking

- Multiple ways to fund participants
- Considerations
  - Activity definitions
  - Intellectual Property
  - Participation in integration meetings and peer & project reviews
  - Deliverables
  - Options
Work Execution & Integration

• Study Integration
  – Route information to and from study teams
  – Resolve issues
  – Ensure consistency in assumptions across teams
  – Find and fill gaps

• Study Guide Maintenance
  – No plan stays intact during execution
Peer Review

• Independent Technical Evaluation
  – Assumptions
  – Methods
  – Data
  – Results

• Midpoint Peer Review
  – Mid-course guidance correction
  – “Argue Early”

• 90% Peer Review
  – Identify critical issues before funding runs out
  – Help formulate generalized conclusions

Effective Peer Reviews enable completing studies on schedule
Project Review

• Purpose
  – Communicate study plans, progress, issues and risks to customer and stakeholders
  – Ensure the customer and stakeholders buy into the process, assumptions, and by extension, the results
  – Make decisions or eliminate options
  – Aide in free-flow of information
  – Solicit ideas and feedback from outside the study team

• Typical timing
  – Kickoff Meeting
  – Midpoint review (optional for short studies)
  – 90% review
Project Management

- **Cost Schedule and Performance**
  - Track performance of study teams
  - Take corrective action as necessary

- **Risk Management**
  - Identify and mitigate risks associated with successfully completing the study

- **Reporting and Metrics**
  - Provide periodic feedback to management on status of study

- **Growth within Scope**
  - Carefully apply contingency resources to additional unplanned work needed to answer “THE QUESTION”

- **Growth in Scope**
  - Try to defer growth in scope (new QUESTIONS) to a follow on study
Report Development

- Formal Report Advantages
  - “Certified” via signature
  - Can be referenced (serialized)
  - Aide future studies
- Format
  - ANSI/NISO Z39.18-2005
  - Letter Report
  - Distribution Statements
  - ITAR statements
- Schedule
  - Start work on the report immediately after the kickoff meeting

The Study Report usually represents the organization, not just the study team.

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Report Contents

- State and answer “THE QUESTION” in a one or two page Executive Summary.
- Identify the customer and articulate the subject context and importance
- Demonstrate the study results answer “THE QUESTION”
- List key assumptions
- Identify tools and methods used
- Include if applicable:
  - Technical and other Programmatic Risks
  - Insights gained and recommendations for further study
  - Assessment of risk of study methodology
- Consider including the Study Guide as an appendix or by reference.
- Consider including a “minority opinion” if applicable
Study Close Out

- Formal review of the Study Report by stakeholders
  - Ensure conclusions are supported
  - Ensure "THE QUESTION" is adequately answered

- Presenting to the Customer
  - Consider using "Tufte-style" 4 page paper
  - Otherwise use PowerPoint
  - Seek feedback from the Customer
Study Close Out (continued)

- Dispositioning and archiving data
  - Retain and archive data for use …
    - as a reference for current / future questions or studies
    - in reproducing results
    - in presentations
    - by future historians
  - How
    - write memos / memos for the record
      - retain in Document Management Systems
    - submit documents to DTIC
    - present at conferences
    - publish in professional society journals.
- Lessons Learned
  - Consider capturing in a serialized memo to improve future studies and facilitate updating process documentation
    - Include feedback from the Customer
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