



# Defense Acquisition in Transition

6<sup>TH</sup> ANNUAL ACQUISITION RESEARCH SYMPOSIUM

## Transactions Cost From a Program Manager's Perspective

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# Report Documentation Page

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# Previous Work

## Defense Acquisition Implications of Transactions Cost Economics (TCE)

- 2005: Franck & Melese,
  - “A TCE View of DoD Competitive Sourcing”
- 2006: Dillard + 2,
  - “A TCE Approach to Defense Acquisition Management”
- 2007: Angelis + 3,
  - “Applying Transaction Cost Economics to Improve DoD Cost Estimates”
- 2008: Angelis + 5/3,
  - “Exploring the Implications of TCE on Joint and System-of-Systems Programs”
  - “Measuring Transaction Costs in DoD Acquisition Programs”



# OUTLINE

- INTRODUCTION (Melese)
- THEORETICAL FOUNDATIONS (Melese)
- THE NATIONAL ACADEMY OF SCIENCE SURVEY OF AIR FORCE PROGRAM MANAGERS (Dillard)
- OUR PRELIMINARY ANALYSIS OF THE DATA (Franck)
- CONCLUDING REMARKS



# Acquisition Challenge: Performance, Cost and Schedule

- Weapons acquisition is afflicted by similar pathologies that impact public sector procurement:
  - Conflicting goals & objectives
  - Information asymmetry,
  - Lack of credible commitments
- In addition to
  - Technical complexity,
  - Asset specificity, and
  - Uncertainty (funding; demand; design; production)



# Background

- 2008, National Academy of Sciences study for *Optimizing U.S. Air Force and Department of Defense Review of Air Force Acquisition Programs*
- Myriad of programmatic and technical reviews prescribed for space and non-space system acquisition programs
- Options to streamline, consolidate, reduce?

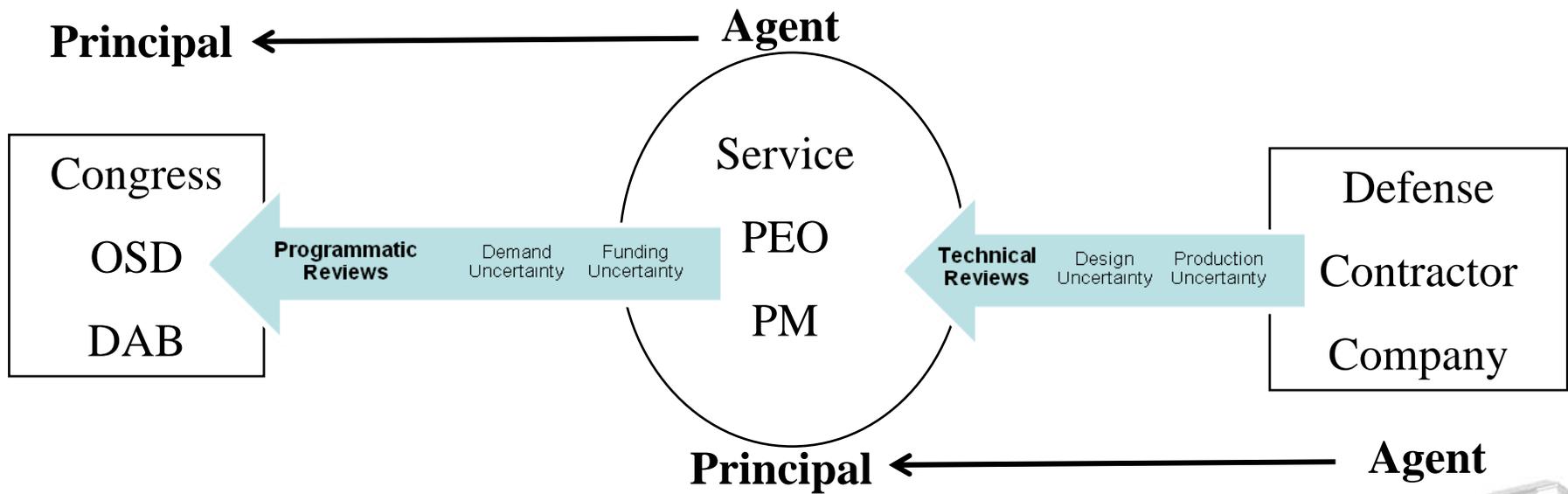


# Contribution of Our Study

- Examine roles of monitoring & oversight
  - Programmatic and technical reviews
- Within the context of two frameworks:
  - Principal-Agent Model (Agency Theory)
  - Transaction Cost Economics (TCE)
- Begin to describe benefits & costs of current monitoring & oversight
  - USAF Survey for National Academy of Sciences



# Principal-Agent Problem



# Principal-Agent Model

- Model Assumptions—Principal and Agents have:
  - Conflicting Goals & Objectives of different players
    - (Congress, OSD, PEO, PM, Contractor, etc.)
  - Asymmetric Information
    - Agent has information advantage over Principal
      - Adverse Selection: Only Agent knows his type (abilities, costs)
      - Moral Hazard: Only Agent knows his effort (quality, savings,...)
  - Imperfect Information
    - Uncertain correlation between Effort and Outcomes
    - Agents are risk averse
- Goal:
  - Evaluate alternative governance mechanisms that align interests of Agents with Principal



# Aligning Interests of Agents with Principal

- Monitoring & Oversight (Reagan: “Trust but Verify”)
  - Ex-ante controls
    - Legal & Administrative Procedures
    - Reporting Requirements
  - Restricts Agents’ flexibility (administrators vs. managers)
  - Ex-post oversight
    - Budgetary Restrictions (color of money)
    - Monitoring (What? & How?) or Surveillance of Agent
      - “Police patrol”: Continued & detailed oversight & direct supervision
      - “Fire alarm”: Rely on third parties (GAO;etc.) for oversight
  - Regulatory oversight cost premium reduces competition
  - Can properly structured incentives & other governance mechanisms substitute for some monitoring & oversight?



# Transaction Costs: Monitoring & Oversight

- According to Heritage Foundation study
  - For six months in the early 1990s, Ambassador Henry F. Cooper (then director of the Strategic Defense Initiative Organization), tracked the costs to support one decision point in THAAD (Theater High Altitude Area Defense). It took:
    - 75,000 government labor hours
    - 250,000 contractor labor hours
    - Over 1 ton of documents
    - \$22 million



# A Transactions Cost Guide

In making outsourcing decisions, it is important to consider not only the internal and external production costs of providing the good or service, but also the cost of managing the transaction internally or externally.

**Total Costs = Production Costs + Transaction Costs**

***Transaction Costs = Search and Information Costs + Bargaining, Decision and Contracting Costs + Policing and Enforcement Costs***

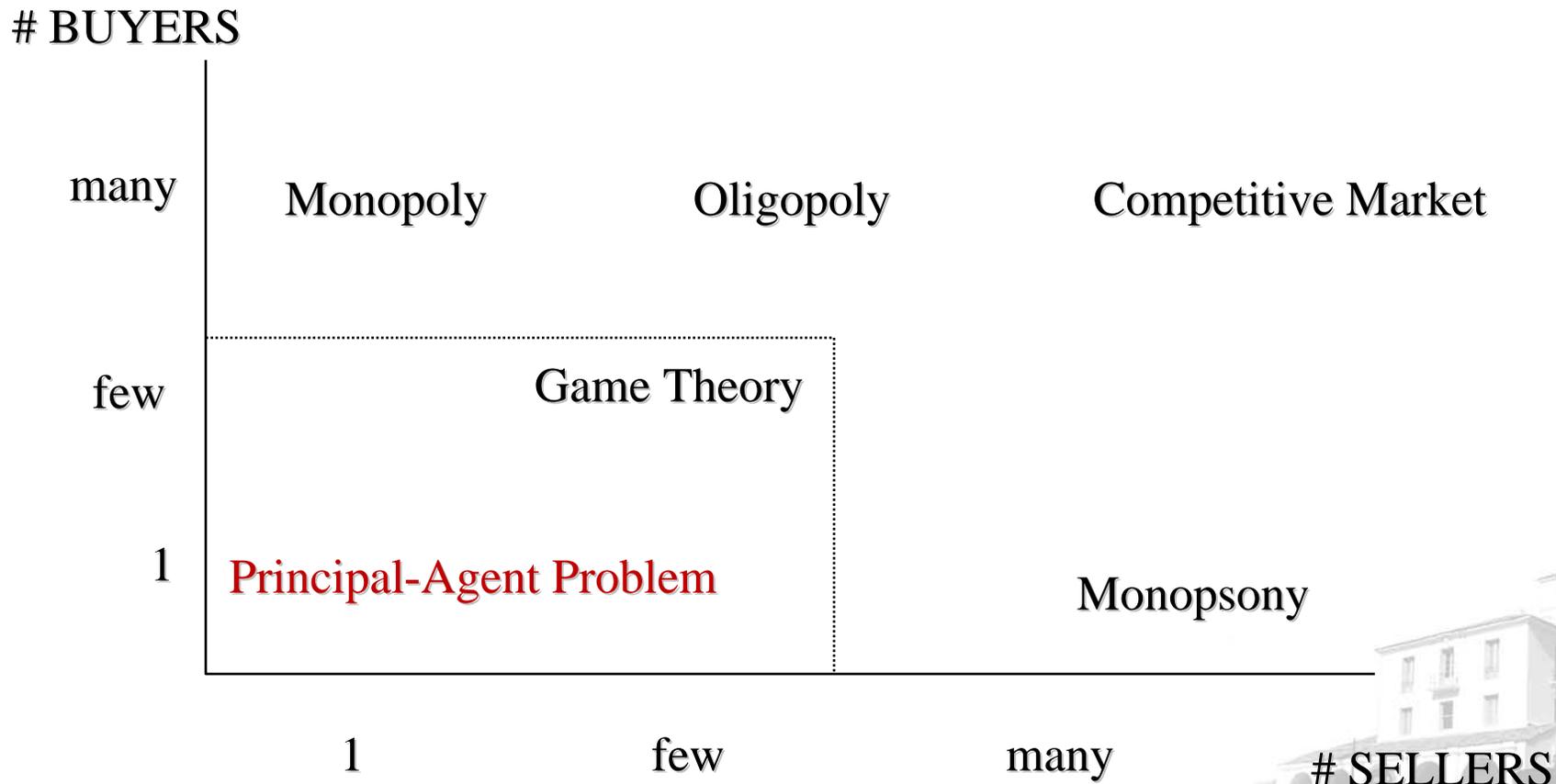


# Transaction Cost Economics (TCE)

- Objective: Design governance mechanisms that minimize coordination costs, and the costs of motivating effort and investments to achieve “better, faster, cheaper.”
- Main insight of TCE is that understanding key characteristics of a transaction can help guide the optimal choice of governance mechanisms
  - Anticipate re-negotiation costs (hold-up, change orders, lock-in, etc.)
  - If ex-post opportunistic transaction costs are ignored, then future cost increases may not be properly anticipated.



# Spectrum of Market Structures (Characteristics of the Product Market)



# Current Acquisition Practices

## Address Some Principal-Agent & TCE Concerns

- Multi-Year Contracting and Frequency
- Integrated Product and Process Development and Asset Ownership
- Cost as an Independent Variable (CAIV) – Heightened Awareness/Shared Risk
- Alpha Contracting for ex-ante Discovery
- Evolutionary Acquisition Addresses Uncertainty Incrementally
- Single Process Initiative Uses Frequency and Specialization
- Reputation and the Use of Past Performance Data and Award for Best Value
- Education, training and expansion of Acquisition workforce
- Increased Monitoring & Oversight (PROGRAM REVIEWS)



# Programmatic Reviews

- Multiple, various title, new and long-established, reviews for management oversight by program executive officer (PEO), Service-level acquisition executive, Office of the Secretary of Defense Staff, and Milestone Decision Authority/Defense acquisition executive
- Often scheduled and conducted according to pre-arranged milestone dates or per an “acquisition baseline” established by PM and multi-level staffs well in advance, or can be on call/ad hoc as program issues arise
- To inform key staff members in the Pentagon (and Congress) about business and technical progress of programs
- Often result in guidance to alter the course of programs through restructuring, re-scheduling, subtracting funds, changing quantities, etc.



# Technical Reviews

- Approximately 9 to 11 standard title, well-established, and broadly recognized reviews within the Systems Engineering Process -- More technical than business oriented
- Conducted at the local (program office) level, chaired by the PM, monitoring the technical progress of the system prime contractor and subcontractors
- Scheduled and conducted at the PM's discretion when appropriate (event or progress-based vs. calendar-based).
- Provide information to key project members/stakeholders for future actions. Facilitate issue discovery and usually do not change the principal course of a program



# NAS Study – PM Survey

- Main question: *Can changes in the number, content, or sequence of program reviews help the program manager more successfully execute the program?*
- Subjective answers from US Air Force PMs and PEOs about reviews and their impact on program execution, such as time or effort dedicated to review preparation, participation, and response to actions produced from them



# Context of the NAS Study

- 2000 - 2008, four iterations of the DOD 5000 series governing acquisition programs
- Number and levels of reviews steadily increasing
  - Technical (Internal to PMO with Contractor)
  - Programmatic (Government levels of oversight)
- For prevention of requirements “creep,” assurance of adequate cost estimation, and attainment of technical maturity in regard to design and producibility
- Questions on their cost, impact, value...



# The Nature of Increasing Reviews

- Occur at Program Executive Office, Service, and Office of Secretary of Defense levels
- New 5000 = New programmatic reviews
  - PSRs, CSBs, OTRAs
  - Extensive preparatory activities for each
- Technical reviews that had been discretionary are now mandatory



# Implications of Theory

- Transaction Costs
  - Can we use PM survey to quantify oversight and monitoring costs?
- Principal-Agent
  - Is there a difference in the perceived cost/benefit of oversight and monitoring activities when the PM acts as the:
    - Principal (technical reviews)?
    - Agent (programmatic reviews)?



# Starting Assumptions

- Subjective perceptions of relative cost/benefit of reviews provide useful insights into transaction costs
- Starting Assumption - PMs are more likely to:
  - View technical reviews as less costly/more beneficial
  - View programmatic reviews as more costly/less beneficial



# Data Analysis

- The only data available from the survey report was in summary form
  - The total response count for each question is available but not the individual responses
- Analysis limited to section 2  
(Program Activity Overview)
  - Provided information on pertinent external reviews/reporting accomplished by programs



# Reviews

| Technical                                  | Programmatic                                            |
|--------------------------------------------|---------------------------------------------------------|
| Technology Readiness Assessment (TRA)      | Defense Acquisition Board (DAB) Milestone Review        |
| Technology Maturity Assessment (TMA)       | Defense Space Acquisition Board (DSAB) Milestone Review |
| Manufacturing Readiness Review (MRR)       | Defense Acquisition Board (DAB) Status Review           |
| System Engineering Assessment Model (SEAM) | Defense Space Acquisition Board (DSAB) Status Review    |
|                                            | Overarching Integrated Product Team (OIPT) Review       |
|                                            | Independent Program Assessment (IPA)                    |
|                                            | Program Support Review (PSR)                            |
|                                            | Logistics Health Assessment (LHA)                       |
|                                            | Air Force Review Board (AFRB)                           |



# Some Hypotheses Tested (to date)

1. The perceived value (impact) of technical reviews is higher than the value of program reviews.
2. Technical reviews are more likely to be rated as helpful (provide useful data) than program reviews.
3. Technical reviews are less likely to be perceived as less beneficial than program reviews.
4. Technical reviews are more likely to be perceived as well structured (less likely to be combined with other reviews) than program reviews.
5. The perceived cost (level of documentation required) of program reviews is significantly higher than the cost of technical reviews.



# Hypothesis 1 – Results (Intuition-Neutral)

- Technical reviews are significantly more likely to be seen as having no impact on program performance and are somewhat less likely to be seen as having a negative impact on program performance.
  - Technical reviews are necessary to keep program on track but have little impact on overall performance.
  - Programmatic reviews may result in unforeseen complications (PM's perspective).



# Hypothesis 2 – Results (Counterintuitive)

- Programmatic reviews are significantly more likely to be seen as providing some or lots of useful data while technical reviews are significantly more likely to be seen as providing little or no useful data.
  - A programmatic review may be an opportunity to make the PM's case to senior leadership.
  - Technical issues may cover ground already familiar to the PM.



# Hypothesis 3 – Results (Counterintuitive)

- Technical reviews are more likely to be rated as least or second least beneficial
  - Programmatic reviews are better opportunities to communicate with higher authorities (consistent with hypothesis 2 results).
  - Less new information (for PMs) surfaces in technical reviews, hence lower impact and less potential benefit to program.



# Hypothesis 4 – Results (Counterintuitive)

- Technical reviews are more likely to be identified as candidates for consolidation
  - Puzzling. PMs presumably have more control over structuring technical reviews than programmatic.



# Hypothesis 5 – Results (Intuitive)

- Technical reviews are more likely to be seen as not having enough documentation.
  - Summarized information provided to higher level authorities is not adequate to understand technical issues.
  - Program managers understand the technical details and are aware of more information that could be used to document them.



# Some Preliminary Conclusions

- PMs find value in programmatic reviews even if they are more costly
  - Essential to program success
  - Pleased that necessary decisions have been made
    - Relieved that its over?
- Perceived value of technical reviews could be lower because
  - Delivered by contractor as required
    - Not necessarily if/when needed
  - PM more in tune with technical issues
    - Review just a formality



# Continuing Our Research

- Working on getting more access to survey results.
- Much better analysis possible with more raw data
  - To understand cost/benefit for specific reviews
  - May provide insight into effectiveness of incentives and principal-agent relationship



# Questions?



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Monterey, CA

# Alternative Options to Align Interests of Agents with Principal

- When Measurement & Monitoring is Costly
  - Invest in more efficient oversight (people & processes)
  - Invest in more complete contract (measurement, etc.)
  - Cost Plus vs. Fixed Price vs. Incentive contracts (NSPS)
  - Gain-sharing
  - “Efficiency wages” (pay a premium above market price)
  - Tournament (promotions, relative performance, etc.)
  - Deferred compensation (pay after experience is obtained)
  - Tenure (negotiate promise of follow-on contracts)
  - Dispute resolution mechanisms (warranties, etc.)
  - Invest in (build) identity, integrity, trust & communication
  - Invest in Transparency & Accountability & Learning

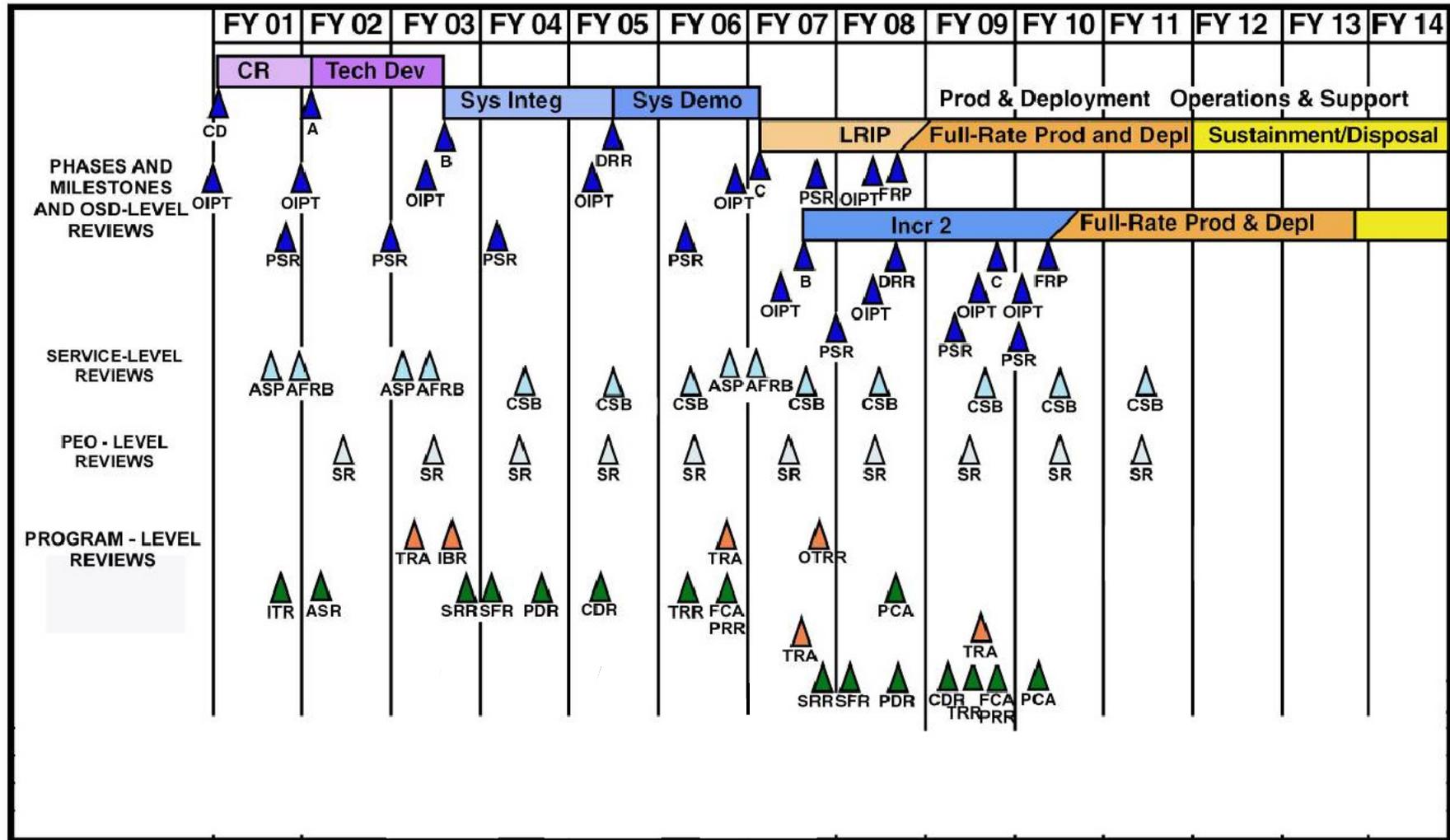


# Minimizing Transaction Costs

- Cut Coordination and Motivation Costs
  - Reduce complexity
    - Invest in more complete contract (search & information costs)
    - Use of Mature technology
  - Reduce uncertainty
    - Invest in more complete contract (bargaining & decision costs)
    - Measurement, Monitoring to reduce information asymmetries
    - Credible deterrents (enforcement, penalty clauses, etc.)
    - Warranties/Bonding
  - Increase frequency
    - Multi-year contracts
    - Reputation
  - Address asset specificity
    - Reduce government requirements for specific investments
    - Align Incentives
    - Government Owned Contractor Operated (GOCO) Specific Assets
  - Increase contestability
    - Government Standby Capacity/Expertise
    - Threat of vertical integration (bring it back in-house)



# Notional Programmatic and Technical Reviews



# Contract Design

(Milgrom & Roberts 1992)

- Informativeness Principle
  - Contract should include any measure that reveals level of agent's effort
- Incentive Intensity Principle
  - Optimal intensity of incentives depends on
    - Opportunity for incremental savings
    - Ability to measure effort & outcomes
    - Agent's tolerance for (willingness to accept) risks
    - Agent's responsiveness to incentives
- Monitoring Intensity Principle
  - Where optimal incentive intensity is high, optimal monitoring is high
- Equal Compensation Principle
  - Risk of Multi-tasking (“what gets measured gets done”)
    - Target measures to align Agents equally to all tasks valued by the Principal



# Transaction Costs

- **TC costs include coordination and motivation costs, such as search and information costs; decision, contracting and incentive costs; and measurement, monitoring and enforcement costs**
- **Each review is discrete, with a substantial workload impact and cost**
- **For oversight (programmatic) reviews, possible diversion from day-to-day core program management activities**
- **Questionable value (GAO program outcomes not improving 2000 - 2008)**



# Defense Acquisition Transactions

- **Key Characteristics of Defense Transactions**
  - **Complex**
  - **Uncertain**
  - **Infrequent (one-shot)**
  - **Time Criticality (war/peace)**
  - **Asset Specificity (transaction-specific investments)**
  - **Limited Contestability**



# The TCE Model

## “Transaction Costs”

- **Coordination Costs**

- Search & Information Costs
  - **Planning: *Identify Alternatives***
  - Costs to acquire timely, accurate & relevant information (AoA)
- Bargaining & Decision Costs
  - **Programming: *Choose an Alternative***
  - Costs of negotiating and writing contracts
- Policing & Enforcement Costs
  - **Budgeting & Execution**
  - Costs of executing, monitoring, measuring, and evaluating contracts

- **Motivation Costs**

- Costs of Countering Opportunistic Behavior
  - Costs of encouraging investments in “**specific assets**”
    - Specific Asset investments that lead to “Hold-Up”
    - Competitive bidding that leads to bi-lateral Monopoly



# Key Characteristics of Defense Acquisition Transactions:

## 1. Complexity

- Can we specify all possible contingencies in the contract?
  - Credence or Experience goods (R&D)

## 2. Uncertainty

- Imperfect Information: probability distributions?
  - Demand/Quantity, Cost, Schedule, Performance/Quality
- Asymmetric information: Does someone have information advantage?

## 3. Frequency

- One-shot or repeated transaction? Does reputation matter?

## 4. Time Criticality

- Wartime or peacetime? How sensitive to price in emergencies?

## 5. Asset Specificity

- Can we encourage specific investments and preserve competition?



# Transaction-Specific Asset Investments

- ***Specific assets*** are specific to the transaction & lose much of their value in an alternative use.
- **Specific Assets** come in a variety of flavors:
  - **Physical Assets** (specialized equipment)
  - **Human Assets** (special skills, knowledge, training)
  - **Site Specificity** (special locations that economize on inventory (EOQ), transport costs)
  - **Temporal Specificity** (investment in bottleneck activities—PERT/CPM—that impact overall project completion costs and schedules)



# Characteristics favoring EXTERNAL market

## transactions:

### ***Asset Specificity:***

If there are few specific investments in human or physical capital required and these investments retain much of their value outside the transaction.

### ***Frequency:***

If the transaction does not require close working relationships between the parties involved, and take place routinely (economies of scale, learning curves).

### ***Uncertainty/Complexity:***

If the transaction is standard, well understood so that detailed agreements are unnecessary.

### ***Performance Measurement:***

If the market regulates quality and performance.



# How to protect (encourage) valuable transaction-specific investments?

- If individuals or companies cannot be assured of realizing the full value of their specific investments, then they will not invest in specific assets to achieve “better, faster, cheaper.”
- Transactions that require specific investments normally also require credible protection against early termination or opportunistic re-negotiation.
  - Multi-year contracts (long-term contractual relationship)
  - Posting a bond (enforceable termination commitments)
  - Reputation

