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Enabling DoD Transformation

Preliminary Thoughts on Time as an Independent Variable in Support of the Acquisition Framework

August 3, 2004

Agenda

- Context
- Monitor Perspective on Use of TAIV as a Program Management Tool
- Managing Uncertainties in the Acquisition Process
- A Framework for Applying TAIV to Program Acquisition Strategies
- Enhancing Program Success with TAIV – Some Examples
- A Contract Framework to Incentivize Contractors to Meet Time Requirements
- Summary

Context

- At request of TSA/DepSecDef, Monitor explored the potential value of using Time as a boundary condition or driver as a complement to current reforms in 5000.2 to help facilitate Transformation in DoD's acquisition process.
 - Monitor considered Time as an Independent Variable (TAIV) [was considered] as another element, like CAIV, to be applied, especially where it was key that capabilities delivered when needed was most important
- On 12 July, Monitor presented its preliminary conclusions to AUSD/AT&L (Wynne), SAF/AQ, (Carley), DDPA&E (Szemborski), TSA/DSD (Patterson), SA/ASA/AT&L (Kelly), DASN(AM) (Brown), Sr/MA/DOT&E (Keegan), Sr/MA/USD/AT&L (Porter)
 - Monitor suggested that, as with CAIV, there is an opportunity to achieve potentially significant results by exploring TAIV concepts in certain acquisitions as a complement to current processes
 - There was considerable interest in concept and a desire to determine feasibility of TAIV; some comments:
 - If we could incentivize people to make schedule as important as performance, it might be a big hit (today we buy on performance and people fail to achieve time targets)
 - We might explore ways to use profit incentives over which we have control as leverage
 - Time can't be ironclad, or else outside oversight can use it to shape/kill projects
- Mr. Wynne expressed the desire for Monitor to work with his staff to explore further, to understand:
 - Where TAIV might be used (i.e., some division of a subset of programs into mission areas, and then which programs might be most amenable to TAIV, recognizing that it might not be applicable to all programs)
 - Then how it might be applied (recognizing that it might be applied to programs differently)
 - Finally, how it might be used to structure a contract to influence contractor, and program manager, behavior

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Monitor's Perspective on the Use of TAIV as a Program Management Tool

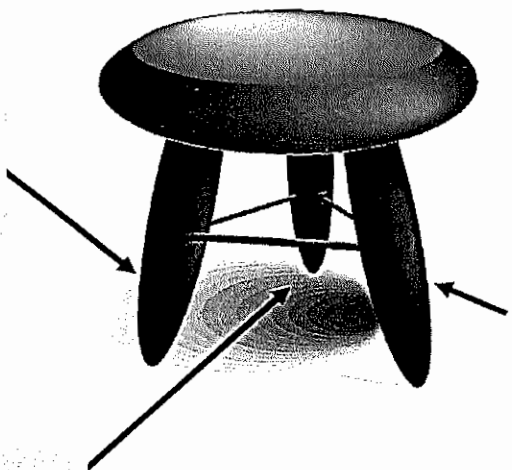
- Traditionally, schedule has been an outcome based on desired performance and/or cost
- We understand that 5000.2 is addressing time with the innovation of Evolutionary Acquisition, however, time as a tool to be used in trades is not fully developed
- We believe that Time – as a unit of measure, not a deadline – can be viewed as an independent variable in a formal selection of acquisition strategy
 - TAIV is not relevant in all acquisitions
 - There are cases where Cost and/or Performance should float
 - TAIV can be implemented as amplifying guidance in the 5000.2 construct as another tool for certain programs where it is applicable
- Using TAIV to plan and manage development requires putting it into practice as a fully realized tool (as has occurred for CAIV)
- Developing a mature TAIV process requires answering the following questions:
 - What types of acquisition strategies (spiral, incremental or single-step) is TAIV best suited for
 - How would it be applied in those cases? How would the TAIV process be designed and what are its practical implications?
 - How can the contract be used to maximize contractor/program manager behavior?

Acquisition as a Three Legged Milk Stool

Acquisition process weighs technical, cost, and schedule performance for success

Technical Performance

TPM's used to track attainment of program goals



Schedule Performance

Traditionally viewed as an outcome that can be traded-off against technical and cost performance.

Time As an Independent Variable (TAIV) could use schedule as a constraint to force choices around investment decisions and acceptable capabilities.

Cost Performance

Cost As an Independent Variable (CAIV) used during system development to make choices above a threshold requirement on cost verses capability.

TAIV is missing as a forcing function in current evolutionary (spiral development and incremental) and traditional single-step to full capability development approaches

Defining TAIV

- Time as an Independent Variable (TAIV) is not the same as a fixed schedule for development. TAIV is a *tool* that planners can use to perform trades that improve successful management of uncertainties related to time
- TAIV includes
 - Trade study to determine optimal tradeoff between time, cost and performance
 - Timeline based on that trade study that strikes the best balance between aggressiveness and achievability
 - Metrics chosen specifically for the program that can be used both to measure success and to predict upcoming problems
 - Tailored incentive structure that will best motivate managers to achieve program milestones
- TAIV is a tradeable parameter similar to CAIV
 - TAIV analysis focuses on finding the optimal point within the trade space defined by minimum and optimal performance, cost and time
 - Only two of these parameters may be fixed at any one time; the decision process for choosing between them is based on an analysis of the key uncertainties facing the program

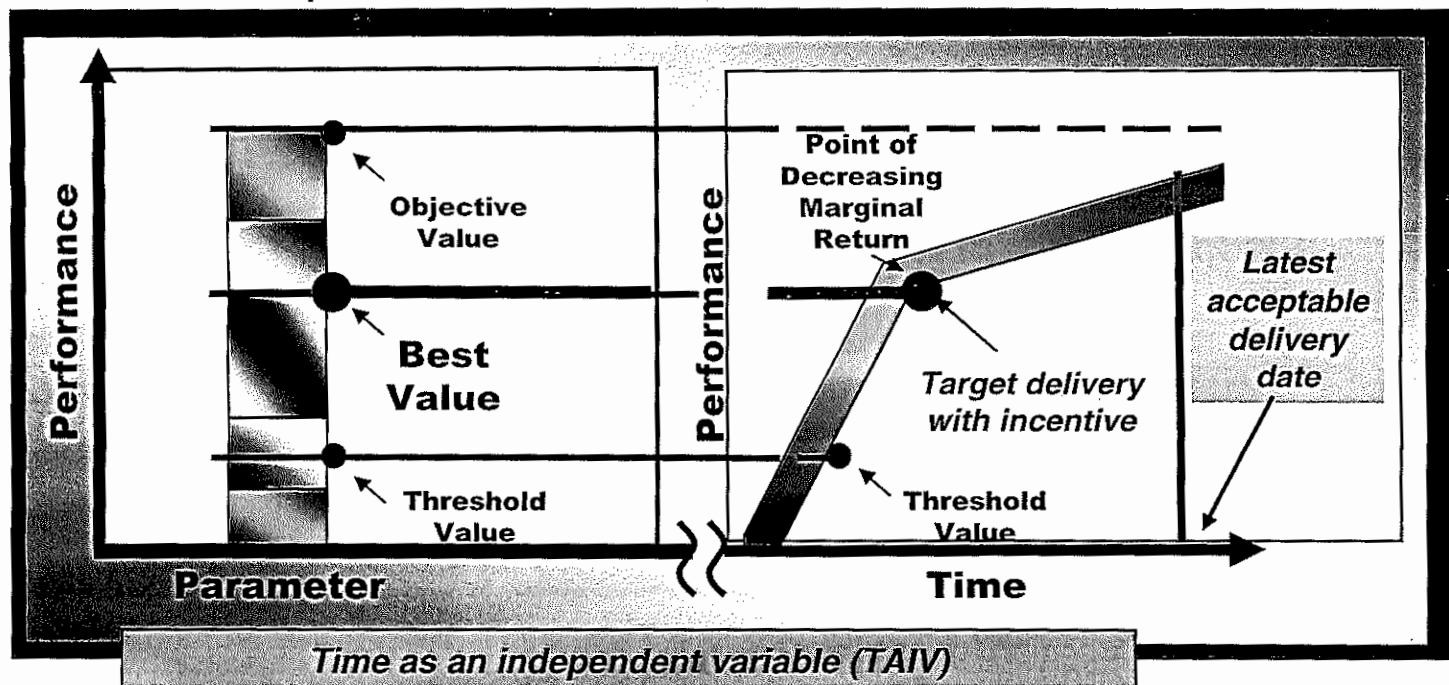
Implementation of TAIV as a Trade Space Dimension

TAIV could become a part of procurements where timeliness is a driver

Government could specify delivery objectives at system level

Contractors would flow down, define, and defend “best value”
time interval or delivery at all program levels based on cost and TRLs

Time would be a key element of system engineering trade studies in procurements to optimize timeliness



Theory of the Case: Applying Time As an Independent Variable (TAIV)

Hypothesis

Making TAIV available as a tool to DoD planners, combined with a process that determines overall acquisition strategy based on key program uncertainties, will enable DoD's transformation and...

Expected Program Success Benefits

- Provide a robust, repeatable process for building more creditable schedules based on intelligent tradeoffs between performance, cost and time
- Manage uncertainties by driving requirements to evolve in parallel with changing technology base and mission needs
- Mitigate external disruption by providing decision makers with credible schedules based on clear analysis
- Introduce needed military capabilities sooner
- Improve alignment with DoD budget cycles, providing increased funding stability

Expected DoD / Industrial Policy Benefits

- Promote innovation and competitiveness within industry by more frequent cycles of competitive opportunities
- Keep pace with innovation by exploiting commercial R&D spending
- Focus both DoD and Commercial R&D investment and foster commercialization of DoD R&D

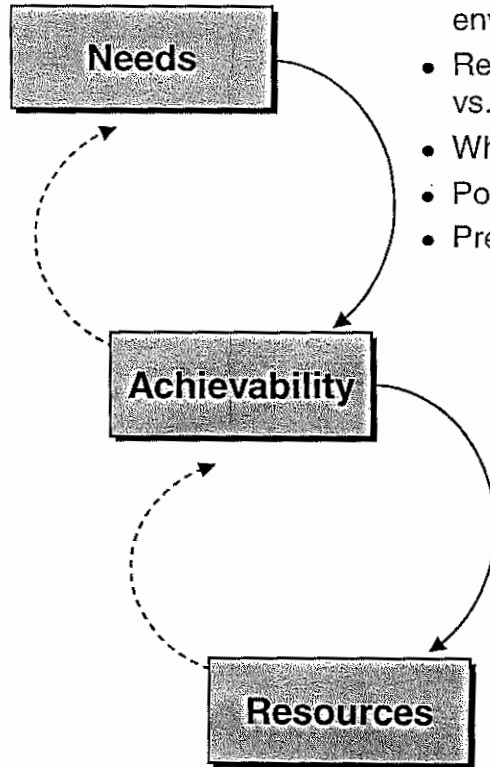
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High Uncertainty Has Characterized the Acquisition Environment

Today's Acquisition challenges derive from uncertainties, including unpredictable threat, actions of key DOD marketplace players such as congress, and a lack of clarity over program future performance and cost. All produce few clues on how to operate more effectively

Key Uncertainties Affecting Acquisition Strategy



- Frequency of changing mission need / threat environment
- Required Capability Needed and When – Desired vs. assured
- What capability can be supplied and when
- Possible emergence of alternative solutions
- Pressure to field something now
- Performance really achievable
- Schedule performance
- Political risks
- Industrial base capability risks
- Contractor workload or differing priorities
- Tech readiness – maturity confidence
- Getting the funding
- Adequate Startup Wedge
- Budget execution
- Industrial Base Availability
- Needed Oversight
- Critical Skills Staffing

Implementation of new tools and strategies

- Revised incremental development to achieve better capability sooner
- Spiral Development for advanced technologies
- Institution of new tools such as TAIV with adoption Incentives

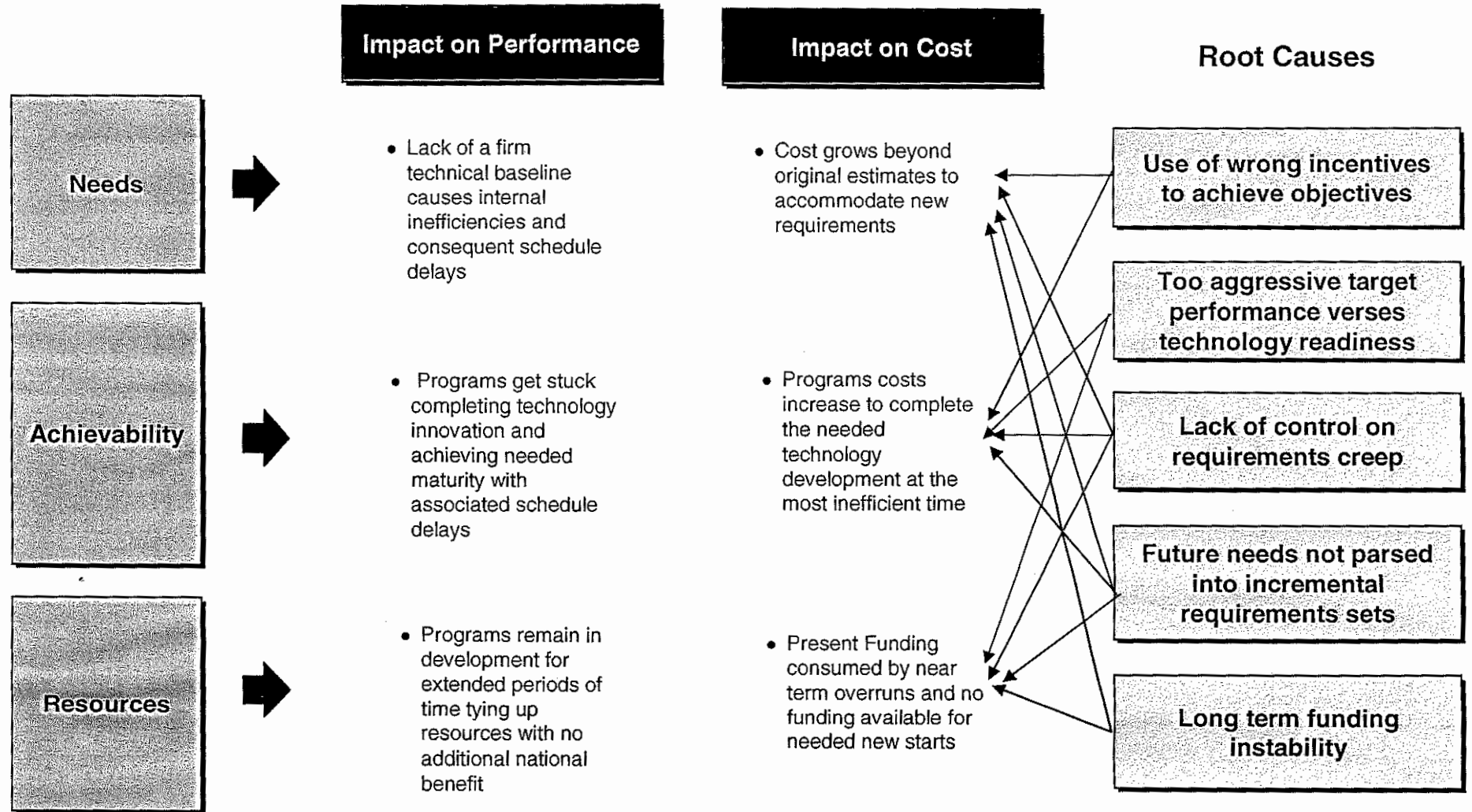
There are Opportunities to Improve Management of Uncertainties in Acquisition Management and 5000.2 Begins That Process

How the Uncertainty was Managed in Past

	Requirements Community/Users	PMO	Contractors
Needs <ul style="list-style-type: none"> • Frequency of changing mission need / threat environment • Required Capability Needed and When – Desired vs. assured • What capability can be supplied and when • Possible emergence of alternative solutions • Pressure to field something now 	<ul style="list-style-type: none"> • Continue to impose new requirements on on-going programs 	<ul style="list-style-type: none"> • Want to maintain program relevance in face of new needs so inclined to say "Can do!" 	<ul style="list-style-type: none"> • Want to satisfy their customers needs keep program sold , so always say "Can do!"
Achievability <ul style="list-style-type: none"> • Performance really achievable • Schedule performance • Political risks • Industrial base capability risks • Contractor workload or differing priorities • Tech readiness – maturity confidence 	<ul style="list-style-type: none"> • Tend to want new capabilities before technology is ready- too optimistic on achievability 	<ul style="list-style-type: none"> • Want to maintain program relevance in face of technology maturity uncertainty so inclined to say "Can do!" 	<ul style="list-style-type: none"> • In face of competition and technology maturity uncertainty, inclined to say "Can do!"
Resources <ul style="list-style-type: none"> • Getting the funding • Adequate Startup Wedge • Budget execution • Industrial Base Availability • Needed Oversight • Critical Skills Staffing 	<ul style="list-style-type: none"> • Presumption that baring something outrageous, resources will be there to execute 	<ul style="list-style-type: none"> • Want to maintain program momentum even when near term funding short. 	<ul style="list-style-type: none"> • Want to maintain business base so motivated to rationalize a way forward, even if a stretch, to get an award.

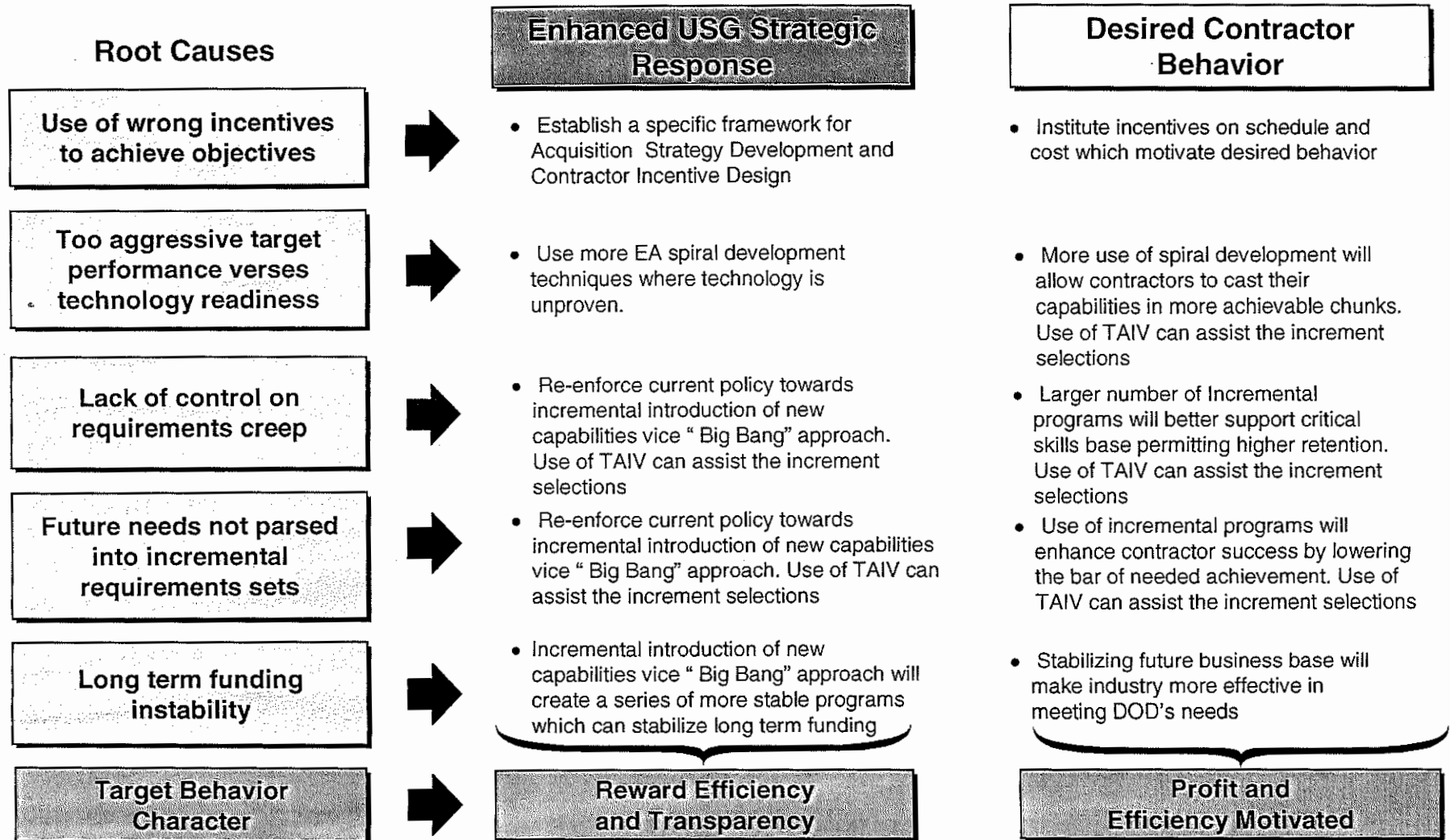
Focus on Root Causes and Manage Uncertainty Where Possible with the Right Tools

A root cause analysis can indicate where enhancements can enhance program success



Address Root Causes to Meet DoD's Schedule and Performance Objectives

TAIV could significantly influence a reversal in the key root causes to improve the future state of performance on selected acquisitions



To Manage Uncertainty, DoD Can Directly Control Some Elements and Influence Others

Identifying those decisions and uncertainties that are under DoD control as well as those that can only be influenced help clarify choices and identify alternative approaches.

Items DoD can Control

What capability can be supplied and when
Pressure to field something now
Performance really achievable
Industrial base capability risks
Contractor workload or differing priorities
Tech readiness – maturity confidence
Getting the funding
Adequate startup wedge
Industrial Base Availability
Needed Oversight
Critical Skills Availability

Items DoD wants to Influence

- Frequency of changing mission need / threat environment
- Required Capability – Desired vs. assured
- Possible emergence of alternative solutions
- Political risks
- Budget execution
- What capability needed and when
- Schedule performance


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Characteristics of Acquisition Approaches and Implications for TAIV

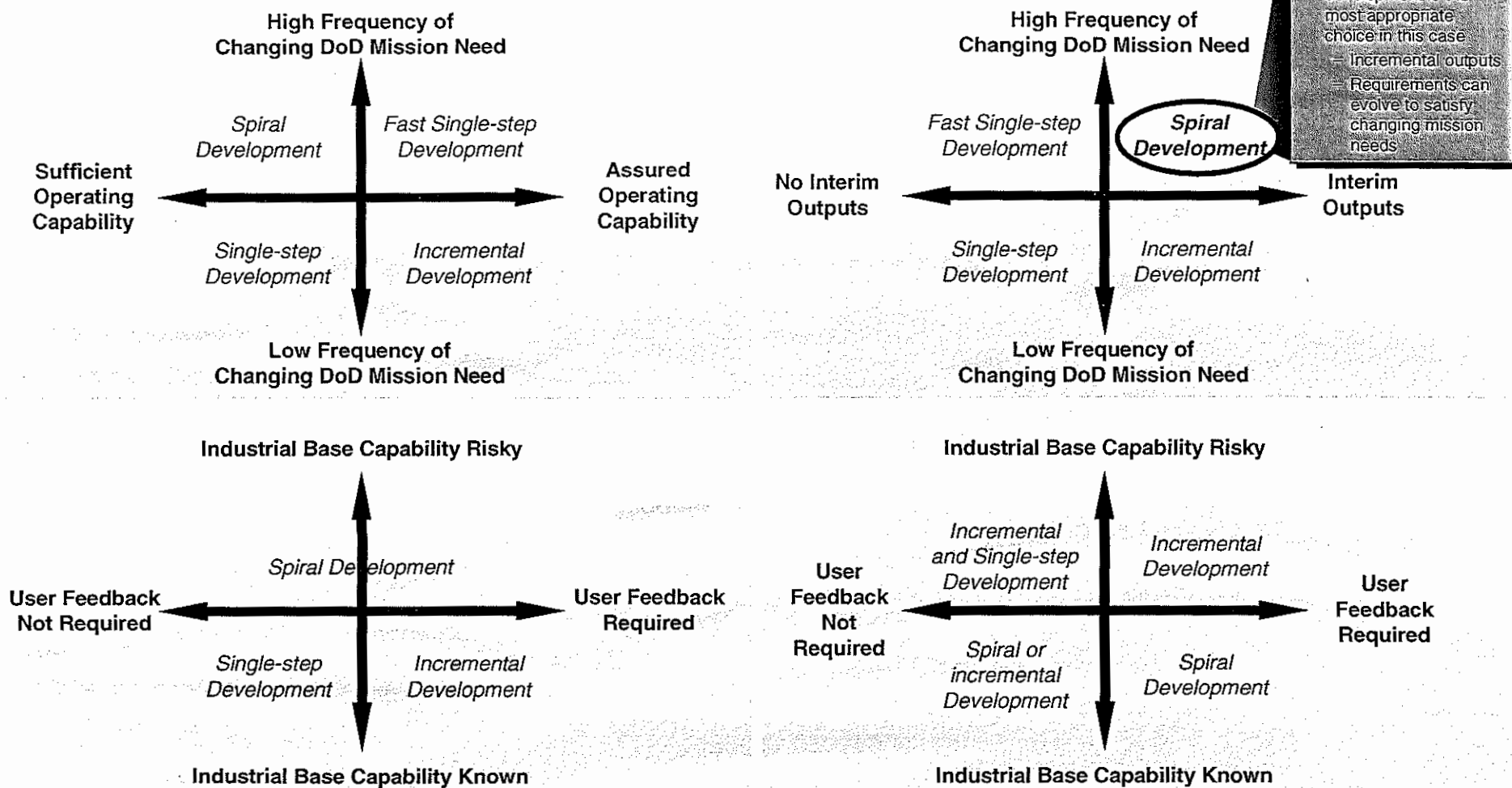
- DoD recognizes three strategies for acquisition. The strategies are distinguished based on whether or not the end-state requirements are known in advance, and whether or not there are multiple development cycles
- TAIV may be used with all three, but different acquisition strategies will have different criteria for the use of TAIV

Acquisition Strategy	End-State Requirements Known	Multiple Development Cycles	Interim Outputs	Implications for TAIV
Single-step to full capability	Yes	No	No	<ul style="list-style-type: none"> • Appropriate for commodity parts based on mature technology • TAIV used to set program length and incentivize compliance • TAIV used to set program milestones and incentivize compliance
Incremental Development	Yes	Yes	Maybe	<ul style="list-style-type: none"> • Most appropriate for programs based on mature technology, or programs that require minimum (rather than assured) operating capability • TAIV used to set increment length and incentivize compliance
Spiral Development	No	Yes	Yes	<ul style="list-style-type: none"> • Appropriate for exploratory development programs, programs based on mature technology, or programs that require minimum (rather than assured) capability • TAIV used to set spiral length and incentivize compliance

 Evolutionary acquisition strategy

Choosing an Acquisition Strategy

Understanding critical uncertainties is helpful in selecting an appropriate acquisition strategy for improving a program's chance for success

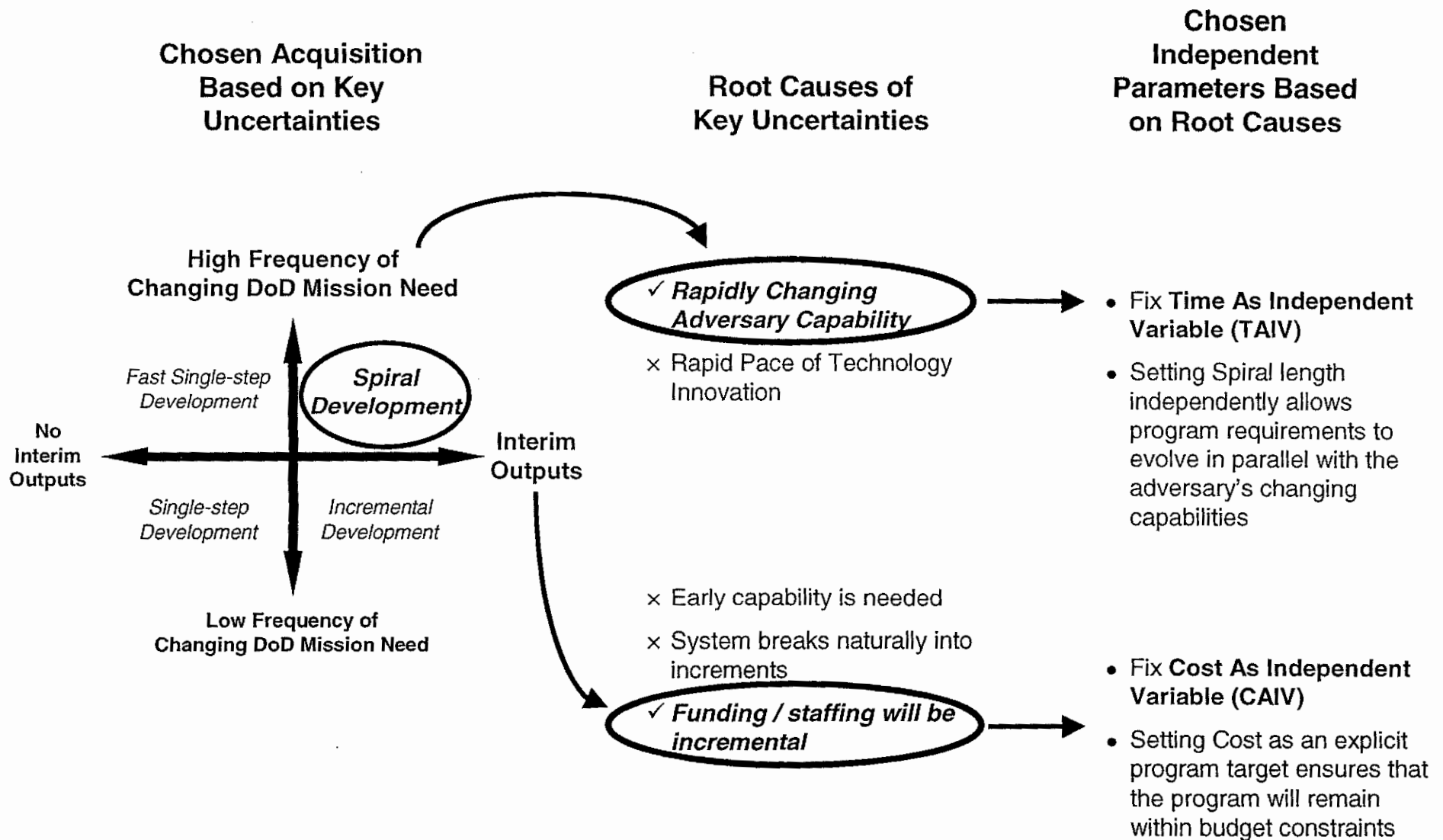


Given a high frequency of changing mission need and a need for interim outputs, Spiral development is the most appropriate choice in this case

- Incremental outputs
- Requirements can evolve to satisfy changing mission needs

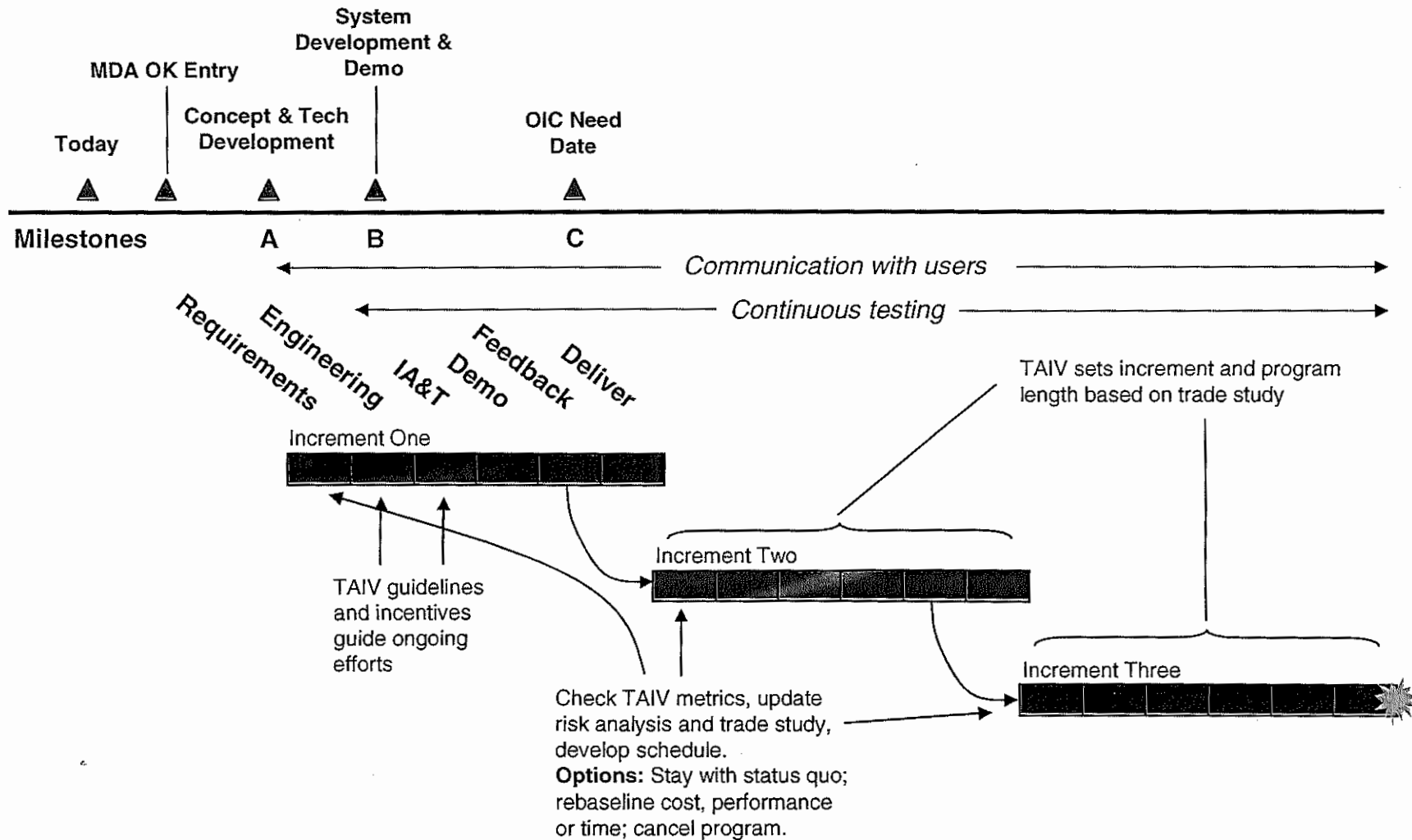
Understanding the Root Causes of Key Uncertainties

Root causes help determine the choice of parameters to fix during planning



Example – Applying TAIV to an Incremental Development Program

Instead of schedule becoming a result, time is traded with cost and performance in an ongoing planning cycle



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Applicability of TAIV to Selected Programs

Land Warrior

Analyzing key uncertainties facing the program would have led to a more iterative approach using more mature technology

- The Army's Land Warrior program is an integrated combat system based around the individual, dismounted soldier that also integrates the soldier into a wider command and control system
 - Program was initiated in 1994 and slated to begin operational testing in 1998; problems with prototypes in 1998 led to program halt and complete review
 - The original contractor was on path to deliver an extremely expensive system with significant human factors problems. They were replaced by a team of Silicon Valley firms who quickly generated an initial prototype based on COTS technologies, and then received the go-ahead to develop the final product
- Land Warrior is a large, complex program with five subsystems that present non-trivial integration problems

Selected Program Challenges

Initial requirements were poorly thought out, leading to prototypes with poor performance profiles, and eventually a complete program restart

Although Exponent-led program has been significantly more successful, program is years behind original target overall. (Operational testing planned to begin in 1998)

Hypothesized Impact of TAIV

- Adopting an evolutionary approach up-front, utilizing TAIV would have caused initial prototypes to have been created earlier with COTS technology, allowing user feedback and surfacing problems more quickly
- TAIV risk analysis would have identified performance characteristics of completely novel combat system as a key uncertainty, and planned schedule around mitigating this potential risk

- TAIV risk analysis would have identified original schedule as ambitious, given technology maturity and overall complexity of system. Program planners would have had analytical tools to demonstrate possible tradeoffs between performance and time, assisting more realistic scheduling
- Combination of incentives and metrics would have helped motivate contractor to meet program schedule, and helped managers track contractor progress

Applicability of TAIV to Selected Programs

Advanced Extremely High Frequency Communications Satellite

Explicit analysis of time requirements and technology readiness could have led to an earlier recognition of the need for an “interim MILSTAR, and re-evaluation of specified performance

- The Advanced Extremely High Frequency Communications Satellite (AEHF) is a satellite system intended to replace the existing Milstar system and to be DoD's next generation of higher speed, protected communications satellites
 - Originally planned to produce 5 satellites at a cost of \$5.4 billion, currently planned to produce 3 satellites at a cost of \$4.8 billion
 - Significant uncertainty around the December 2006 deliverable date
- Satellites' unique, essential capabilities and inevitable obsolescence make time to deliverable crucial. However, DoD's efforts at schedule-based planning to date have not been effective. TAIV's time-based planning would have helped managers make better-informed tradeoffs, and incentivized them to do so

Selected Program Challenges

DoD frequently changed requirements in the early stages of the program. While considered necessary, these led to significant cost and schedule overruns.

High-risk plan, proposed by the contractors, in which schedule depended on a chain of events taking place within a narrow timeframe. With no margin for schedule slip, plan could not accommodate risk, leading to dependent cascading risks.

Hypothesized Impact of TAIV

- Robust, repeatable methodology for making tradeoffs between time, cost and performance would have allowed program team to quickly adjust to changing requirements
- Possible reduction in requirements to help meet cost and schedule targets. Realistic appraisal of impact on cost and schedule of requirements changes could have influenced DoD decision makers

- TAIV risk analysis at program inception (or program restart at requirements change) would have revealed high probability of schedule slip inherent in program plan
- A schedule more likely to be successful would have been crafted by choosing different cost and performance targets. If external constraints prevented this, TAIV metrics would have given early warning of probably schedule slip, and allowed team to react

Applicability of TAIV to Selected Programs

Extended Range Guided Munition

Performing a risk analysis using time would have identified immaturity of underlying technology, this could have been responded to by building redesigns into the program schedule

- The Extended Range Guided Munition (ERGM) is a precision-guided munition that uses a coupled GPS and inertial navigation guidance system to steer the projectile to the pre-selected payload expel/dispense point. The ERGM is designed to provide highly responsive precision engagement of threats to U.S. Marine Corps or U.S. Army ground combat forces operating ashore
 - Development costs have increased 316% since program initiation, unit procurement costs 262%
 - Development time has increased by 147% since program initiation
- “In October 2003, the Navy issued a solicitation for alternative precision-guided munition concepts that could be a complement or competitor to ERGM. In particular, the Navy is concerned about the unit costs of the ERGM round and is looking to develop alternatives that could increase cost savings.” – GAO

Selected Program Challenges

A series of problems with the design of the ERGM delayed program progress and significantly increased development costs. Some subsequent redesigns introduced new problems, further delaying development



Hypothesized Impact of TAIV

- Initial risk analysis would have responded to immaturity of key technologies underlying ERGM:
 - Use of incremental, time-based development model to mitigate risk of design failure by explicitly building redesigns into program schedule
 - Redefine a less ambitious set of requirements that would have allowed use of more mature technologies including COTS to enter early testing

Unit procurement cost rose significantly, as the ERGM was redesigned to counter unexpected design difficulty.



- Incremental, time-based approach would have given planners better visibility into changing procurement costs during development
- Pre-planned redesigns of ERGM would have afforded planners the opportunity to respond by changing program requirements or by violating set time constraints

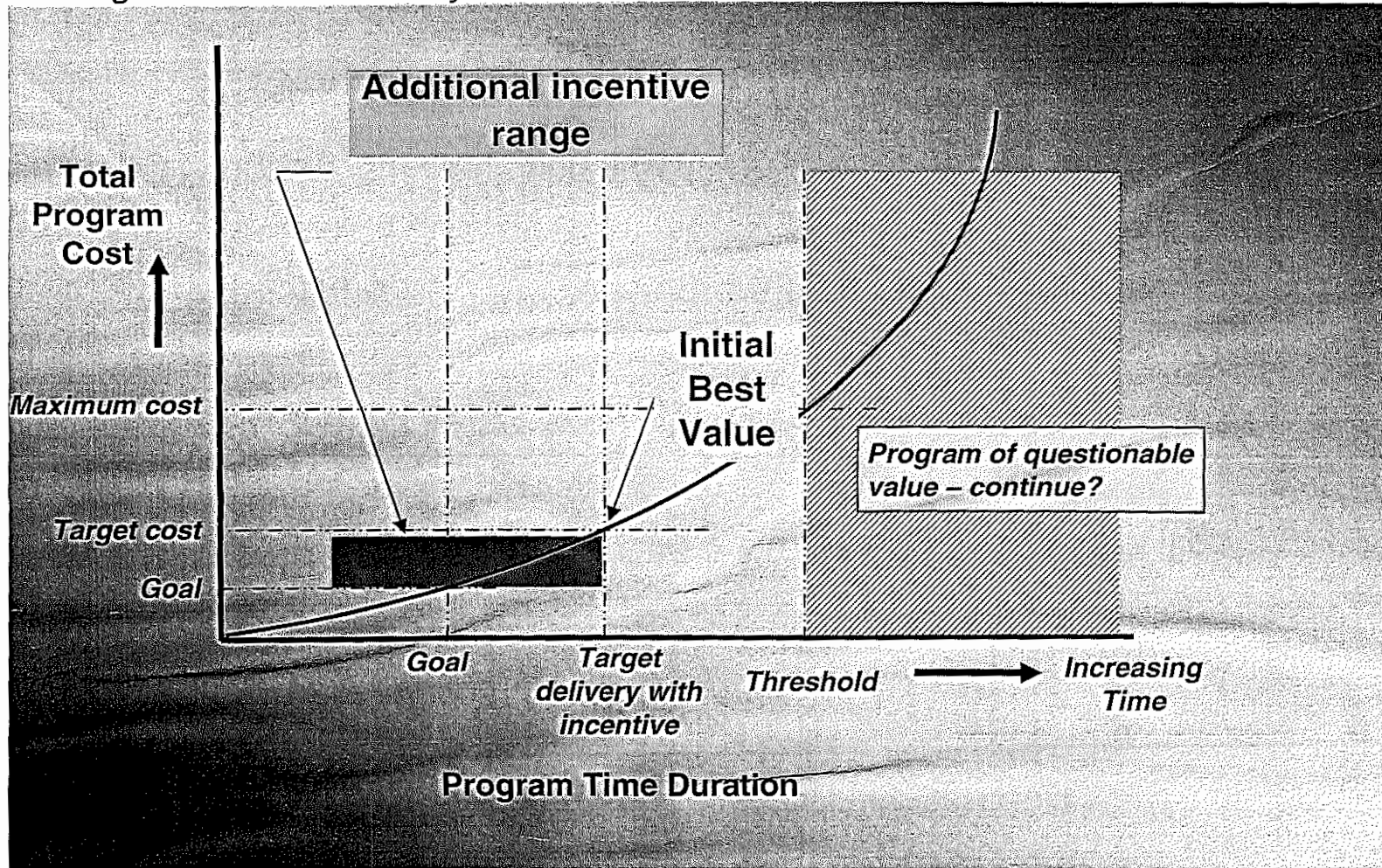
Source: Government Accounting Office; Department of Defense; Monitor analysis

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Implementation of TAIV and Incentives to Affect Contractor Behavior

TAIV trade studies reveal where to apply incentives that influence contractor behavior and bring increased value the DoD. Contractor could be offered large incentive in "Additional incentive range" for earlier delivery



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Summary

- Of the three traditional acquisition measures (Cost, Performance & Schedule), Schedule has often been a de facto outcome based on desired performance and/or cost
- We believe that using time as an independent variable similar to CAIV can help manage uncertainties associated with the acquisition process, increase schedule credibility and reduce cost uncertainties
- Time as an Independent Variable (TAIV) is not the same as a fixed schedule for development. TAIV is a *tool* that planners can use to perform trades that improve successful management of uncertainties related to time
- 5000.2 provides a framework with sufficient latitude to incorporate TAIV
- Institutionalizing TAIV can provide an additional tool to support the implementation of incentives that influence contractor and program manager behavior
- TAIV:
 - Is applicable to all three acquisition strategies
 - Aids in selecting Acquisition Strategy
 - Adds creditability to program planning & scheduling
 - Adds a tool to support 5000.2
 - Benefits both DoD and industry
- The benefits of adding TAIV to the acquisition methodology warrant further study