

Timing it Right for Successful System Developments

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Topics for Discussion

- 1. Time in Our Changing Times
- 2. Making Sense of Patterns
- New Insights for Realizing a Capability
- Improving Time-Dependent Outcomes
- 5. Summary & Conclusions

Goal: Understand How Different Contexts of Time Can
Affect System Decisions & Outcomes

Why Worry About Time and Timing?

"Time is Money."
Benjamin Franklin

"This Time, Like All Times, is a Very Good One if We But Know What to Do With It." Ralph Waldo Emerson

"The Early Bird Gets the Worm, But the Second Mouse Gets the Cheese." Willie Nelson

Event Time, Timing, and Order are Essential to Technical and Financial Success

Today's Defense Environment: Shifting Patterns

Rapid Evolution of Threats

- Unconventional Tactics
- Emerging Superpowers

Rapid Requirement Changes

Pace of Technology Change

- Internet
- Miniaturization
- Commoditization

Volatile Solution Spaces

Time to Market Pressures

- Production-Ready
- Defense Innovation Unit Experiment (DIUx)
- Commercial Practices

Compressed Schedules

Time and Time-Critical Decisions are Central in Today's System

Developments

Recognizing Patterns of Time, Order, & Change by Domain^{1, 2}

Complex

- Shifting Order/ Emergent Patterns
- Rapid, Inconsistent Change
- Time Variations

Complicated

- Evolving Order
- Slow, Governed Change
- Time Inefficiencies

Chaotic

- Disorder/Unconstrained
- Continuous Change
- Time-Indeterminate

Obvious

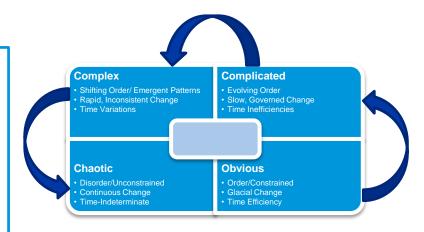
- Order/Constrained
- Glacial Change
- Time Efficiency

Patterns and Domains Provide Insights Regarding Time and Timing Decisions

Today's Outcomes: Volatility³

Instability and Conflict

- System Design Activities/Maturation Overlap with Proposal Creation
- System Architecture Incomplete Before System Design/Development Begins
- Design Maturations/Changes Cross into Production Producing Conflict with Program Execution
- Potential Inefficiencies and Risks Resulting from Schedule Compression & "Activity Tailoring"

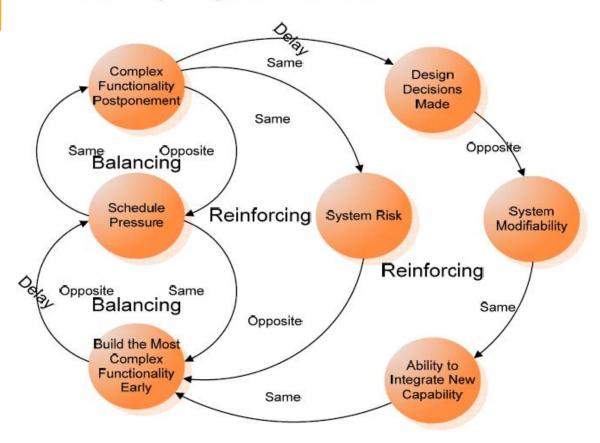


Today's Outcomes: Time Delays⁴

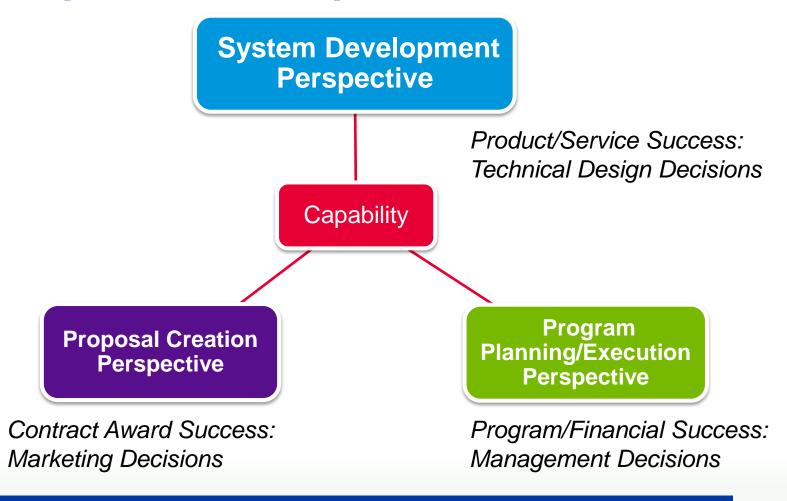
Bow Wave Effect

- Compounding of Assumptions / Delayed Decisions
- Approved
 Requirements
 Before
 Understanding of
 Cost
- Accumulation of Deferred Functionality
- Failure to Account for Complexity

A Causal Loop Diagram of the bow wave effect.



Realizing a Capability: Three (3) Interdependent Perspectives



Each Perspective Entails Different Planning Mentalities and Decisions Involving Time & Timing

Classifying Patterns for New Insights

	Domain:	Obvious	Complicated	Complex	Chaotic
	Domain.		Complicated	Complex	Chaotic
	Environment:	 Rigid Constraints Best Practice Well-Defined Threat Slow Pace of Technological Change 	 Governing Constraints Good Practice Evolving Threats Evolving Technology 	 Enabling Constraints Emergent Practices New Threat- Emergence Technology Emergence 	 No Constraints Novel Practice Continual Threat Evolution & Emergence Rapid Technological Change
Perspective	System Development:	Established w/minor variantsPredictable Results	Fail-Safe DesignRepeatabilityConsistent Results	VolatileEmergent PropertiesPotential Varying Results	 Level of Effort Response Real-Time Discovery High Risk
	Program Execution:	Stable, DefinedLow Risk	PredictabilityManaged Risk	Expert JudgmentParallel ExperimentationModeling	Level of Effort ResponseReal-Time DiscoveryHigh Risk
<u>a</u>	Proposal Creation:	Standard Templates	Tailored Offers	Multi-Dimensional Offer w/Options	Interchangeable ConditionsMultiplicity of Alternatives
	Addressing the Timing Challenges:	Lean PrinciplesRigid Plans	ModularityStandards Adherence	 Agile Techniques Safe-to-Fail Experiments Models / MBSE 	 Hybrid/Flexible Plans & Schedules Continuous Monitoring /Reporting
	Example(s):	 JDAM IDIQ Contracts	KC-46A TankerIDIQ Contracts	Bomber / F-35System of Systems	Cyber SystemsSystem of Systems

Aligning Perspectives of a Capability and Time Domains

	Perspective / Domain Misaligned	Perspective / Domain Aligned	
System	Flawed DesignInconsistent PerformanceUndesired Behavior	Balanced DesignReliable OperationCompliant Solution	
Program	 Bad Decisions / Rework Strategy - Needs Disagree Mis-Ordered Events Compounding Costs 	Optimum DecisionsSeamless ExecutionOrderly TransitionsEfficient Performance	
Proposal	Missed UrgenciesInconsistent MessagingIncomplete CoverageFlawed Rationale	Timely DeliveryCompelling MessagingCompliant & Efficient OfferWinning Result	

Making Up Time

Information Shortcomings

- Systems Thinking Techniques / Causal Loop Diagrams
- Safe to Fail Experiments
- Internet / Crowd-Sourcing

Skillset Shortages

- Journeyman/ Apprentice Pairing
- Just in Time Training
- Rapid Skills Acquisitions (Consultants)
- Talent Pool

Judgment Shortcomings / Bad Decisions

- Adapting Decisions for Changed Environment (ala Cynefin)
- Redundancy / Back-Ups in Resources and Talent
- Use Expert Opinion (e.g., In Complex Environment)



Timing Better Outcomes⁵

Agile Design of Systems

- Development & Integration in Time Increments (a.k.a. Sprints)
- Identification of Iteration Loops and Work Done in Each
- Continuous Verification of Work Products
- Project Control Adjustments Based on Tighter Feedback Cycles/Iterations

Dynamic Planning or Dynamic Project Enactment

- Dynamically Re-Plan as More is Learned and as Things Change
 - Identify Tasks to Be Performed
 - Determine 50%, 80%, and 20% Estimates
 - Highlight Task Dependencies and Assign Resources
 - Construct "Working Schedule", "Customer Schedule", & "Goal Schedule"
 - Incentivize the Goal Schedule
 - Adapt to Changes, Update, and Re-compute the Schedule

Agile Design and Dynamic Planning Enable Schedule Flexibility and Potential for Better Outcomes

More Time Saving and Recovery Methods

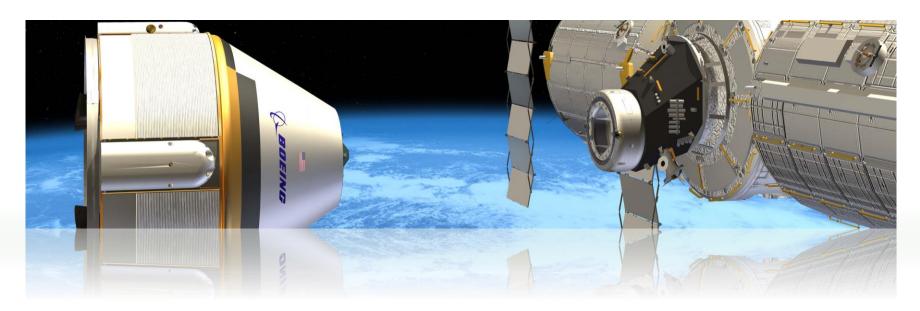
Resiliency in System Design: Accommodate Unexpected Inputs

Adaptability: Deal with Unanticipated Environments

Higher-Level System Safeguards: Address Emergent Behaviors

Schedule "Crashing" or "Fast Tracking": Over-come Schedule Delays and Manage Accelerations

Urgency/Importance Determinations: Enable Prioritization of Activities



Summary & Conclusions



1. System Development Success via

- Interdependent Perspectives of System Design, Program Plan/Execution, and Proposal Creation
- Domain Patterns in Obvious, Complicated, Complex, and Chaotic
- Aligning Perspectives with Domains
- 2. Planning and Recovery Techniques
- 3. Time and Timing Matter:
 - Time is Money
 - Know What to Do With Time ...at Any Time
 - Good Timing is No Accident (i.e., the Early Bird and the Second Mouse)



References

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- 7. INCOSE; Systems Engineering Handbook, 4th Edition; 2015

Abstract

For systems engineering success on programs, timing is everything. Whether it be timing risk reduction activities in preparation of an RFP response, scheduling the right skills at the right time during an execution, or implementing earlier verification activities to expedite a system completion, timing matters. That fact coupled with the costs of development resources for proposals and programs means that any misuse or loss of resources due to bad timing contributes to waste, which simply cannot be tolerated in today's age of tight schedules and cost constraints.

Getting the timing and order of events right to maximize success implores a disciplined and thoughtful application of classic and new systems principles to the problem; a problem that's well-understood in regard to timing needs, with solution components properly planned and sequenced for all stakeholder interests. When combined with the possibility of what works in one instance may not work in another, what and how much systems engineering is needed may vary for different situations and domain complexities.

This presentation will explore contributors to program risks arising from timing matters. It will examine the differences in timing and planning mentalities for proposal preparation, program planning, and system development. It will also examine how the decision-making environment and other complexities must be considered to appropriately adjust activity timing and plan tailoring. Finally, it will examine what can be done to overcome shortcomings in information, skillsets, judgments, and other factors contributing to undesirable results, ---ultimately turning a difficult, unpredictable situation into a successful outcome.