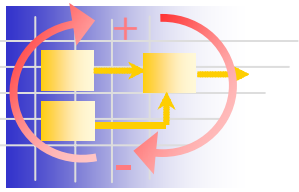


ESD.36J System & Project Management



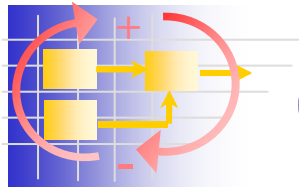
Project Success Factors

Instructor(s)

Prof. Olivier de Weck

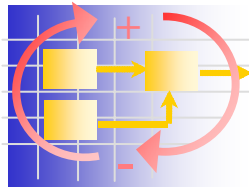
Lecture 22

11/20/2003




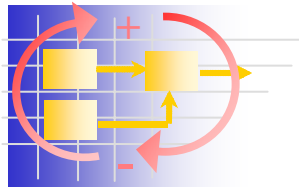
Overview

- Project Success (Traditional answer)
 - What is project success?
- Review of Metrics
 - finish “Project Monitoring” lecture
- Variables of Project Success
 - Actions to maximize likelihood of success
 - PM “Best Practices”
 - Reasons for Project Failure/Trouble, e.g. NASA Messenger
- Project Success Factors (LAI answer)
 - Lifecycle Value Model
- Class Discussion



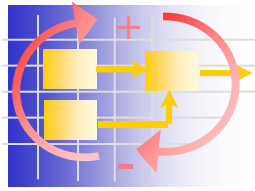
Project Success

- What is project success? (Traditional view)
 - Completion of set of activities within the constraints of time, cost, and performance? (Kerzner, 2001)
- Completion (Expanded View) 
 - within allocated time period and budgeted cost
 - at proper performance or specification level
 - with acceptance by the customer/user
 - when you can use customer's name as reference
 - with minimal and mutually agreed scope changes
 - without disrupting lives, organizations and cultures



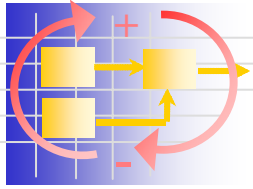
Metrics

- Source
- Formulation
- Use
- Approaches, problems



Source of Metrics

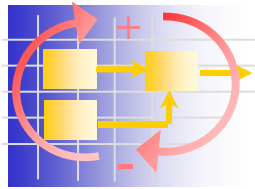
- Useful Goal = Metrics + Target Value
- Flow from goals - what the product's intent, what it does (process), what it is (form)
- Distinguished based on level of importance.
 - Live or die, vital, system success dependent (0.1)
 - Very important (0.2)
 - Desirements (0.3)
 - Nice to have (0.4), etc.
- Focus on one or two highest level



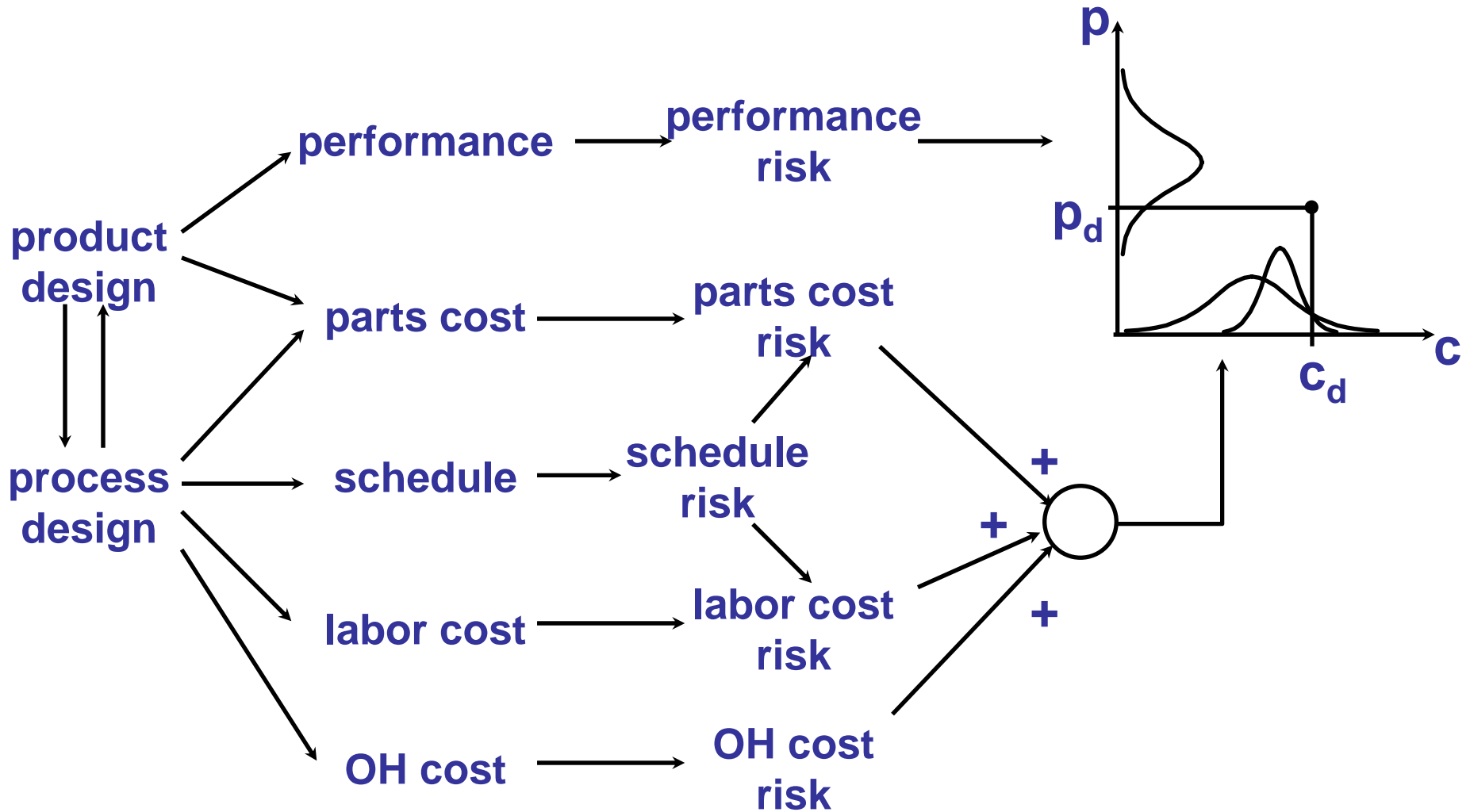
Formulation of Metrics

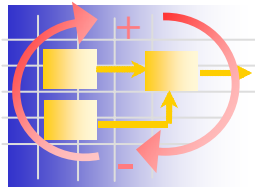
- May be marginal, absolute, probabilistic
 - = X% improvement in _____
 - = X value of _____
 - = X value of _____ with 90% confidence
- Tradition is metric based on benefit/performance (with cost*, schedule and risk assessed later)
- Current practice is metric based on benefit/performance and cost (with schedule and risk assessed later)
- “Ideal” would be metrics which include benefit/performance, schedule, cost and risk

* **cost can include liens on resources in addition to \$**



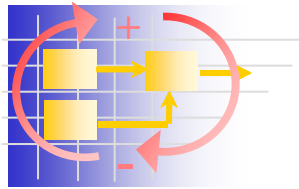
Notional "Ideal" Metric



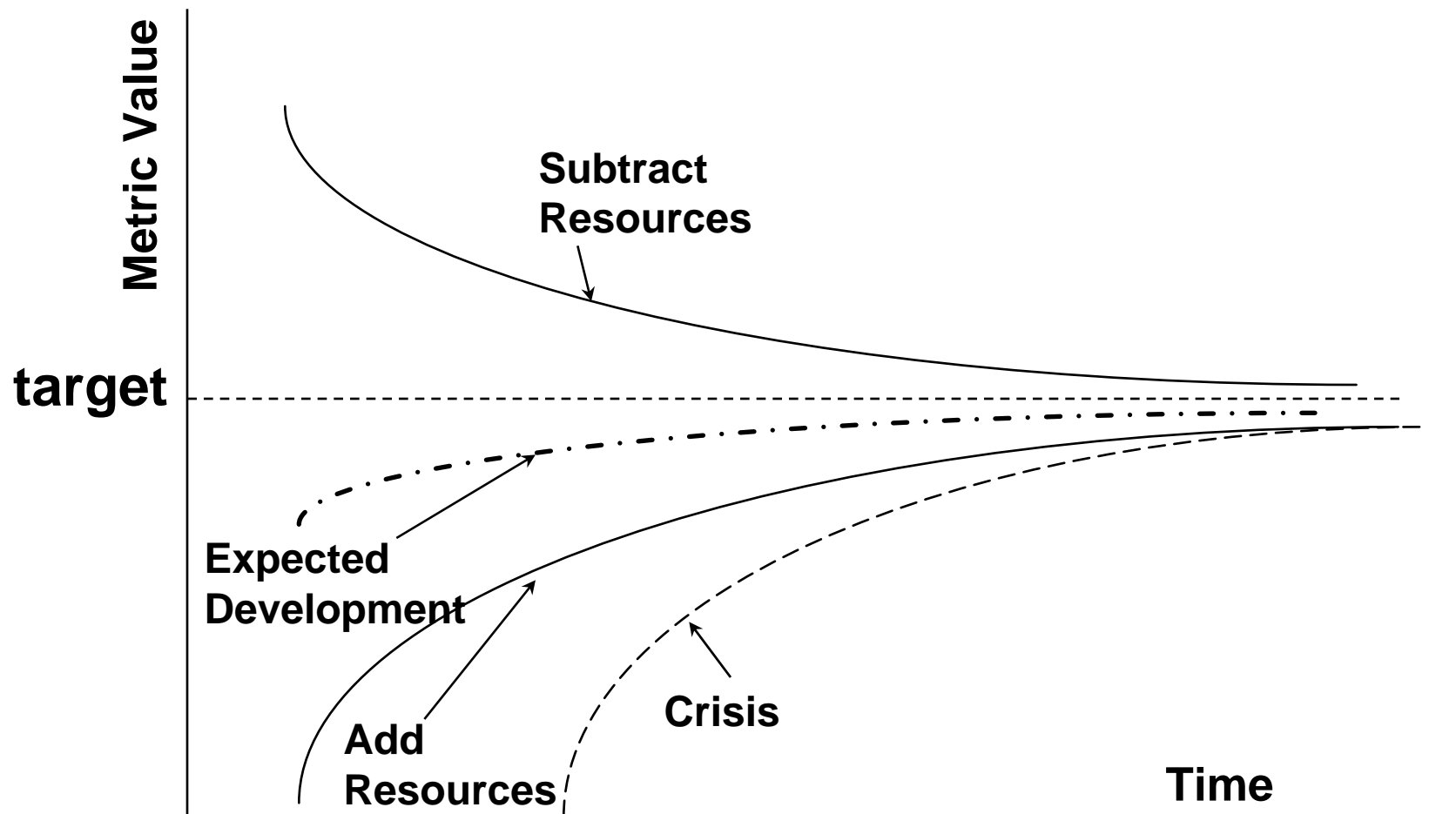


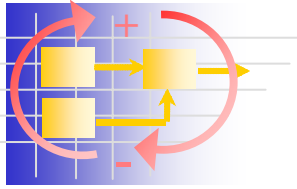
Use of Metrics

- System architecture
 - Selection of architecture usually done by quantitative comparison of metric - very sensitive to choice
- Project Management - Tracking
 - High level metrics can and should be tracked during development
 - Progress towards target should have milestones
 - Discrepancies can be the basis of decisions (add resources, subtract resources, flag for “tiger team”)



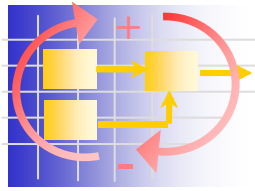
Metric Tracking





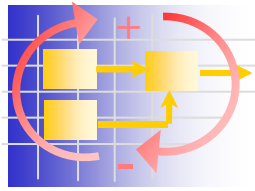
Problems with Metrics

- Identifying real and appropriate metrics is often one of the most difficult parts of engineering system design
 - customer often does not vocalize real metric
 - often have several metrics (must treat independently or combine)
- Metrics don't necessarily add linearly
 - mass does, cost doesn't (can push cost to another element easily)
 - hard to flow metrics down



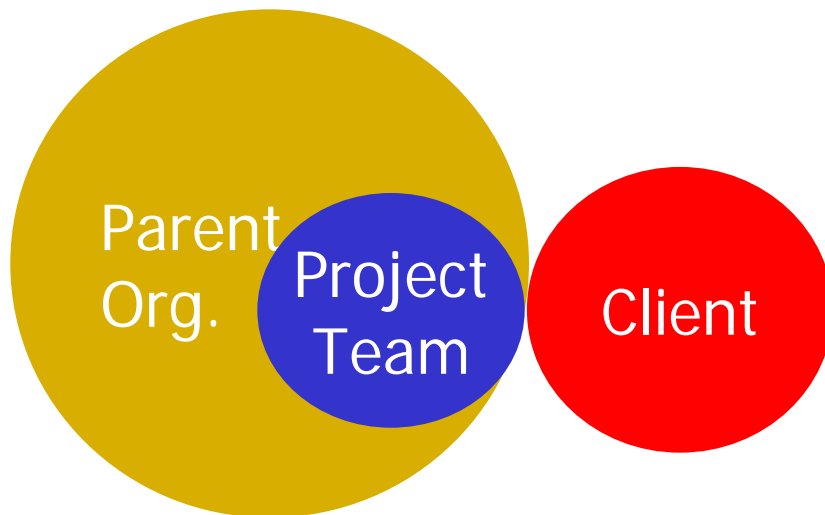
Lecture 1 comments

- What is most difficult to track in a project?
 - Keep track of the exact hours spent on a particular project because many people work in a multi-project environment (L. Curhan)
 - Track progress: Almost impossible. Milestones are poorly defined and whether they have been met or not is often subjective and can be "gamed" (E. Butler)
 - Time left to complete the tasks (reverse view from the endpoint of the project - not time spent) (Mike Nolan)

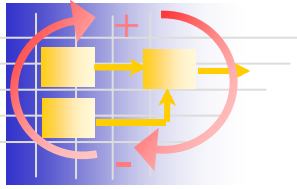


Variables for Projects Success

- Actions for ensuring Project Success
- PM “Best Practices”
- Reasons for Project Failures
- Example: NASA Discovery - Messenger

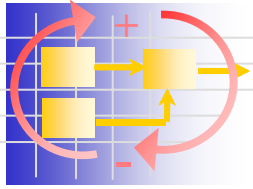


Ref: Kerzner, 2001, CH9



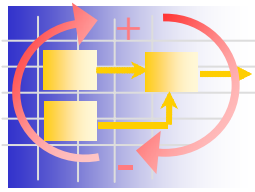
Ensuring Project Success (I)

- Don't only consider: cost, schedule, performance
- Look at larger context of organization ("steady stream")
- Actions taken by : project manager & team, parent organization, customer organization
 - Project Manager & Team
 - reserve the right to do proper team member selection
 - establish a mission and clear project goals early
 - maintain flow of communication with client and parent
 - Employ an effective set of methods, processes and tools
 - Develop realistic cost, schedule and performance estimates & targets
 - Anticipate future problems, develop backup strategies, ...

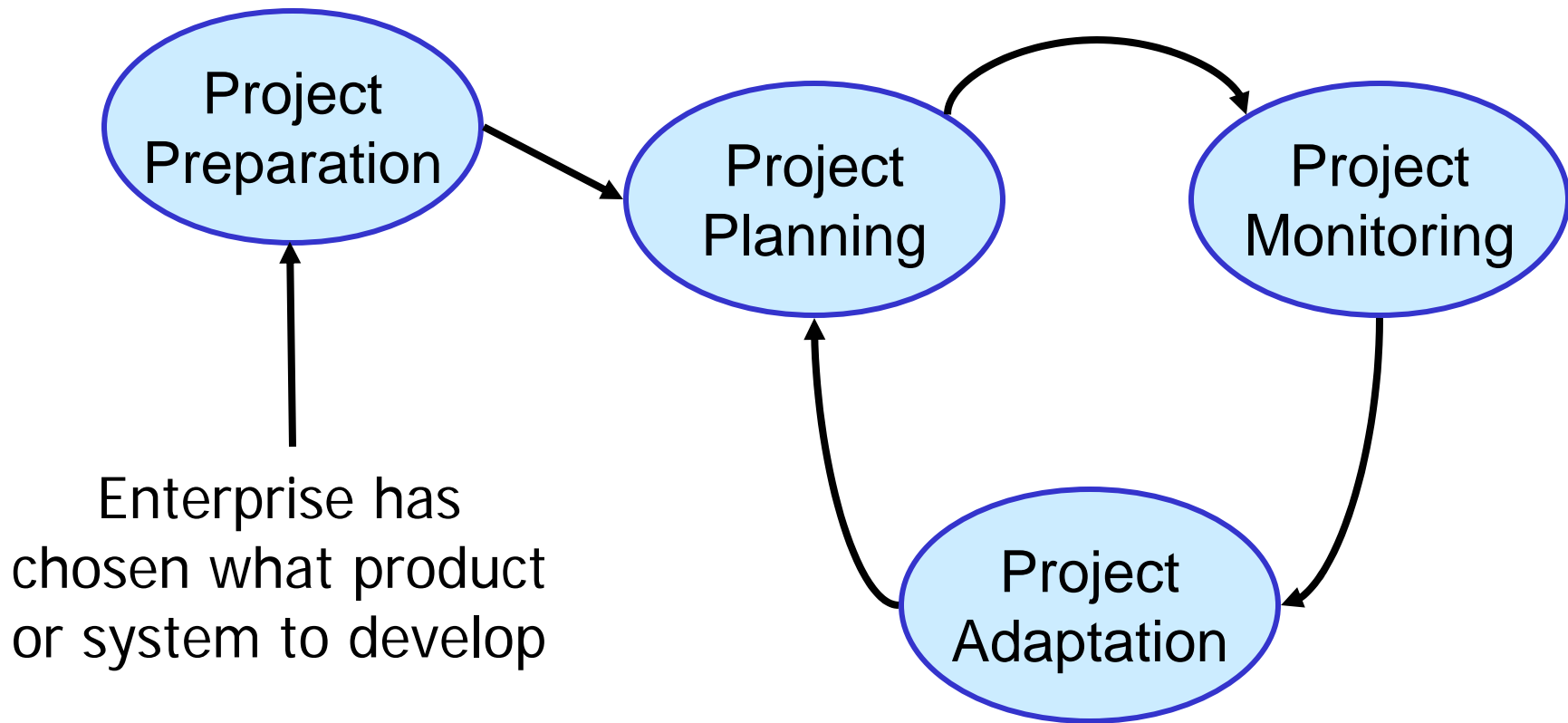


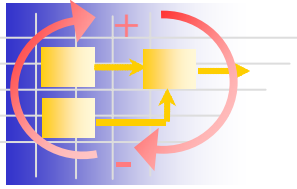
Ensuring Project Success (II)

- Parent Organization
 - Willingness to coordinate efforts and remain flexible
 - Willingness to give sufficient resources and priority (realistic mission, see System Dynamics “initial conditions”)
 - Bringing in experience and lessons learned from past projects
 - External buffering
 - Corporate “acceptance” and visibility of the project
- Client Organization
 - Establishment of realistic goals and acceptance criteria
 - Rapid response to requests for information
 - Well established procedure for scope changes
 - Don’t μ -manage the contractor
 - Provide sufficient authority to the client contact



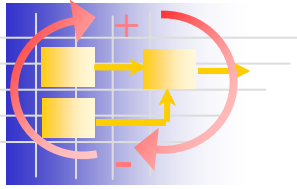
System Project Management ESD.36 Framework





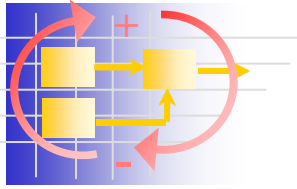
Project Management “Best Practices” (I)

- Adequate project preparation & planning
 - Match right people to the right jobs
 - Work Breakdown Structure (proper size packages)
 - Adequate planning of milestones, task, schedule
 - Understand uncertainty - treat schedule, cost etc. probabilistically, set metrics (few !)
 - Identify “critical” items: critical path, scarce resources, ... DRAG, critical chain
 - Place planned ITERATIONS at strategic locations in the project
 - Identify RISKS: market, performance, cost, schedule



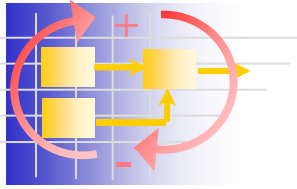
Project Management “Best Practices” (II)

- Adequate project tracking & adaptation
 - Use “metrics” but distinguish
 - Real progress from Perceived Progress
 - Communication flow between team, parent, client
 - Do projections and anticipate problems
 - Replanning and Adaptation (use System Dynamics?)
 - Add Resources
 - Descope
 - Overlapping and Concurrency, Replan task sequences
 - Prepare Project End
 - Delivery and Acceptance testing
 - Closing work orders, capture “lessons learned”,...



Frequent Reasons for Project Failure

- Selected the wrong product (system) concept
- Wrong person as project manager
- Upper management is non-supportive
- Inadequately defined tasks, goals ... (ambiguity is never removed)
- “Impossible” mission
 - Over-scoped, under-funded, not enough time
 - Starts project dynamics
- Wrong corrective measures
 - kicks off vicious circles (SD)... burnout, fatigue...
- Project “end game” is not planned
- Reward and Incentive systems not aligned

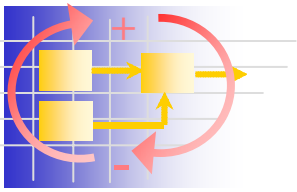


Project Trouble - “Early warning signs”

- Example: NASA “Messenger” Project
 - First mission to planet Mercury in 30 years
 - First Discovery-class mission to bust \$299 million cost cap (out of 7 so far)
 - Prompting changes in PM: now 25% cost margin required
 - Ambitious technically: instruments, ΔV , thermal !
- Early warning signs
 - Significant under-spending early
 - Trouble with staffing up
 - Departure of key personnel

ESD.36J System & Project Management

A Framework for Achieving Lifecycle
Value In Aerospace Product
Development

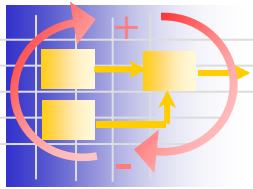


Instructor(s)

Alexis Stanke and Earl Murman

Lean Aerospace Initiative

11/20/2003



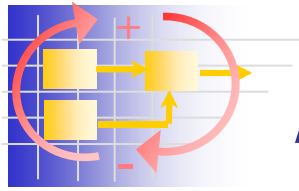
Lean Aerospace Initiative

Consortium of aerospace industry, government, academia, and organized labor

Vision: US aerospace enterprises reliably and efficiently creating value and rapidly adapting to change

Mission: Research, develop and promulgate practices, tools and knowledge to enable and accelerate the envisioned transformation of the greater US aero-space enterprise through people and processes

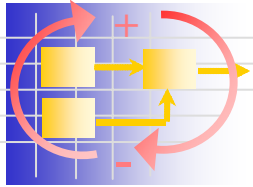




Aerospace Systems

What makes modern aerospace systems and programs “successful”?

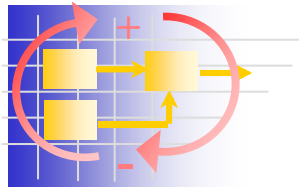
A balance between technical capability and programmatic performance, for the lifecycle of the system.



Lifecycle Value Defined

Balanced stakeholder expectation for effective system performance (quality, cost, and timing) and the associated risks to deliver best value throughout the life of the system.

Rooted in value management, lifecycle costing, and systems engineering



Motivation

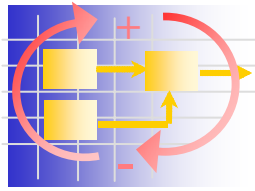
Characterization

- How is lifecycle value defined for different systems?

Achievement

- What enabling practices and metrics contribute to achieving lifecycle value, however it is defined?

**Capture enabling practices for future programs.
Codify knowledge for implementation and training.**



Exploratory Research Design

Case Study Approach

- 4 cases and 150+ participants
- Structured survey interview format
- Primarily qualitative data

F/A-18E/F Super Hornet

- Upgrade of previous Hornet aircraft

JAS 39 Gripen

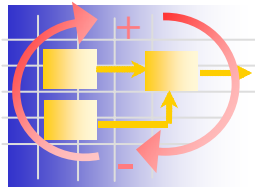
- “Clean sheet” design

F-16 Falcon

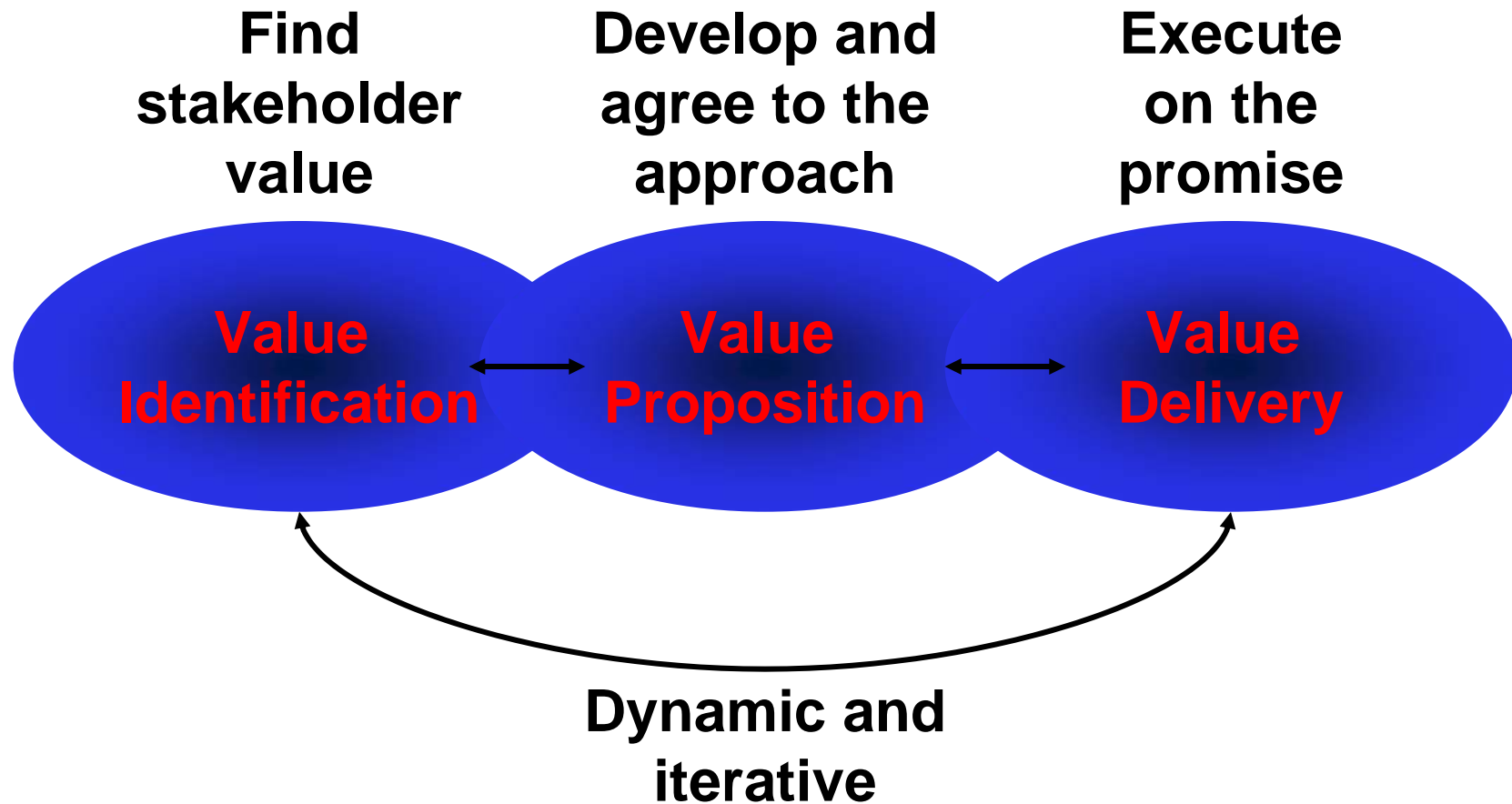
- Evolutionary block upgrades

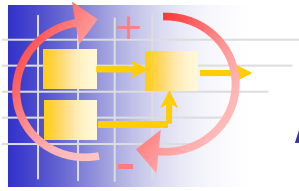
777

- Product family of derivatives from “A model” 777-200



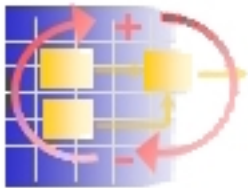
Value Creation Framework





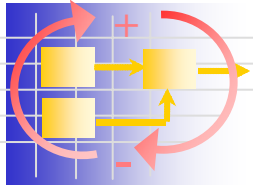
Assumptions

- Value is a multi-dimensional system attribute
 - Minimally comprised of technical capability, cost, and timing
- System stakeholders agree to focus on value
- Stakeholders have insight and influence into each of the three value processes



Value Attributes

	Value Identification	Value Proposition	Value Delivery
Holistic Perspective			
Organizational Factors			
Requirements and Metrics			
Tools and Methods			
Enterprise Relationships			
Leadership and Management			



Holistic Perspective

Consideration of an entire system and its lifecycle

Value Identification

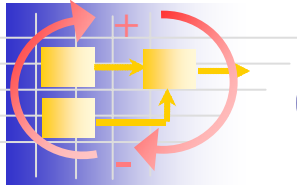
- Desired system capability in terms of function throughout its lifecycle

Value Proposition

- Incorporation of flexibility and upgradability

Value Delivery

- Awareness of entire system including interfaces and visibility of its lifecycle



Organizational Factors

Cross-functional working teams which balance integration experience and functional expertise

Value Identification

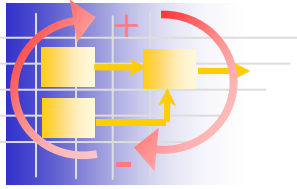
- All stakeholders contributing to a value focused discussion

Value Proposition

- Enterprise stakeholders have visibility and participation when system and program trade-offs are made

Value Delivery

- Effective product IPTs aligned with product decomposition



Requirements and Metrics

Specification, allocation, and tracking

Value Identification

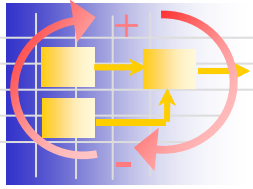
- Stakeholder expectations clearly communicated

Value Proposition

- Requirements definition reflects expectations and contributions of all stakeholders, including metrics with established target values

Value Delivery

- Metrics are tracked and shared regularly throughout the enterprise for proactive management



Tools and Methods

Significance of technological development

Value Identification

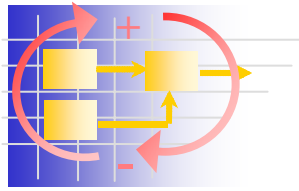
- Emerging tools and methods are properly assessed and planned for accordingly

Value Proposition

- Systems engineering approach implemented for program and system trade-offs

Value Delivery

- Common, fully-integrated tools and standard processes throughout the enterprise



Enterprise Relationships

Working relationships throughout the extended system
enterprise

Value Identification

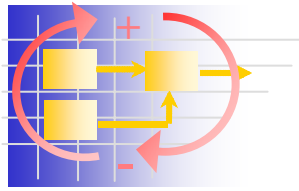
- Leadership alignment based on open communication

Value Proposition

- Focus on core competencies of enterprise value chain

Value Delivery

- Consistent working relationships and open communication



Leadership and Management

“Best” management strategies and practices to facilitate continuity through leadership transitions

Value Identification

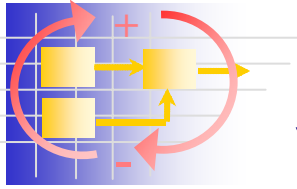
- Small number of common goals and objectives

Value Proposition

- Homogenous management perspective established based on common goals and objectives

Value Delivery

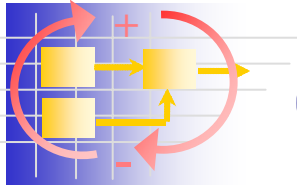
- Distributed leadership based on clear roles and responsibilities



Summary - LAI Study

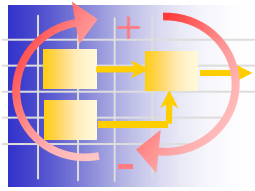
RESULTS:

- Led to capability maturity models for each of the value creation processes
- Synthesized current industry best practices from the four case studies
- Outlined approach for product development, system design, and program management
- Were vetted and well received by many industry representatives



Go back to Lecture 1 comments

- Why is System Project Management hard?
 - Interdisciplinary nature of systems (N. Svensson)
 - Definition of the project often poor (ill-defined in terms of specifications and functionality)
 - Underfunding (Sashi Somavarapu)
 - Organizational factors: Managing of people of different functions, with different objectives leads to people pulling to different directions (M. Stevens)
 - Compressed schedule - too little time to do things right E.g. at Raytheon a "Spiral" product development process leads to faster development, but higher extra effort, difficult to plan for. (E. Butler)
 - Because they are unpredictable (M. Usan)



What is your opinion?

- Critical Project Success Factors
 - On-campus students
 - Off-campus students