Lean Aerospace Initiative

Growing the Lean Community

An LAI Plenary Conference

A Framework for Achieving Best Lifecycle Value

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Outline

- Session Format
- Motivation and approach
- Theoretical framework for lifecycle value
- Data analysis and capability models
- Value attributes
- Lifecycle value creation model
- Summary
- Program and panel introductions

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Motivation

- Best lifecycle value is a LAI Phase III research focus

Two Primary Issues:

- Characterization
  - How is best lifecycle value defined for different systems?
- Achievement
  - What enabling practices and metrics contribute to achieving best lifecycle value, however it is defined?

Capture enabling practices for future programs.

Codify knowledge for implementation and training.

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Research Design

Synergies in Exploratory Research:

Theoretical Framework

- Evolved from work in LAI on a book
- Further developed and characterized by this work

Case Study Approach

- Using a structured survey interview format
- Collected qualitative and supporting quantitative data

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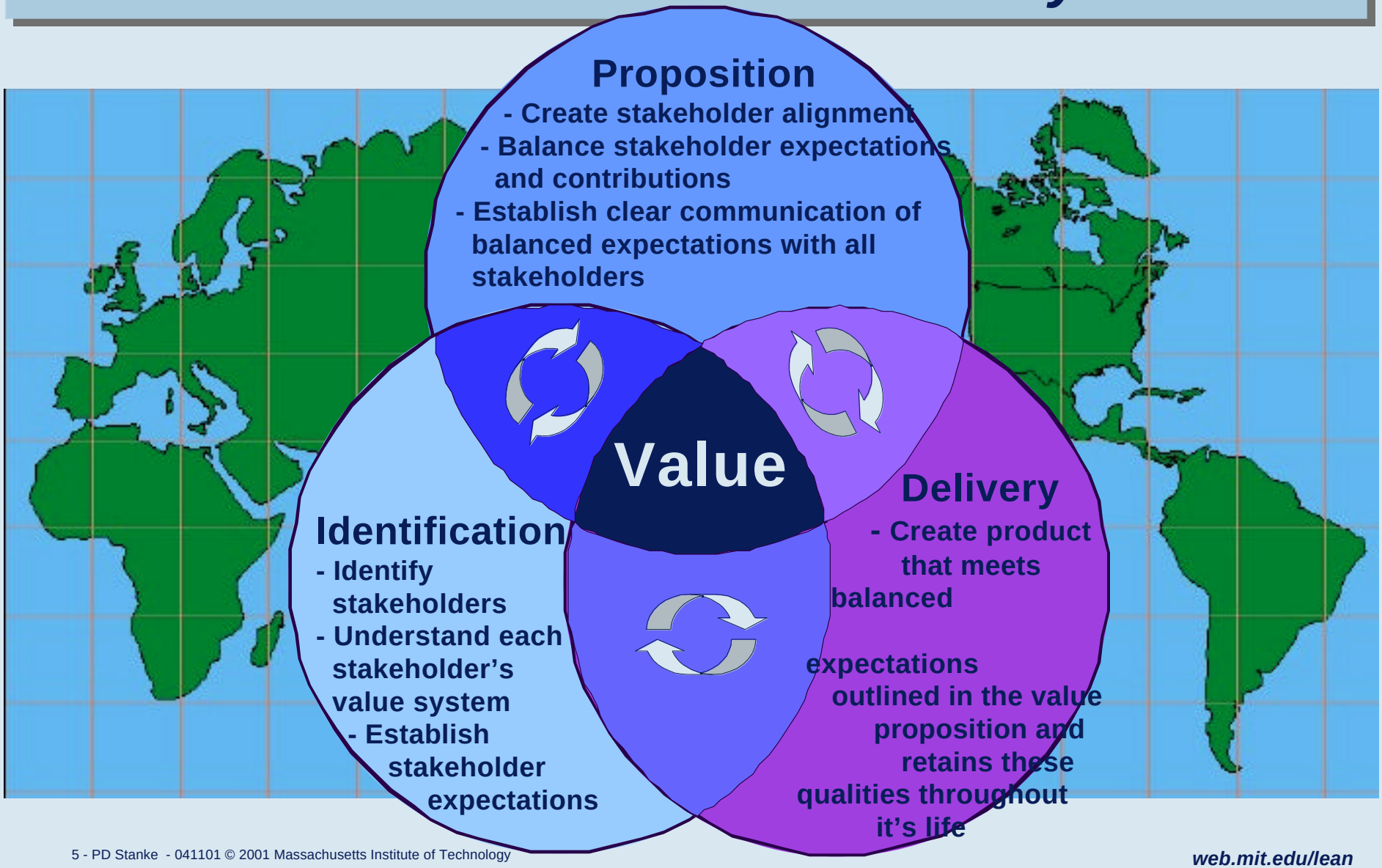
Theoretical Framework for Lifecycle Value



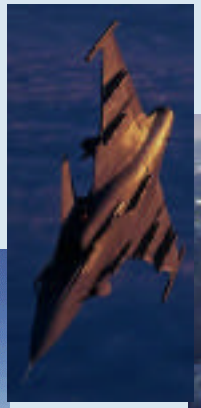
Case Studies

- **Case Selection Criteria:**
  - **Recent development work (late 80's - early 90's)**
  - **System already in production**
  - **External measure of program/system success**
  - **Holistic view of research (i.e. synergies between cases)**

F/A-18E/F Super Hornet

F-16 Falcon

JAS 39 Gripen



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- **Interviewee Selection Criteria:**
  - **A perspective of entire system and its lifecycle**

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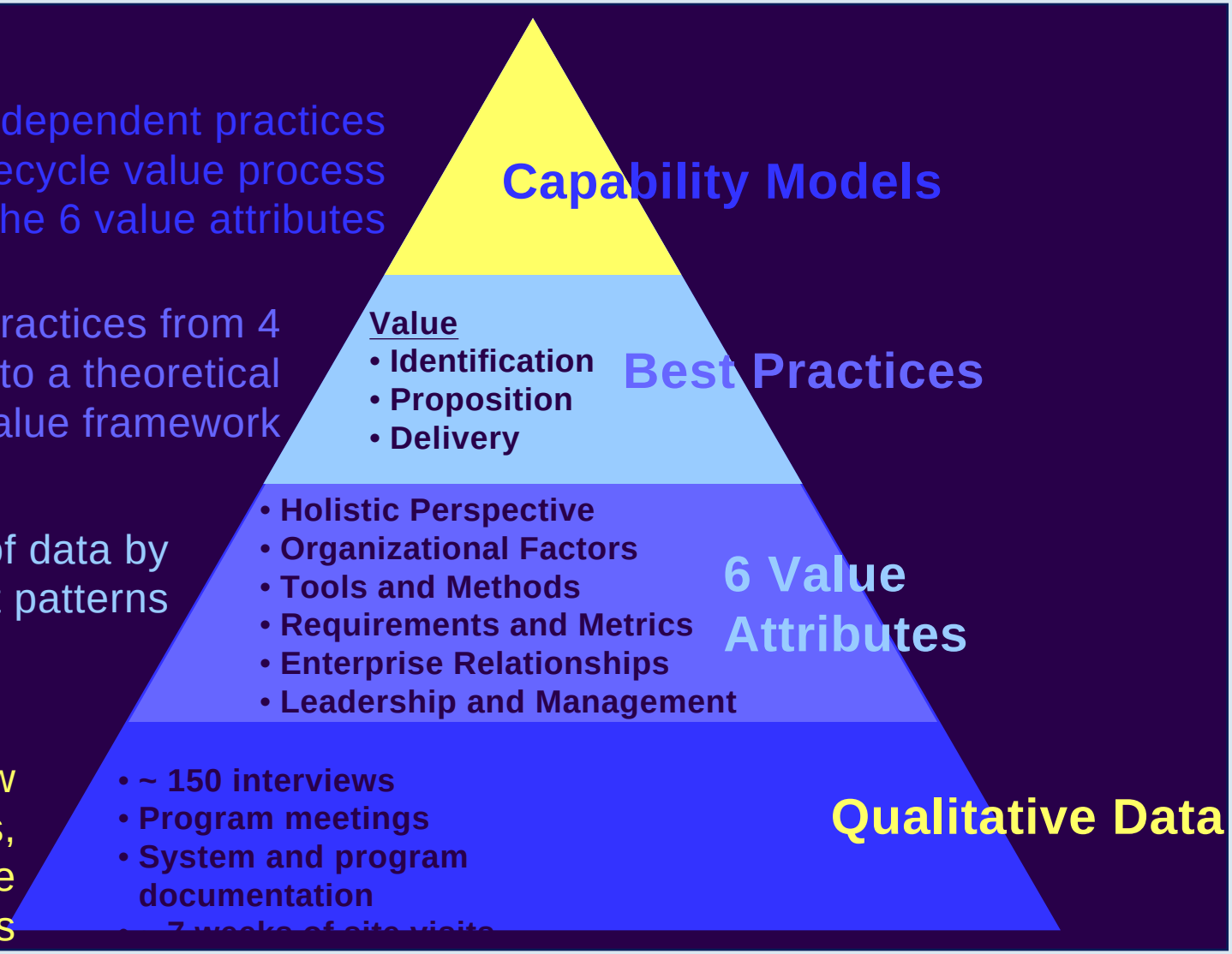
Data Analysis

Context independent practices each lifecycle value process based on the 6 value attributes

Comparison of practices from 4 cases studied to a theoretical lifecycle value framework

Clustering of data by emergent patterns

Interview transcripts, documentation, site visit experiences



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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

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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

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Requirements and Metrics

Specification, allocation, and tracking

Value Identification

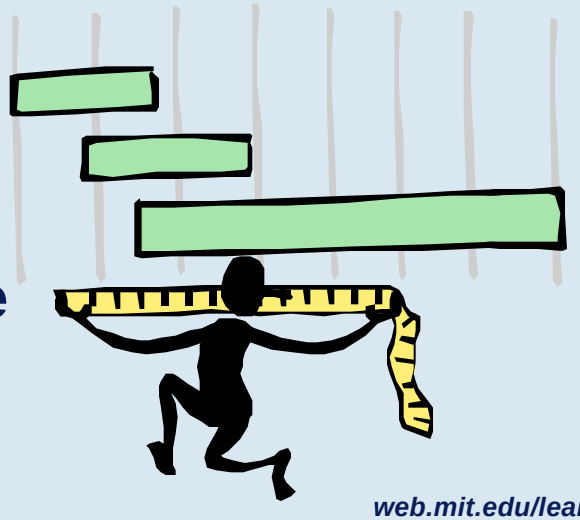
- Stakeholder expectations clearly communicated

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

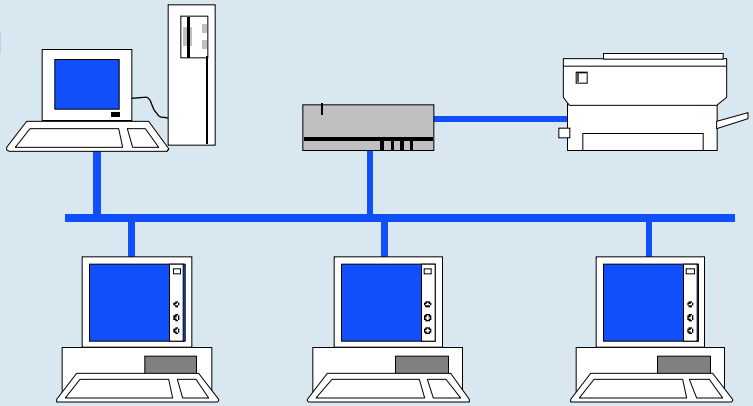
Significance of technological development

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

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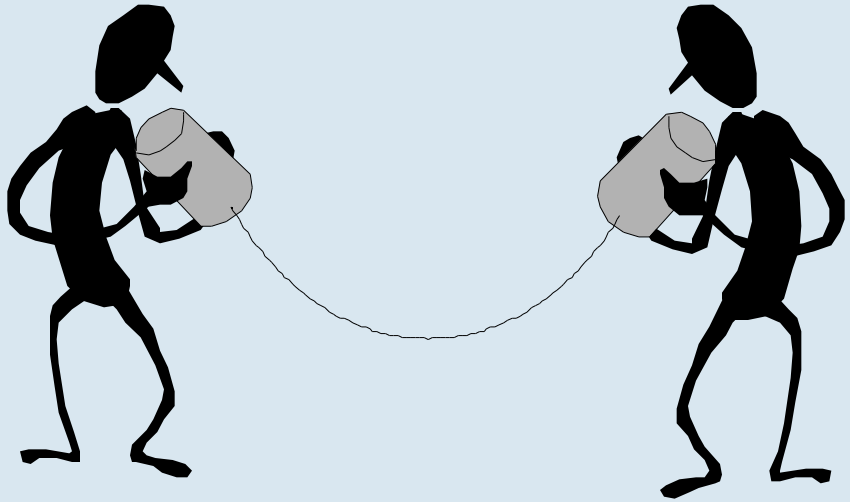
Enterprise Relationships

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

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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

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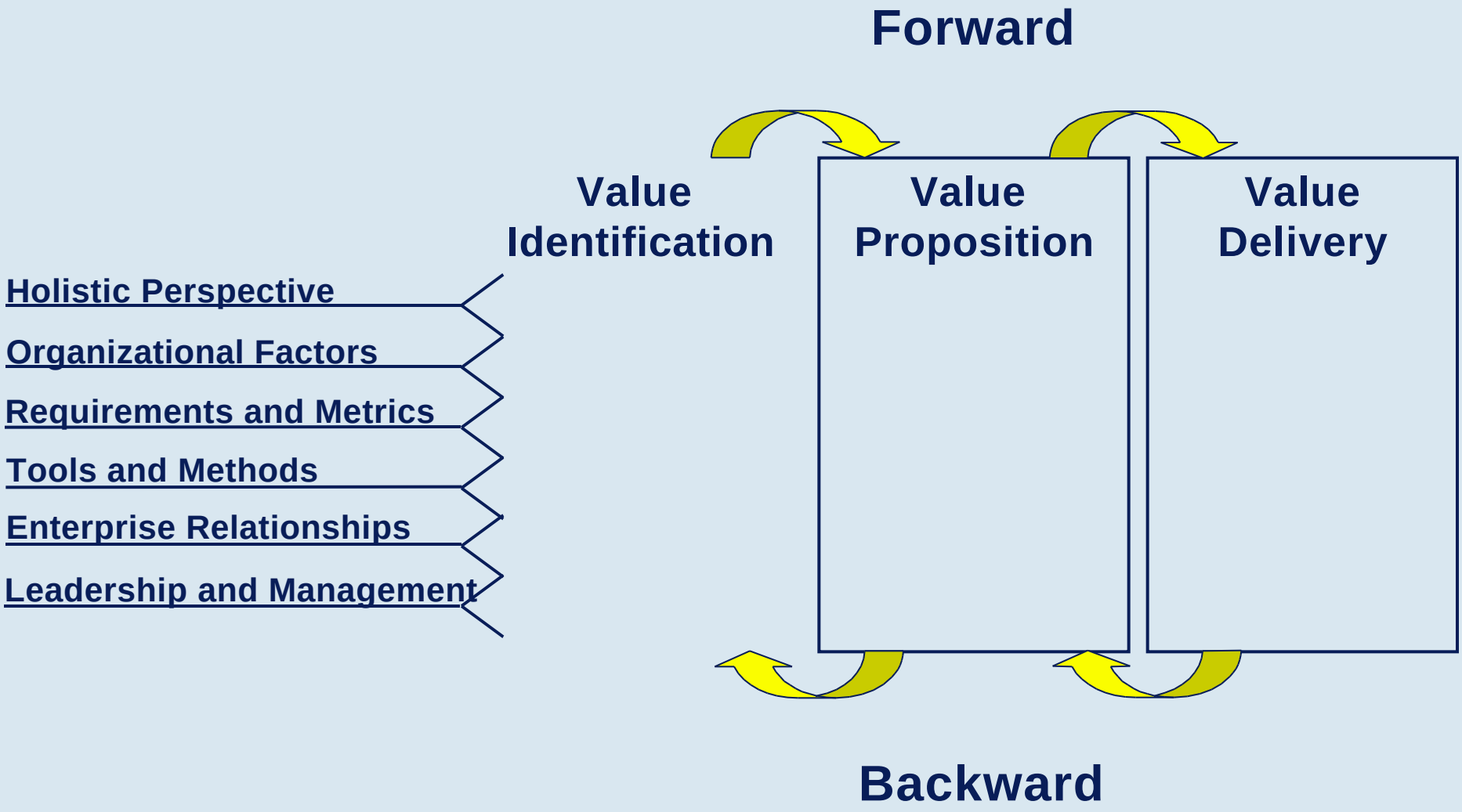
Lifecycle Value Model



Summary

- Framework for lifecycle value has been developed
  - Value Identification, Value Proposition, Value Delivery
- Process attributes span all three value creation processes
- Applicable capability matrices have been constructed
  - Each lifecycle value process based on the six process attributes

All cases studied are representative examples of programs working to achieve best lifecycle value.

F/A-18E/F Super Hornet

The Most Capable and Survivable Carrier-Based Combat Aircraft

Super Hornet Requirements

- 25% greater *payload*
- 3 times greater ordnance *bringback*
- 40% increase in unrefueled *range*
- 5 times more *survivable*
- Designed for future *growth*

- Replace the A-6, F-14 and earlier model Hornets
- Reduced support costs
- Strike fighter for multi-mission effectiveness

Air Superiority | Fighter Escort | Reconnaissance | Aerial Refueling | Close Air Support | Air Defense Suppression | Day/Night Precision Strike | All Weather Attack

Highly capable across the full mission spectrum

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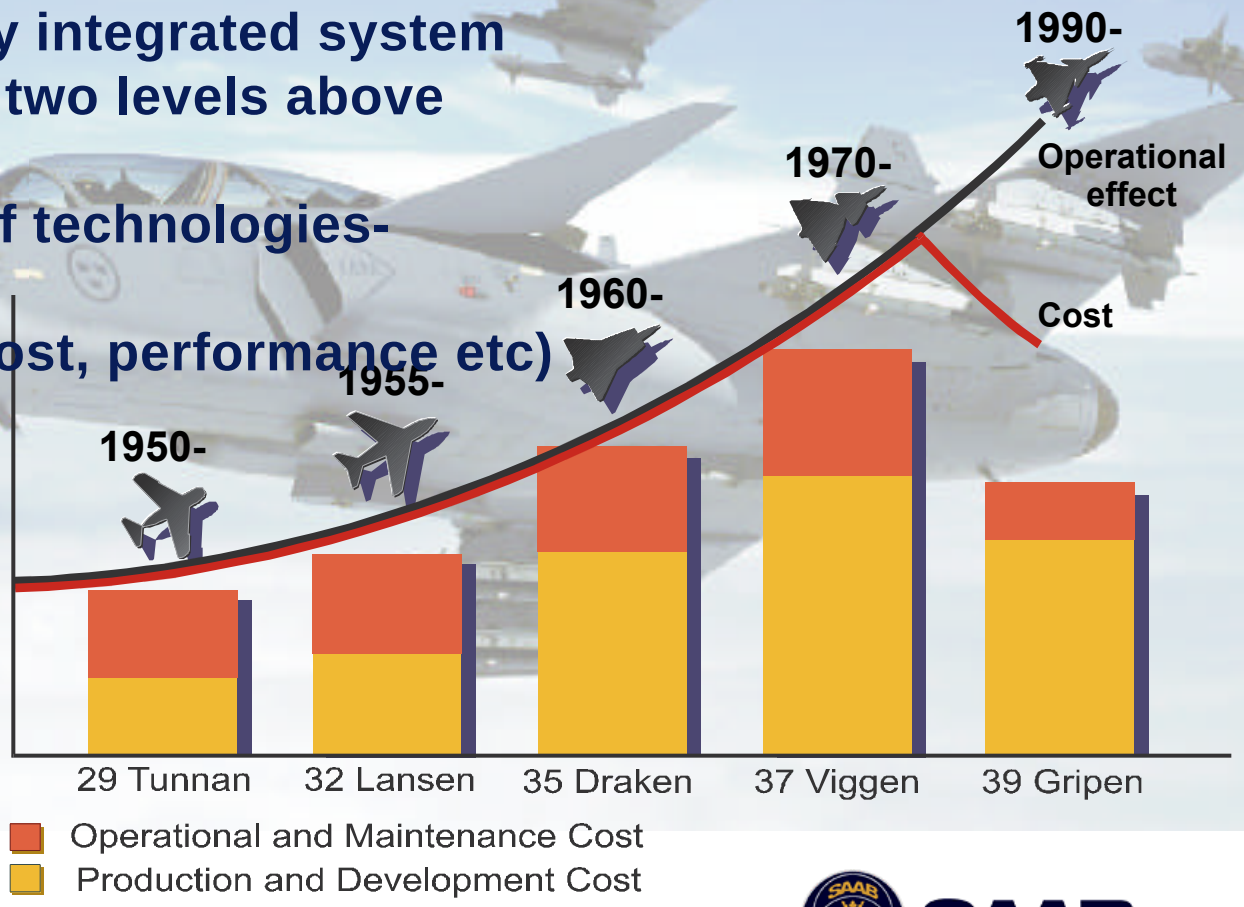
JAS 39 Gripen

- Multirole aircraft
- Small and light weight
- Simplicity
- 4th generation fully digital systems aircraft
  - Complex highly integrated system
- System hierarchy two levels above platform
- Wide bandwidth of technologies- clockspeed
- Lifecycle Value (cost, performance etc)



SAAB

Evolutionary Success Driven by Worldwide Customer Requirements

78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01

20 Worldwide Customers

4285 Aircraft Orders Placed

46 Follow-on Buys by 14 Customers

Six Major Block Changes (117 Versions)

Four Generations of Core Avionics

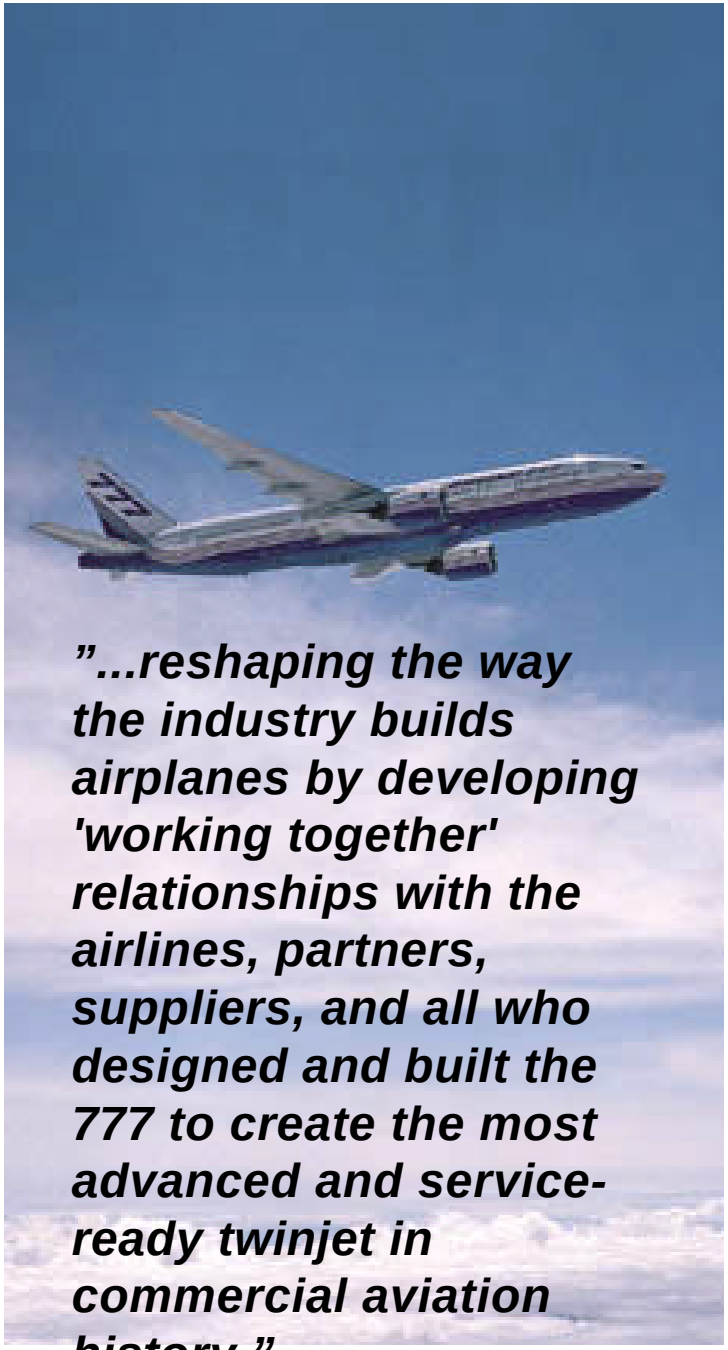
Five Engine Versions

Upgraded Electronic Warfare Suites

Upgrades of Most Subsystems

Global Supply/Support Systems

Delivering a Lifetime of Customer Value



"...reshaping the way the industry builds airplanes by developing 'working together' relationships with the airlines, partners, suppliers, and all who designed and built the 777 to create the most advanced and service-ready twinjet in commercial aviation history."

The Boeing 777

First 777 delivered in June 1995

Family: 777-200, 777-200ER, 777-300, 777-200LR, 777-300ER

Fastest-selling twin-aisle airplane in history with 564 orders and 325 deliveries as of March 2001.

Ranges from 5,150 to 8,820 nmi.

In a three-class configuration, passenger capacity ranges from about 320 for the 777-200s to a maximum of 386 for the 777-300s.

MTOW ranges from 545,000 lbs. for the 777-200 to 752,000 lbs. for the longer-range 777s.

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