Lean Enterprise Model

LEAN AIRCRAFT INITIATIVE

Lean Aircraft Initiative Plenary Workshop

LEM IPT

October 8-9, 1997

Presented By:

Ed Harmon,
Northrop Grumman Corporation

Tom Shields
MIT

Don Meadows
Lockheed Martin Corporation

LEM IPT Has Focused On Three Areas

- **Development of "Web" Version Of LEM V 1.0**
  - » **Prototype Site Demonstrated**
  - » **Process On Schedule**
- **Expansion Of Database In LEM V 1.0**
  - » **Activity Funded By Mantech**
  - » **In Place And Identification Of Data Sources Initiated**
- **Development Of Alternative Module To LEM**
  - » **Task Force Identified And Evaluated Candidate Options**
  - » **LEM IPT Selected Option For Recommendation To Board**
  - » **Seek Executive Board Approval To Continue**

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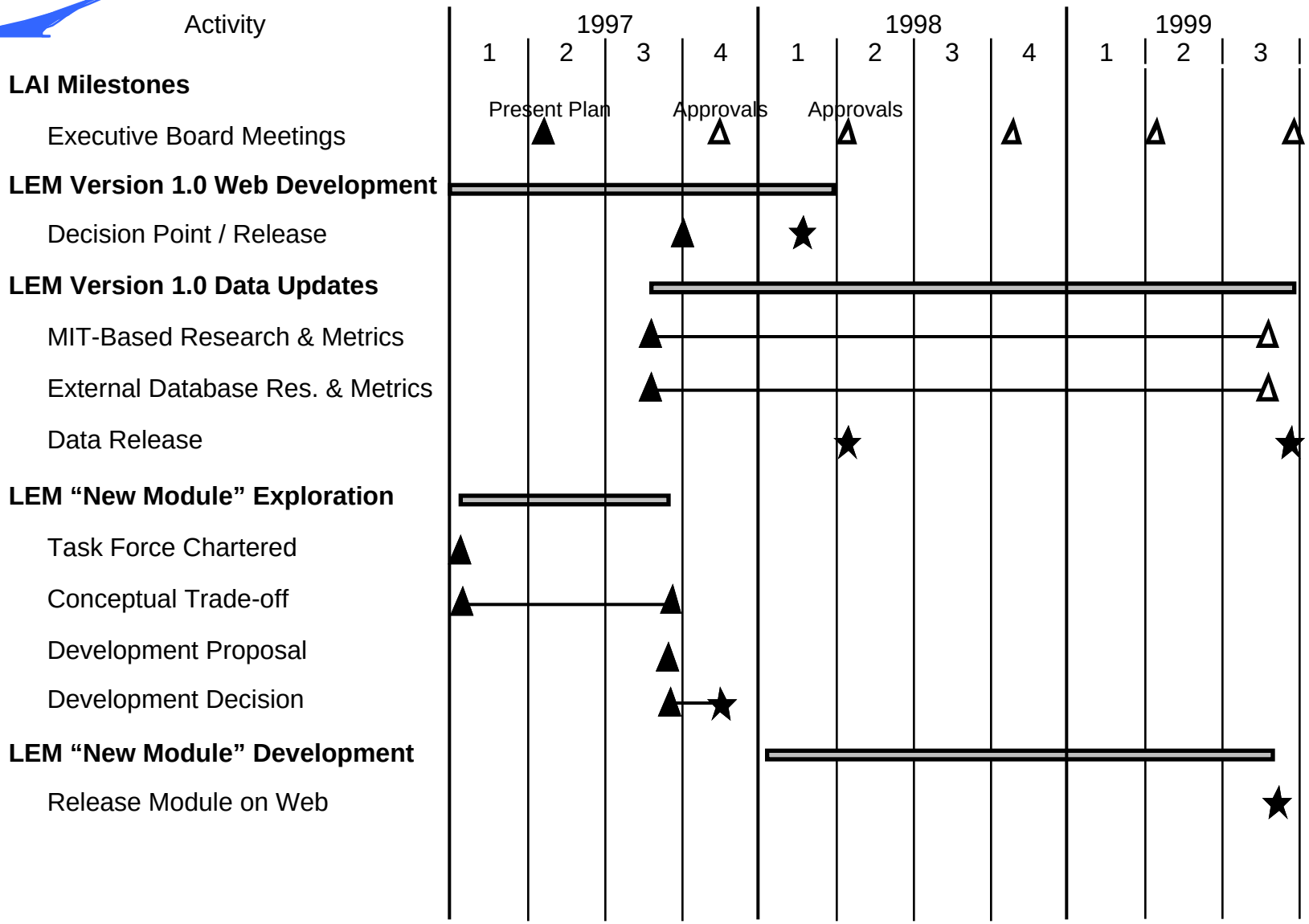
Phase II Activity Schedule



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Presentation Of Phase 2 Status

Version 1.0 Web Development..... Tom Shields

Version 1.0 Data Updates..... Ed Harmon

“New Module” Exploration.....Ed Harmon

“New Module” Development..... Don Meadows

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Outline

- **Web LEM development specifications**
- **Web LEM development process**
- **Web LEM alpha site demonstration**

Web LEM Development Specifications

- **LEM Version 1.0 will not be modified**
- **Will have comparable Visual Basic features**
- **Accessible on LAI home page (protected)**
- **Link to LAI references (new feature)**
- **Web LEM to be downloadable by member**
- **Member specific data must be loaded on member's intranet**
- **Supported by Netscape & Microsoft browsers**
- **No new documentation**

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Web LEM Development Process

- User group formed
- Determination of Web host format
- Determination of Web development method
- Employment of professional user interface designer
- User interface design reviewed by the users group
- Development of the Web LEM alpha test site
- Review by the users group
- Updates to the site based on users group
- Opening of the site to a broader review (Beta test)
- Update to final site configuration
- Opening of the Web LEM site

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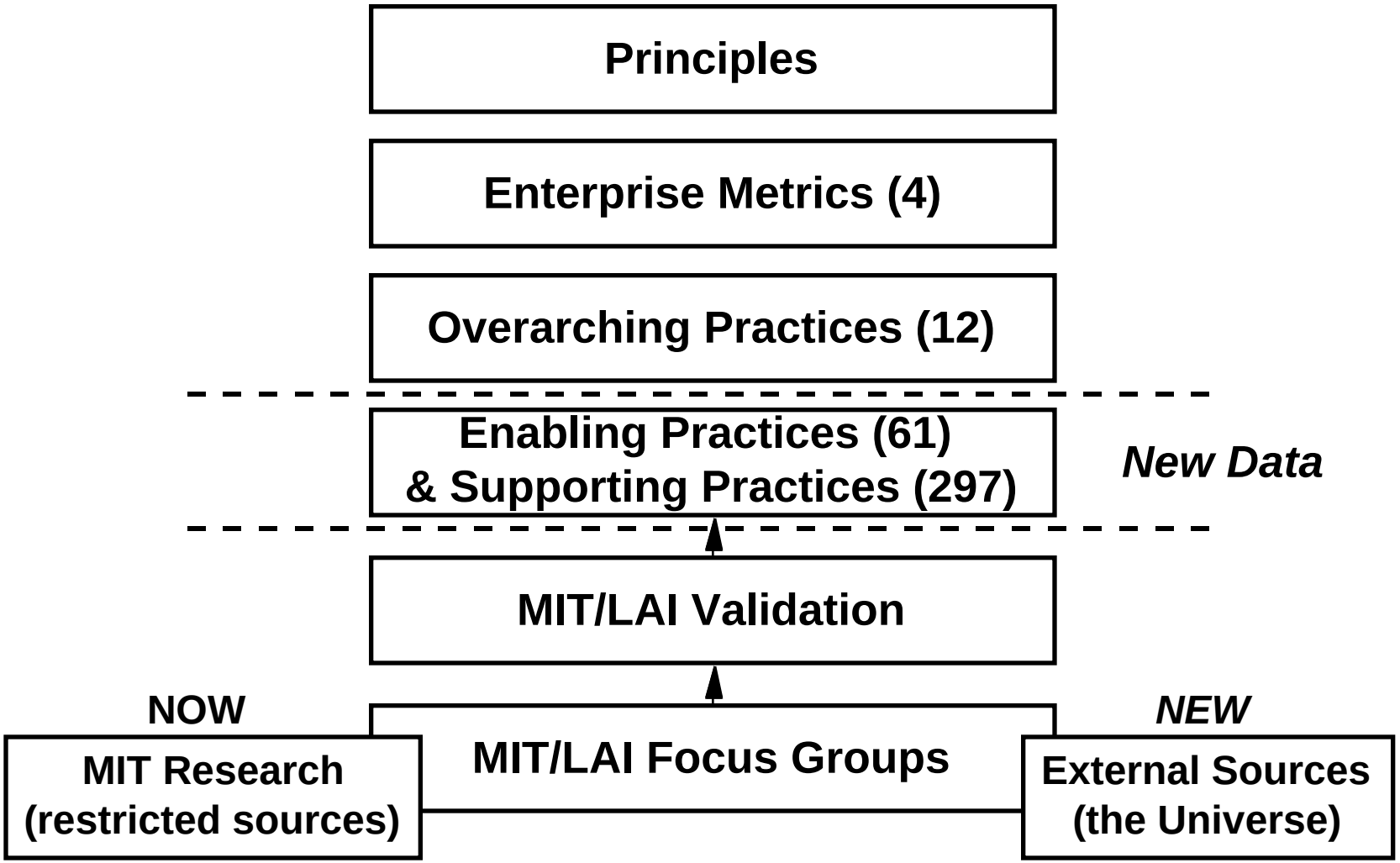
Activity To Augment LEM V 1.0 Data

- **Collaborative Effort in Support of Enhancing LEM Version 1.0 With External Database Research and Metrics**
  - » **Government: AF Mantech (Funding Source)**
  - » **Industry: Textron Systems (Management/Resources)**
  - » **Academia: MIT (Data Validation)**
- **Objective Is to Supplement Current MIT-Based Research and Metrics in LEM With Research and Metrics Existent in Any Other Relevant and Accessible Data Sources.**
- **Effort Initiated in August '97**
  - » **Researchers Co-located at MIT's LAI Center**
  - » **Closely Aligned With LEM IPT Activities**
  - » **7 Step Process Initiated**

Leveraging LEM



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7-Step Process To Leveraging LEM

1. **Review LEM**
   - **– Identify & Understand Where the Holes Are, and Why**
   - **– Identify & understand the Tall Poles**
2. **Survey Available Sources of "Universal" Data**
   - **– Internet Sources, Corporate/Industry Consultants...**
3. **Screen Applicability to Enabling/Supporting Practices**
   - **– Use Existing Measures**
   - **– Add New Measures**
   - **– Match to Data Holes and Big Payoff Metrics**
4. ***Collect, Format and Organize New Data***
5. **Test (Validate) New Data**
   - **– Working With MIT/LAI Focus Groups**
6. **Input Approved Data (LEM Web Version)**
7. **Report and Document**

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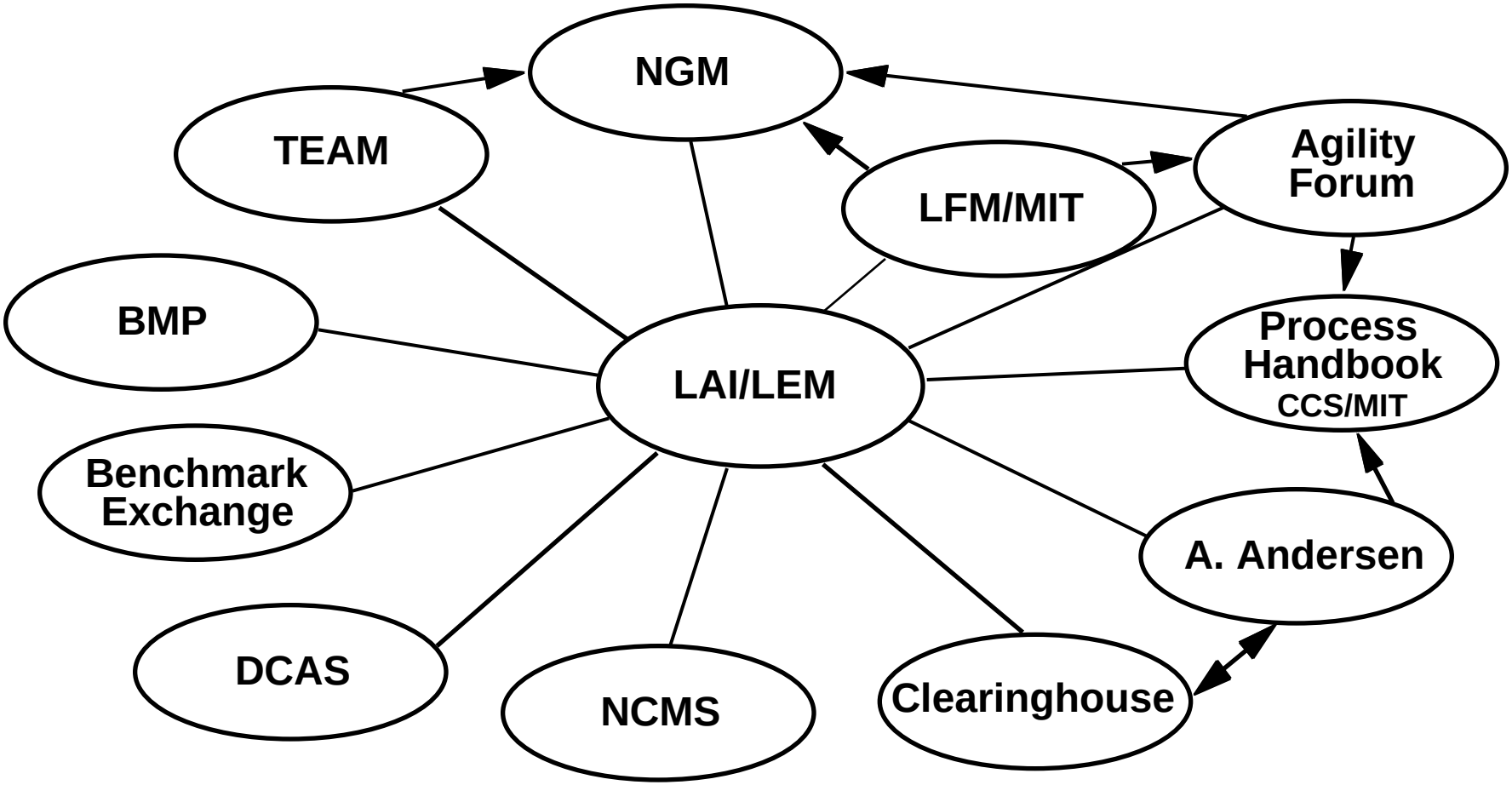
Examples Of LEM External Database Opportunities



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LEM "New Module" Task Force Members

Air Force

John Crabill

Dave Judson

Mick Hitchcock

Industry

Ed Harmon

Don Meadows

Jim Woodroffe

M.I.T.

Kirk Bozdogan

Mark Klein

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LEM IPT Recommendation
Develop "Complementary Module"

- **Need Identified During Phase 1**
  - » **Reference Module Provided "Lean Practice Model"**
  - » **Desire For "How To" Tool**
- **Looked At Four Options**
  - » **System Dynamics**
  - » **"How To"**
  - » **"What To"**
  - » **Knowledge Base**
- **"Implementation Module" Chosen As Most Valuable**
  - » **Organizes Lean Practices Into Proper Sequences**
  - » **Provides "How To" Guidance**

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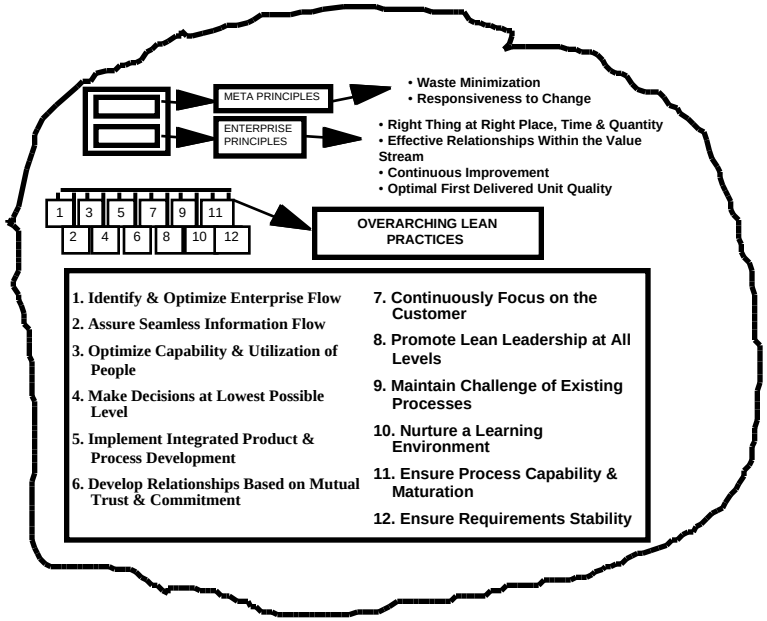
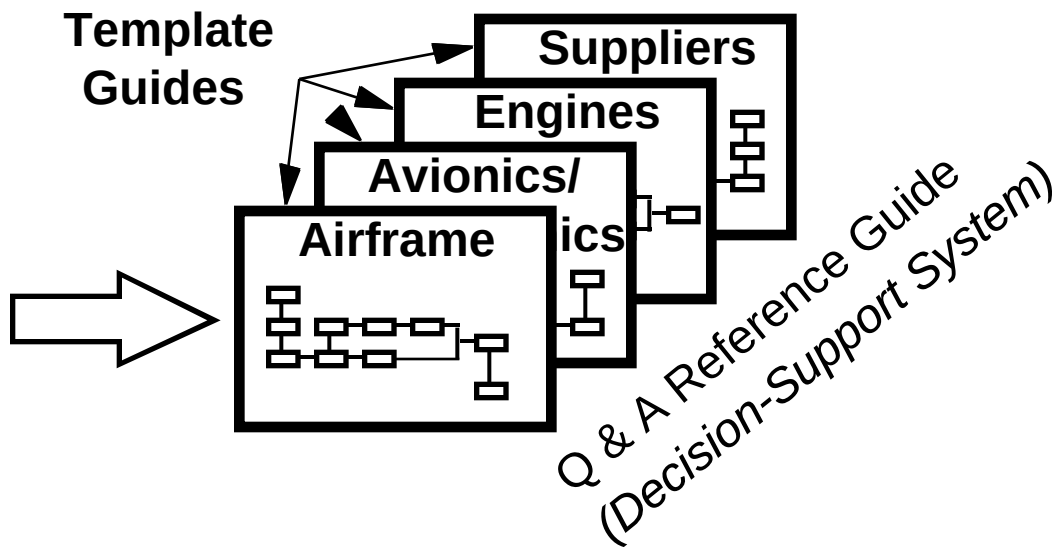
Implementation Module Is Template Based

Current LEM Module



- 12 Overarching Practices
- 61 Enabling Practices
- 297 Supporting Practices
- Benchmarking Database
- Case Studies

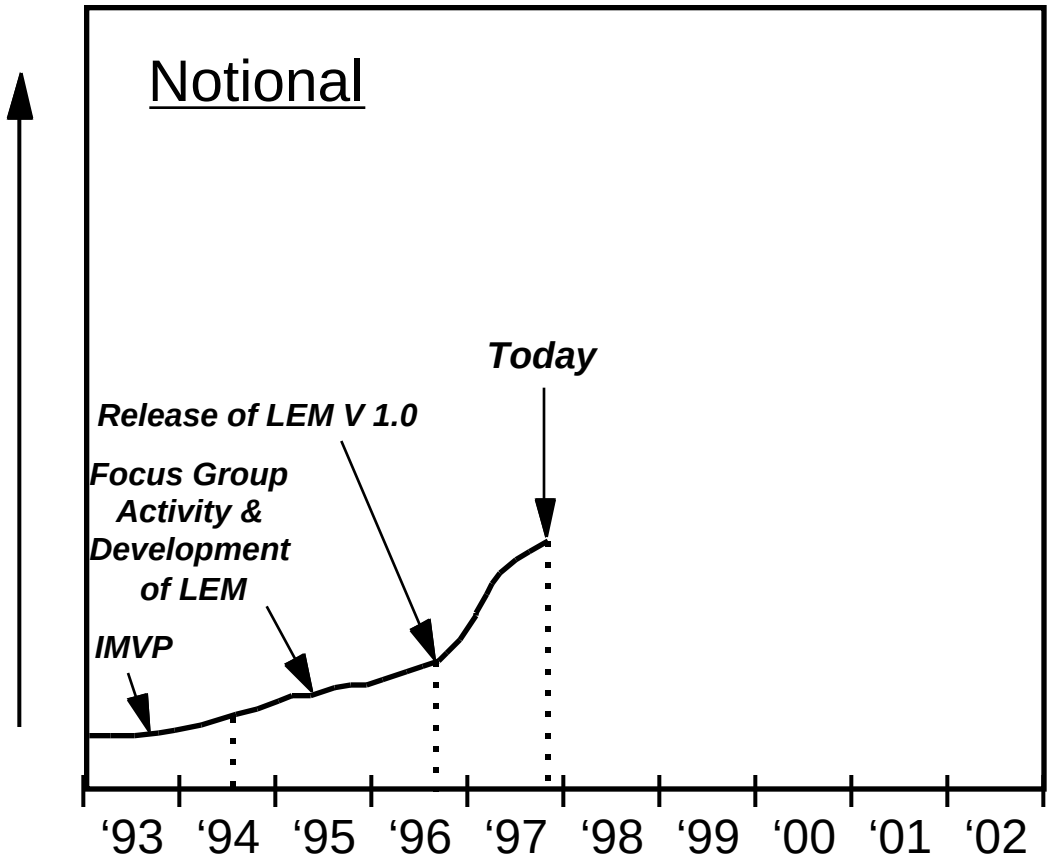
LEM Implementation Module



- Organized, Time-Sequenced Arrangement of Lean Practices
- Tailored to Each Sector, Including Supplier Base
- Selected Stages of Weapon System Life Cycle (e.g. Product Development, Production, Sustainment)

LAI Process Of Knowledge Growth

Expanding Knowledge Base Of Lean Development, Design, Build And Sustainment Practices



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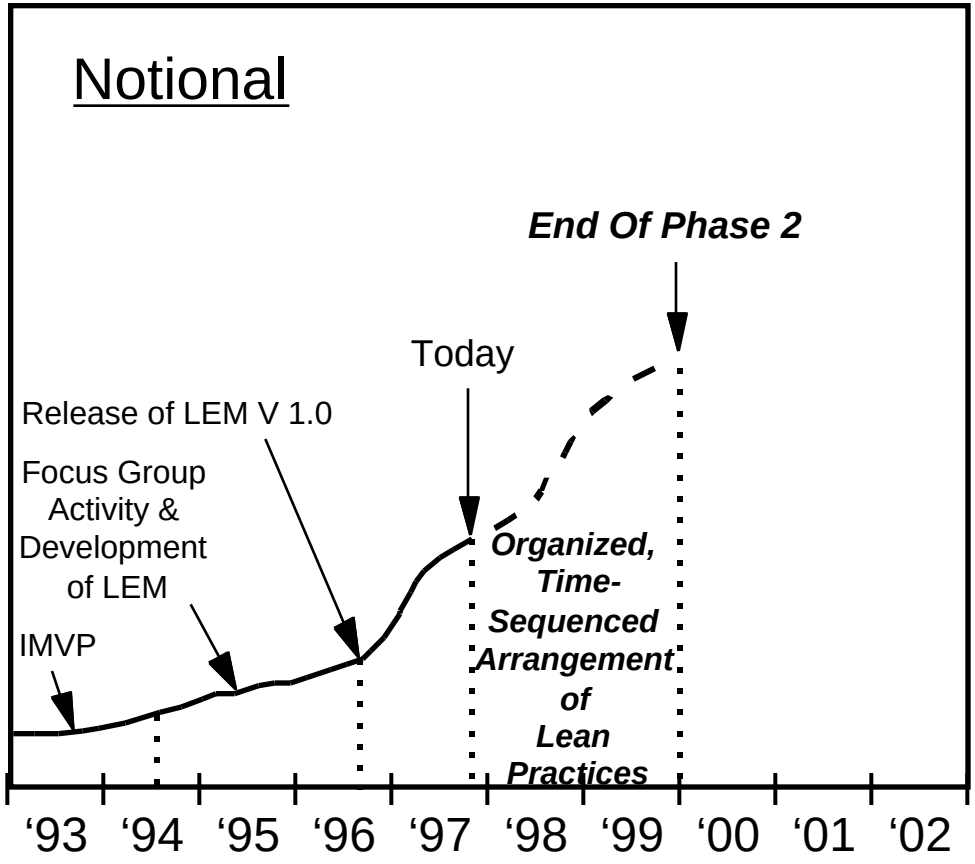
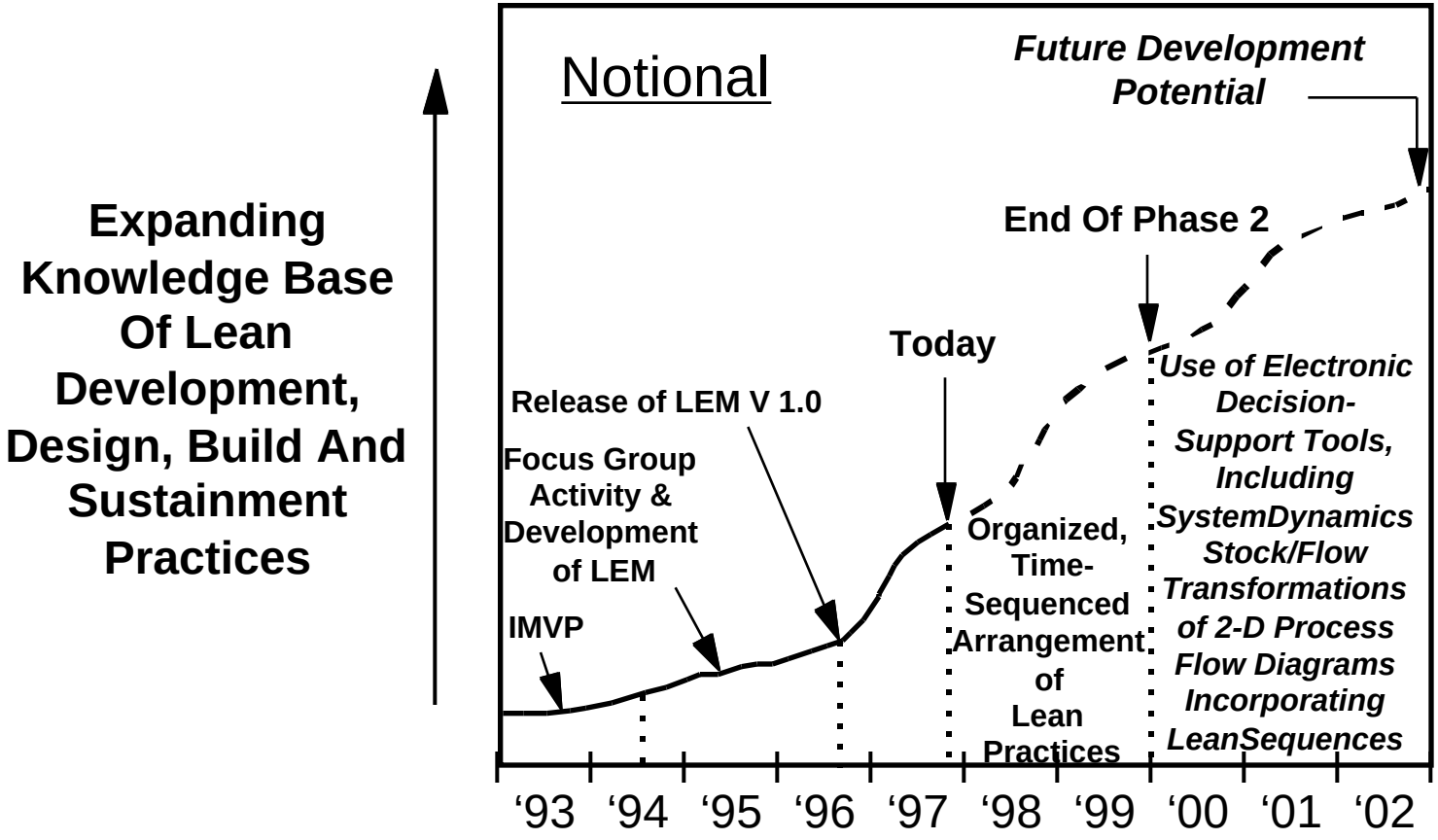
Development Of Implementation Module Will Continue Knowledge Growth

Expanding Knowledge Base Of Lean Development, Design, Build And Sustainment Practices



Potential For Further Knowledge Growth



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Framework For Executing This Activity

- **LEM IPT Industry Consortium As Prime**
  - » **Need LAI Consortium Member Commitment To Support**
- **Creation Of IPTs To Develop Specific Flow Modules**
  - » **Sector Representation**
  - » **Focus Group Oriented**
- **Lean Forum IV Potential Funding Source**
  - » **Need For Implementation Module Identified As A High Priority**
  - » **Competitive Source Selection**
  - » **Contract Activity Start June, 1998**
- **Organizing, Planning And Concept Definition Covered Within Current Scope Of LAI**

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Lean Implementation Model

Objective:

To meet the request of consortium members for a "how-to" guide for implementing Lean Production.

Lean Implementation Model

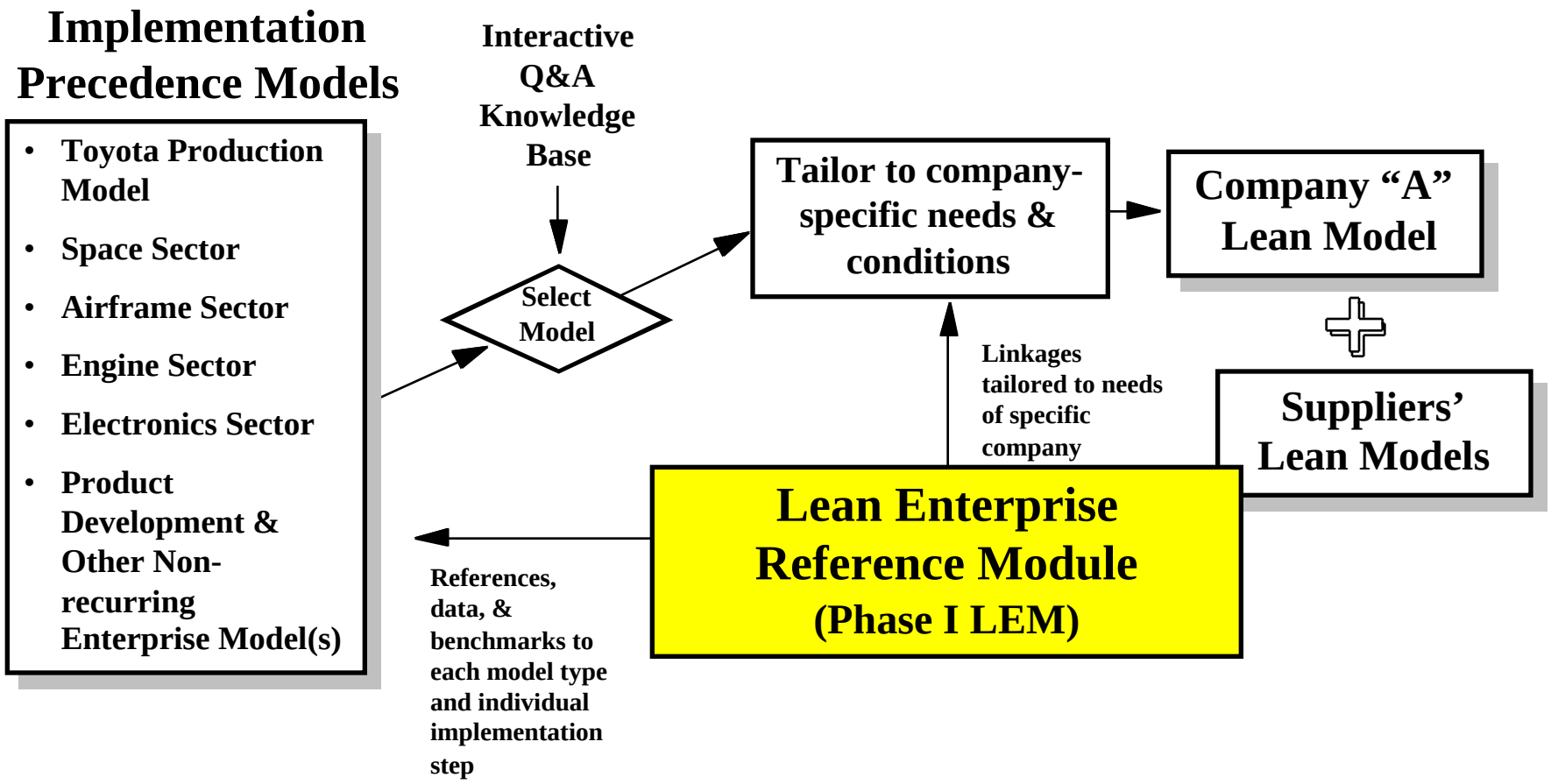
REQUIREMENTS:

- **Enhance decision making on how to become lean; in particular, provide key sequential steps required**
- **Meet the needs of each sector of LAI (airframe, engines, electronics, space)**
- **Complete task within the Phase II timeframe**

Lean Implementation Model: Approach

- **Utilize precedence network models to capture experience of LAI consortium members**
- **Create common model where feasible; capture sector peculiarities as required**
- **Involve designated representatives from each sector in the development of model(s)**
- **Create conceptual framework that integrates current LEM reference model with new implementation precedence models**

LEM Implementation Framework



Lean Enterprise Model
Version 1.0
November 4, 1996

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PRINCIPLES

- Meta-Principles -

Responsiveness to Change ◆ Waste Minimization

- Enterprise Principles -

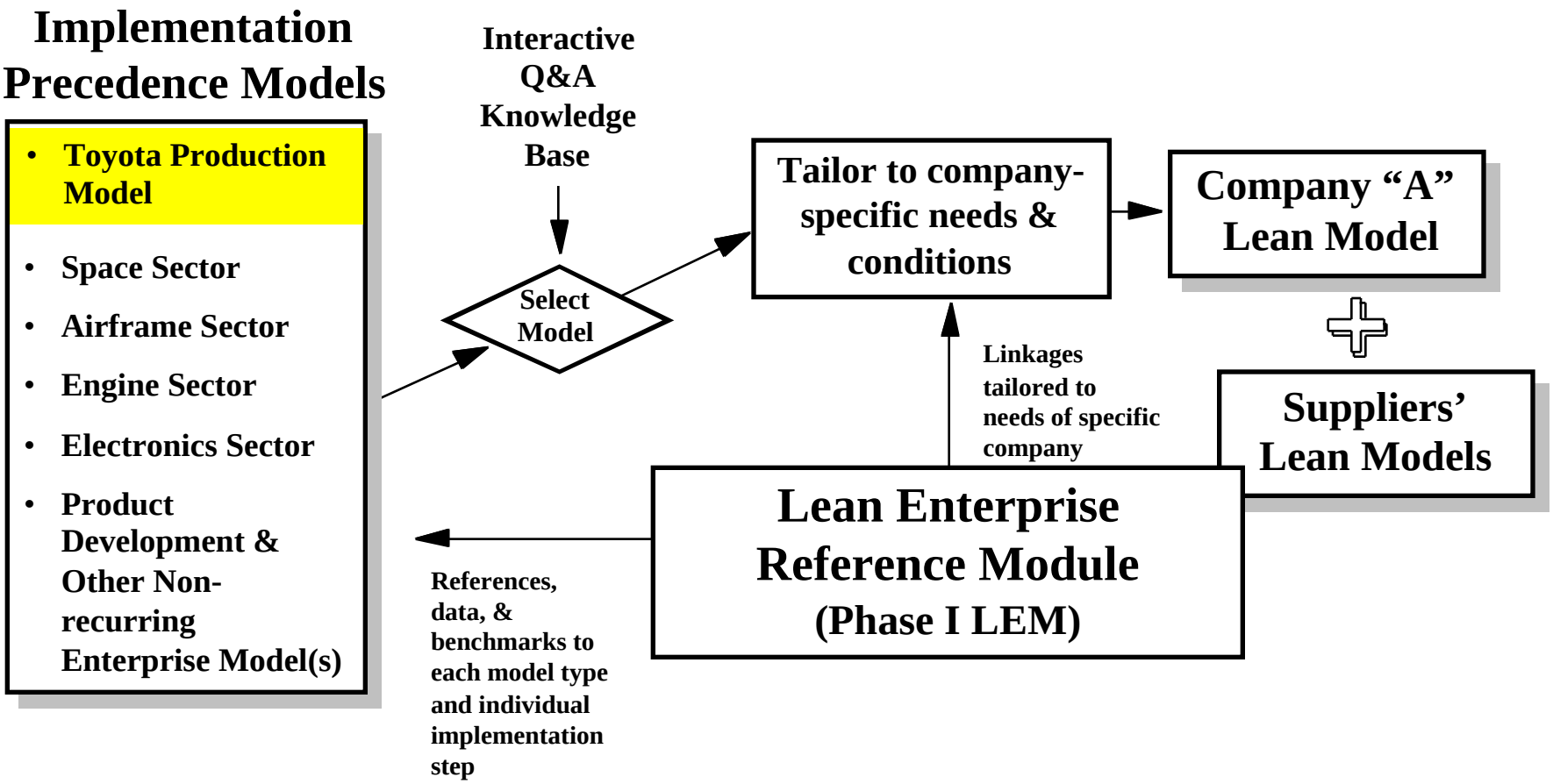
Right Thing at Right Place, Right Time, and in the Right Quantity
Effective Relationships within the Value Stream
Continuous Improvement
Optimal First Delivered Unit Quality

ENTERPRISE LEVEL METRICS

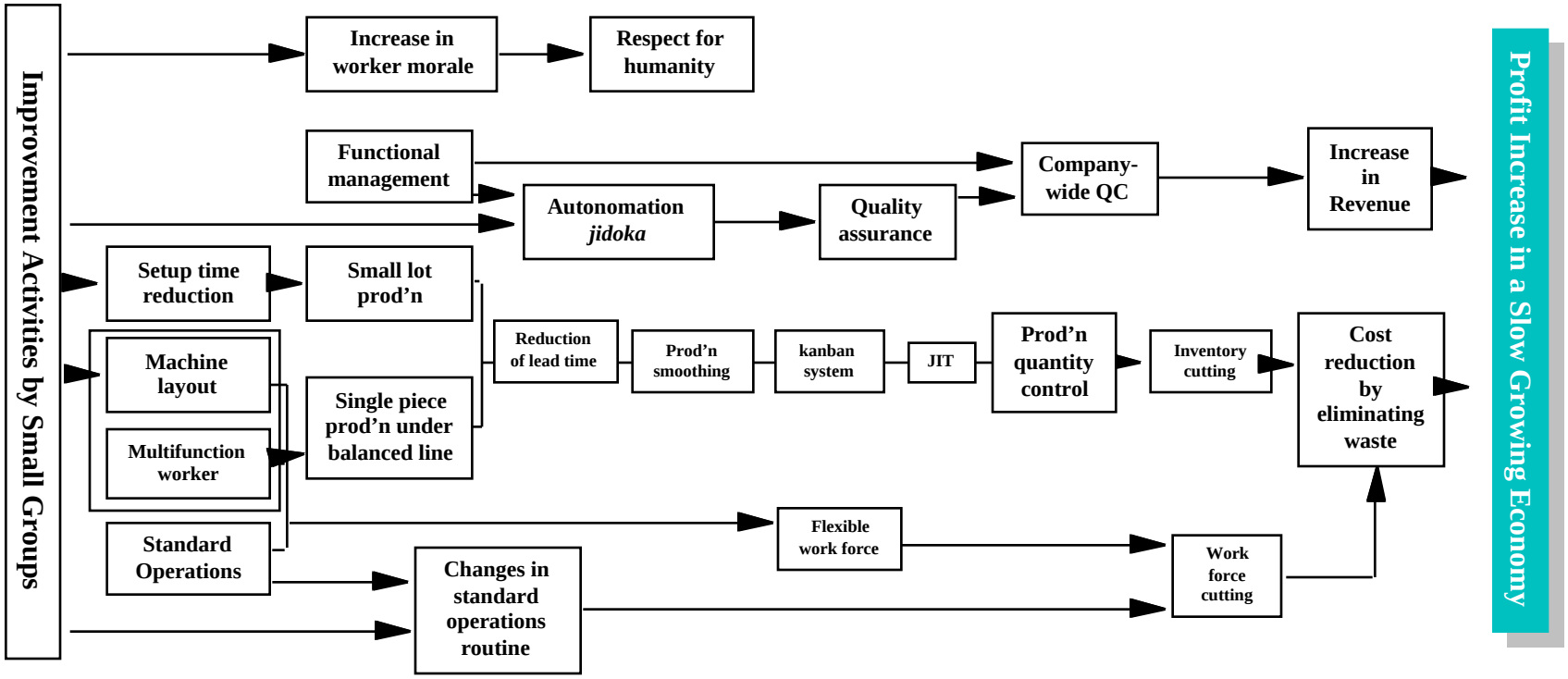
Flow Time
Stakeholder Satisfaction
Resource Utilization
Quality Yield

1. **Identify and Optimize Enterprise Flow**
2. **Assure Seamless Information Flow**
3. **Optimize Capability and Utilization of People**
4. **Make Decisions at Lowest Possible Level**
5. **Implement Integrated Product and Process Development**
6. **Develop Relationships Based On Mutual Trust and Commitment**
7. **Continuously Focus on the Customer**
8. **Promote Lean Leadership at All Levels**
9. **Maintain Challenge of Existing Processes**
10. **Nurture a Learning Environment**
11. **Ensure Process Capability and Maturation**
12. **Maximize Stability in a Changing Environment**

LEM Implementation Framework

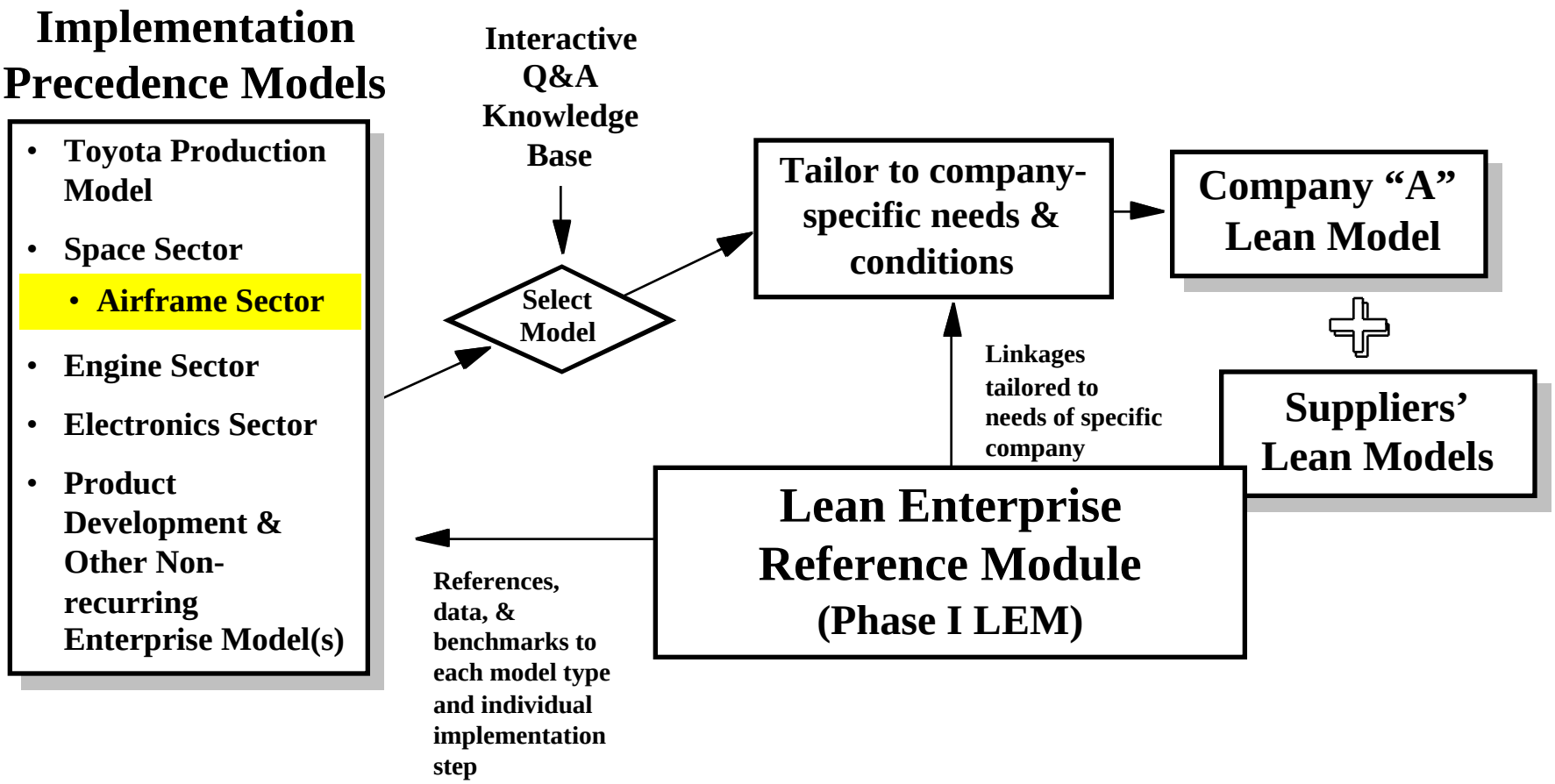


Toyota Production Model



Source: Yasuhiro Monden, *The Toyota Production System*, p. 4

LEM Implementation Framework



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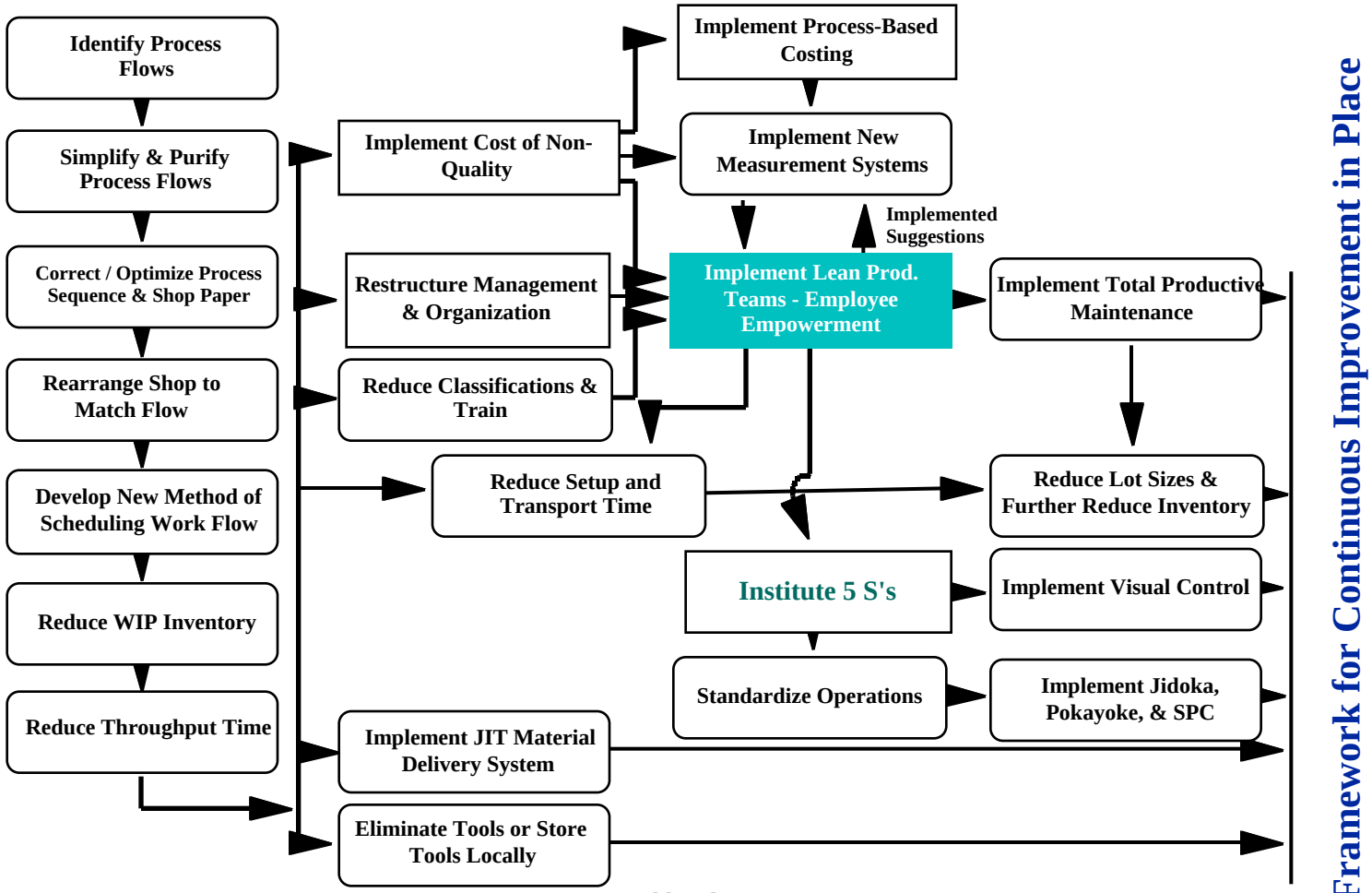
Airframe Sector—Example



Source: Lockheed Martin Corporation

Lean Implementation Model Features

Phase II

- **Introduces precedence relationships among key lean practices; allows implementers to focus on reduced, time-phased data set**

Future

- **Provides "click-on" linkage from precedence step to LEM reference model with availability of research results, definitions, barriers, enablers, lower level practices**
- **Allows high level overview of Lean with extensive "drilldown" capability**
- **Provides potential of narrative descriptions of each step, reasons for the precedence position, and practical methods of achieving any particular step**

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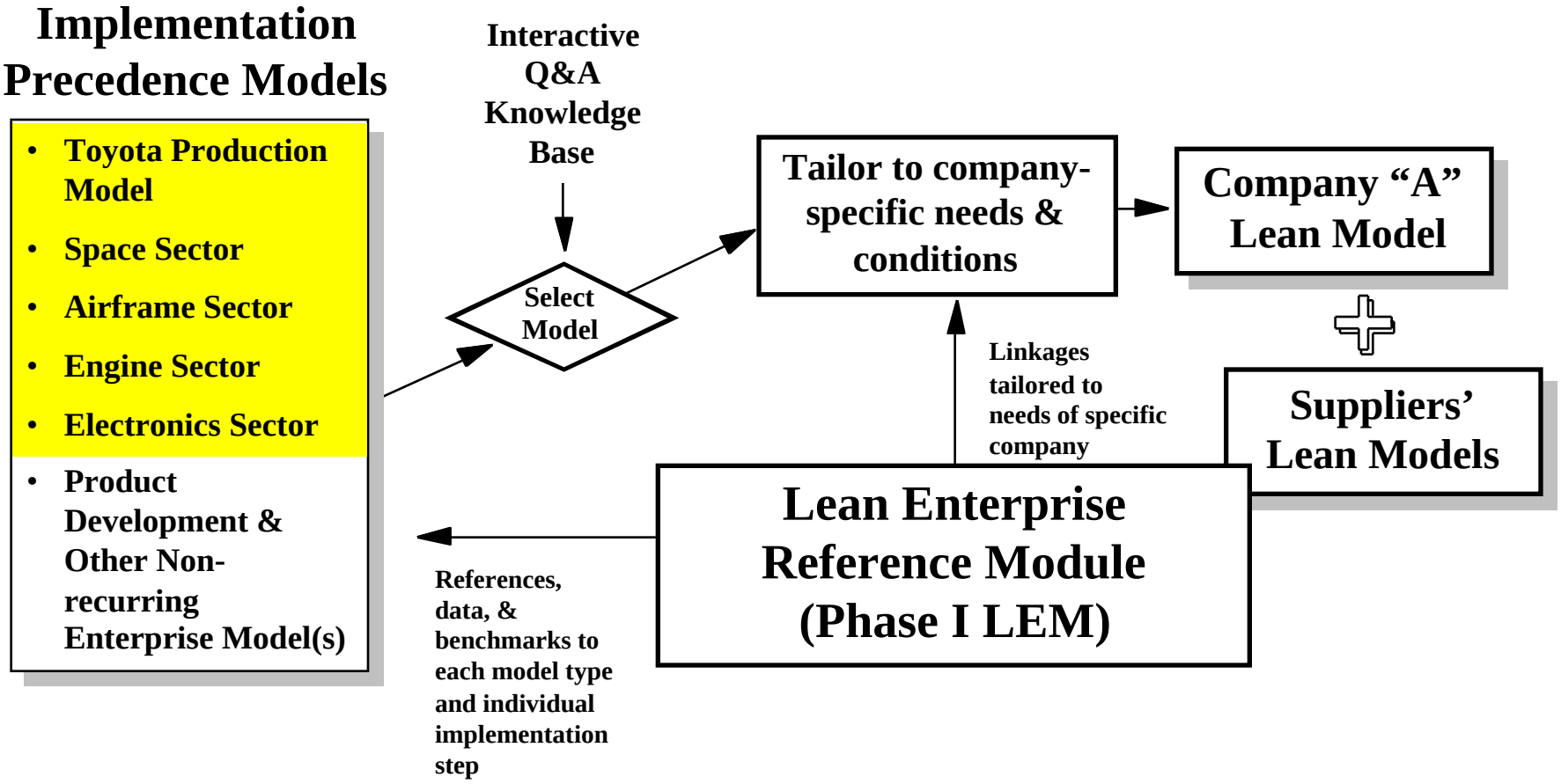
Lean Implementation Model Specific Tasks (Phase II)

- ☞ **Create precedence models for each sector**
- ✒ **Rationalize each model to a common model where possible**
- ✓ **Create conceptual "click-on" linkage to LEM reference model & other data bases**
  - » **create high level architecture/design**
  - » **generate cost & schedule for future proposed effort**
- ✓ **Capture sector discussions & experience on precedence steps for incorporation into future database**
- × **Evaluate COTS/other decision support systems as management aids in lean implementation**

LEM Implementation Framework

Phase II:



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Lean Implementation Model Schedule & Major Milestones