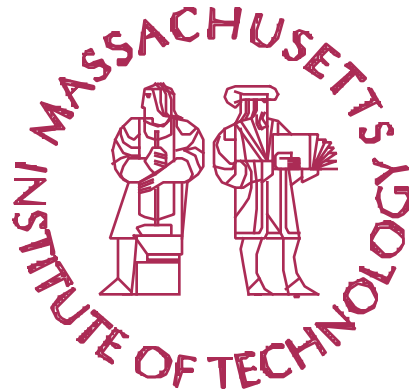


LEAN AEROSPACE INITIATIVE
Supplier Networks Research Team Workshop
Building Lean Supplier Networks



January 13-14, 2000

Presented by
Kirk Bozdogan, Hamid Akhbari & George Reynolds
Co-Leads, Supplier Networks Research Team
Contact: bozdogan@mit.edu; 617 253-8540
Document: Team Summary

Phase III Team Charter

CHARTER: Develop and deploy concepts, strategies and tools that optimize value streams supporting the design, production and sustainment of aerospace systems offering best lifecycle value

EXPECTED BENEFITS: Best lifecycle value to the customer; “win-win” prime-supplier relationships; significant network-wide (value stream) performance improvements & shared benefits

- ⇒ Greater efficiency; higher quality
- ⇒ Lead time reduction
- ⇒ Flexibility and responsiveness

CO-LEADS

MIT

**Kirk Bozdogan
Charlie Fine**

INDUSTRY

**George Reynolds
Northrop Grumman
ESSS**

GOVERNMENT

**Hamid Akhbari
C-17 SPO, WPAFB**

- ❖ **Strategies, methods & tools for flowing lean principles throughout multi-tiered supplier networks⁺**
 - ↳ **Lean transformation roadmap:** Change management strategies & enablers; implementation steps & metrics
 - ↳ **Methods and tools:** Self-assessment tool; common supplier development guide; value stream mapping; performance metrics; gainsharing methods; electronic integration practices
- ❖ **Models for innovative supply chain integration to deliver best lifecycle value to customer⁺**
 - ↳ **Supply chain design & integration models for building dynamic sustainable network-wide competitive advantage^{*}**
 - ↳ **Fostering & “pulling” innovation over supplier networks**
 - ↳ **Information infrastructure for building integrated virtual enterprises enhancing flexibility & responsiveness[#]**

⁺ Involves major international cross-benchmarking survey in collaboration with UK-LAI & LARP

^{*} Joint with Acquisition Research Team & with Lean Sustainment Initiative; in collaboration with UK-LAI, LARP and ISCM (see Chart #6)

[#] Joint with Product Development Research Team.

Additional Phase III Research Topics*

- ❖ ***Cross-functional integration of procurement, production and sustainment operations and processes***
- ❖ ***Optimizing centralized/decentralized procurement strategies***
- ❖ ***Developing sustaining supplier relationships in an environment of changing aerospace market conditions***
- ❖ ***Mapping the supplier knowledge value stream***
- ❖ ***Designing new information-technology-mediated organizational structures, business practices and management strategies fostering interorganizational learning***
- ❖ ***Linking technology roadmaps across government-prime-supplier networks***

*Contingent upon availability of additional funding (not listed in priority order)

PRODUCT CATEGORIES	MAJOR PRODUCTS (Examples)
OUTREACH	<ul style="list-style-type: none"> • Provide “content” support to regional supplier workshops • WEB-based communication products (on-going) • Annual “for fee” conferences on special topics open to all small-to-medium size aerospace suppliers*
LEARNING	<ul style="list-style-type: none"> • Topical and/or implementation workshops (twice a year) • Lean transformation roadmap, methods & tools • Summer short course on supply chain management strategies and methods (yearly, starting in 2001; provide support to “Integrating the Lean Enterprise” short course in June 2000) • Supply chain design & management self-assessment tool* • Common supplier training and development guide* • IT tools for mapping supplier knowledge value stream*
ENDURING	<ul style="list-style-type: none"> • Contributions to Lean Enterprise Model (LEM) • Conference reports, working papers and publications • Book contribution –“SUPERCHAINS”
POLICY	<ul style="list-style-type: none"> • Policy recommendations (potential examples) <ul style="list-style-type: none"> ⇒ Fostering innovation in supplier networks ⇒ Interoperability, globalization & international collaboration

*Contingent upon availability of additional funding.

SYNERGY: Links to Other Activities

✿ LAI-related activities

- Lean Sustainment Initiative (LSI)
- LAI international collaborative projects (e.g., UK-LAI; LARP)
- Labor Aerospace Research Agenda (LARA)

✿ Other MIT activities

- Integrated Supply Chain Management Program (ISCM), Center for Transportation Studies
- International Motor Vehicle Program (IMVP)
- Center for Innovation in Product Development (CIPD)
- System Design and Management Program (SDM)

✿ Other organizations

- Regional organizations (e.g., NESI, CMTC)
- National organizations - expected (e.g., AIA, NIST)

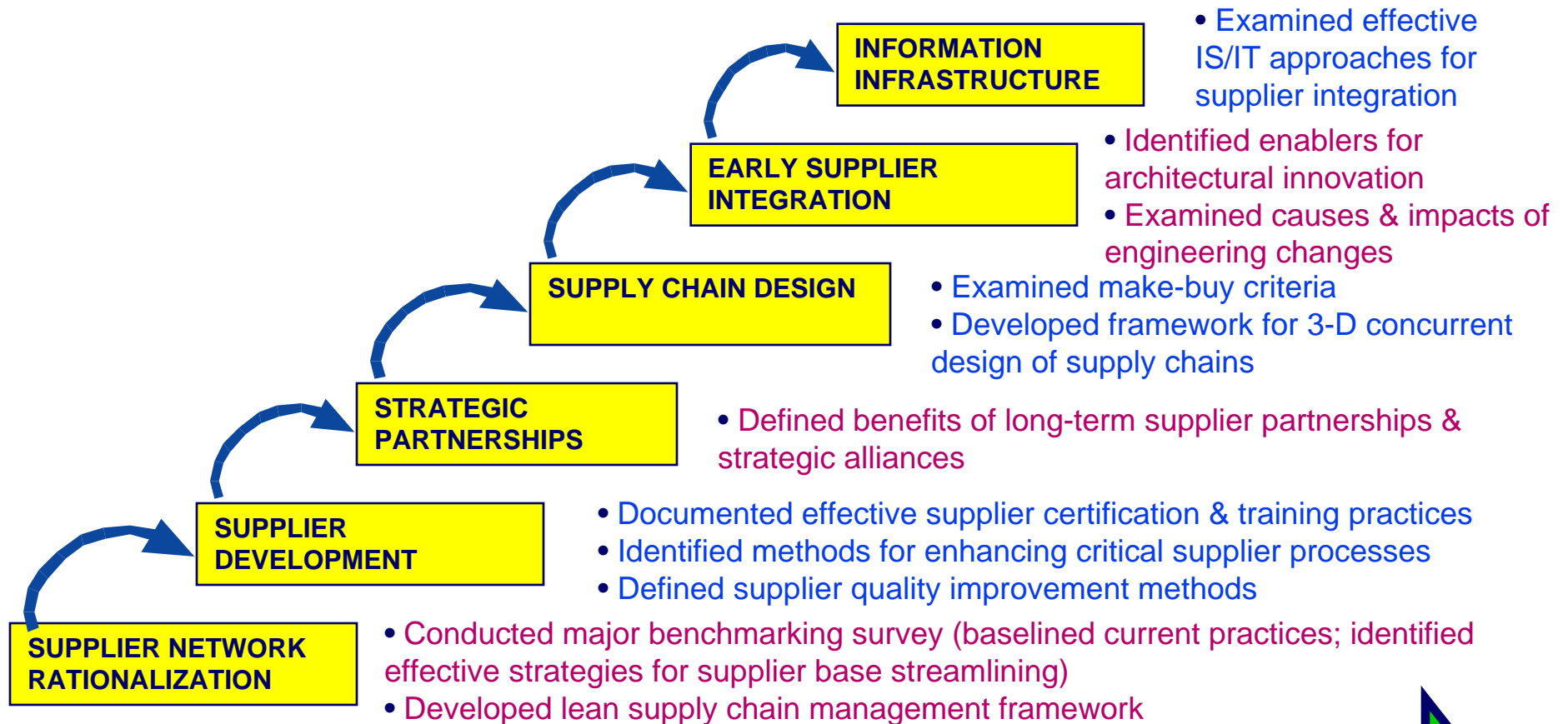
*LEAN AEROSPACE
INITIATIVE*



ATTACHMENT

LEAN AEROSPACE INITIATIVE
Supplier Networks Research Team
Phases I & II Research Summary

Research Progress (Phases I & II)



PROCESS:

Survey research, case studies, site-visits, workshops

PRODUCT:

Briefings, customized survey feedback, reports, theses, inputs to LEM

IMPACT:

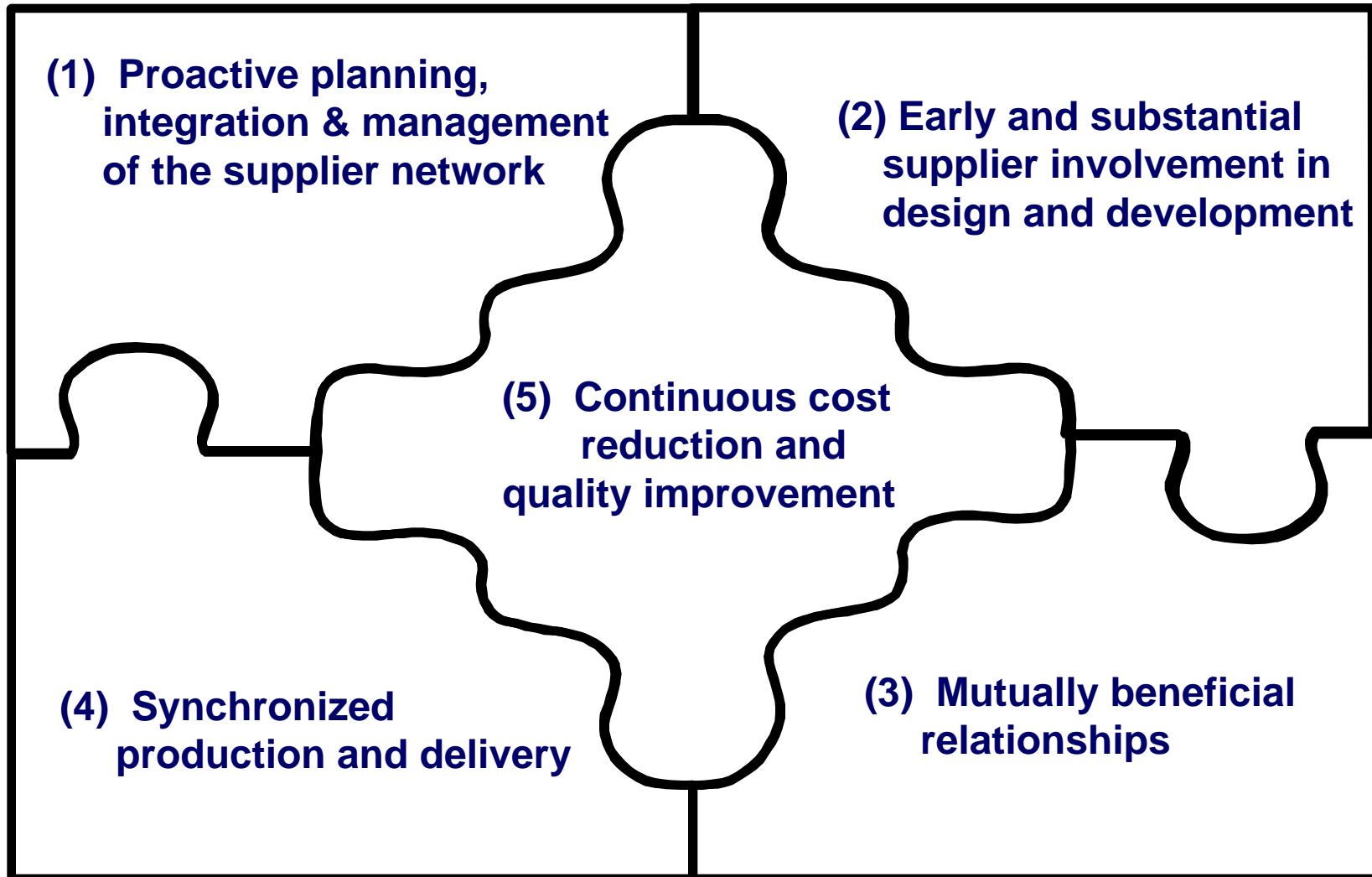
Research findings implemented by consortium members (on-going)

Summary of Major Products (Phases I & II)

- ❖ **Output of major benchmarking survey on supply chain management practices in aerospace industry**
 - Communication of emerging lean practices (numerous briefings/presentations)
 - Customized feedback packages to sponsor companies
- ❖ **Lean supply chain management framework (Team Product)**
 - Overarching, enabling, supporting & operating practices
 - Performance metrics at all levels
- ❖ **Learning workshops & symposia (Illustrative)**
 - Electronic integration of supplier value streams (cross-industry) --Feb 99
 - Barriers to flowing lean principles throughout value stream (cross-industry)-- June 99
 - Regional Supplier Workshops (on-going support)
- ❖ **Invited briefings at major sponsor events (Examples)**
 - AF MANTECH strategic planning meeting -- Feb 95
 - Boeing materiel management executives meeting-- March 96
 - Sundstrand Supplier Council-- March 96
 - Texas Instruments Supply Chain Integration Forum-- Sept 96
 - F-22/F119 Executive Supplier Conference -- June 99

Summary of Major Products (Phases I & II -- Continued)

- ❖ **Invited presentations at national conferences, workshops and special events**
 - NAECON -- May 95
 - National Research Council (policy Issues in aerospace offsets -- sponsored by DOD, Dept of Commerce, DARPA, White House) -- June 97; Jan 98
 - Ship Design and Shipbuilding Technology Symposium -- May 97
 - Defense Science Board
 - Industry Consolidation Task Force -- Sept 97
 - Acquisition Reform Task Force -- Jan 98
 - OSD Cost Analysts Annual Conference -- Feb 98
- ❖ **Many reports and publications** (Illustrative topics)
 - Early supplier integration into design & development
 - Three dimensional concurrent design of products, processes & supply chains
 - Sharing the benefits of interorganizational R&D collaboration with suppliers
 - International aerospace offsets: policy issues
 - Collaborative learning networks in defense aerospace industry
 - Dual-use supplier management & strategic international sourcing
 - Controlling uncertainty through close ties with suppliers
- ❖ **Contributions to the Lean Enterprise Model (LEM) -- Datasheets**



Phase II Specific Research Projects & Products (1)

☑ Early supplier integration into product development*

“Architectural Innovation in Product Development through Early Supplier Integration” (KBozdogan, JDeyst, DHoult, MLucas), *R&D MANAGEMENT*, Vol. 28, No.3 (July 1998)

☑ Information infrastructure for supplier integration*+

Building Information Systems to Integrate the Manufacturing Supply Chain -

Michelle Antonelli; MS Thesis, EE&CS and Technology and Policy; Supervisors: Dr. Daniel Whitney & Dr. Kirk Bozdogan (Completed: May 99)

Information Infrastructure for Collaborative Product Development⁺: Anna Öhrwall Rönnbäck, PhD Candidate; Licentiate Thesis; Supervisor: Prof. Staffan Brege, Linköping Univ., Sweden (Expected Completion: March-April, 2000)

* Joint with Product Development

+ Collaborative project with Lean Aircraft Research Program (LARP), Linköping Univ., Sweden

Phase II Specific Research Projects & Products (2)

☑ **Make-buy and strategic outsourcing decisions**

Make-Buy Strategies in the U.S. Aerospace Industry - Rob Perrons; MS Thesis, Technology and Policy; Supervisor: Dr. Kirk Bozdogan; (Completed: Aug 97)

Dual-Use Supplier Management and Strategic International Sourcing in Aircraft Manufacturing - Prof. Todd Watkins, Lehigh Univ.; Working Paper (Revised/completed Oct 97)

Strategic Outsourcing and Supplier Integration in the Helicopter Sector - Rudy Prudente; MS Thesis, System Design and Management Program (SDM); Supervisor: Dr. Kirk Bozdogan (Completed: Feb 99); collaborative project with LARP

Outsourcing - Strategic and Operational Realities : Reine Wasner, PhD Candidate; Licentiate Thesis; Supervisors: Prof. Ove Brandes, Prof. Staffan Brege (Completed Oct 99); collaborative project with LARP

Phase II Specific Research Projects & Products (3)

☑ Engineering changes and design-manufacturing integration over the supplier network*

Causes and Impacts of Class One Engineering Changes: An Exploratory Study Based on Three Aircraft Acquisition Programs -

Ted Hsu; MStHesis, Aeronautics and Astronautics and Technology and Policy;
Supervisors: Dr. Kirk Bozdogan & Prof. John Deyst (Completed: May 99)

System Dynamics Modeling of Barriers to Design-Manufacturing Integration over the Supplier Network[#] - Bill Blake; MS Thesis, SDM;
Supervisors: Prof. Daniel Frey & Dr. Kirk Bozdogan (Expected completion: March-April, 2000)

* Joint with Product Development

Title approximate

Phase II Specific Research Projects & Products (4)

Managing transition to a performance-based business environment

(continuation of Phase I research on “Supplier Network Restructuring, Integration and Governance Structures”)

The Institutional Context and Manufacturing Performance: The Case of the U.S. Defense Industrial Network - Dr. Maryellen Kelley (NIST; formerly Carnegie-Mellon Univ.) & Cynthia Cook (Harvard Univ.); Working Paper (Revised/Updated Mar 98)

Transition to Commercial Practices in the U.S. Aircraft Industry - Ernest (Jay) Campbell; MS Thesis, Sloan School of Management; Supervisors: Dr. Don Rosenfield & Dr. Kirk Bozdogan (Completed: May 98)

Supply Chain Management Practices in the U.S. Engine Sector -

Bill Gostic; MS Thesis, Sloan School of Management, Sloan Fellows Program; Supervisors: Dr. Don Rosenfield & Dr. Kirk Bozdogan (Completed: May 98)

Production Networks Revisited: Causes and Consequences of Supplier and Customer Linkages in the Metal Manufacturing Sector - Cynthia Cook, Ph.D. Thesis, Harvard University; Supervisor: Prof. Peter Marsden (Completed: Jun 99)

Phase II Specific Research Projects & Products (5)

☑ Sharing the payoffs of collaborative R&D in the supply chain ✧

“Pie-Division” in Interorganizational Collaboration - Prof. Sandy Jap, MIT; Working Paper (Completed: Oct 98)

☑ Supplier integration in the electronic instruments sector

Achieving Supplier Integration through Implementation of Supplier Managed Inventory Programs - Mike Bravo; MS Thesis, SDM; Supervisor: Dr. Kirk Bozdogan (Completed: Jan 99)

☑ Technology supply chain management* -- Research completed; main results published

Three-Dimensional Concurrent Engineering: Product, Process and Supply Chain Development - Prof. Charles Fine & Prof. Morris Cohen (Wharton School), main results published in Charles Fine, **CLOCKSPEED** (Reading, MA: Perseus Books, 1998)

✧ Joint with Policy and External Environment

* Joint with Product Development

Phase II Research Products (4)

Supply chain coordination strategies and mechanisms

Direct and Indirect Bargaining Costs and the Scope of the Firm - Prof. Duncan Simester (MIT Sloan School) & Prof. Marc Knez (Univ. of Chicago); Completed Aug 99.