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The Lean Enterprise Model

The Lean Enterprise Model (LEM) is a systematic framework for organizing and disseminating MIT research and external data source results of the Lean Aerospace Initiative (LAI). It encompasses lean enterprise principles and practices and is populated by MIT and external data derived from surveys, case studies and other research activities. The LEM is available to all LAI consortium members as a reference to help them understand better the leanness of their own organizations and processes. It is intended to provide insights as to where they might direct lean efforts in the future.

PRINCIPLES

Meta-Principles

Effective Relationships within the Value Stream Continuous Improvement Optimal First Delivered Unit Quality

ENTERPRISE LEVEL METRICS

- QUALITY YIELD Scrap and Rework Rate Design Changes / Initial Release / Project Phase

The LEM: An On-Line Tool

The LEM is presently available on-line for all LAI members and their authorized suppliers. For more information about on-line access, please visit http://web.mit.edu/lean or contact your organization's LAI Champion for more details.*

*A complete member listing with the correlating "Network of Champions" is also available on-line at http://web.mit.edu/lean - please refer to "LAI Communities."



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1 IDENTIFY AND OPTIMIZE **ENTERPRISE FLOW**

"Optimize the flow of products and services." either affecting or within the process, from concept design through point of use."

- Flow Efficiency = <u>actual work time</u>
- * Throughput
- ▲ Order to point of use delivery cycle time Total PD cycle time, concept to launch

ENABLING PRACTICES

Minimize space

distance traveled

by personnel and

(1.2.3.5.6.7.12)

production and

the value chain

delivery throughout

Maintain equipment

Synchronize

(1,2,6,9,12)

to minimize

utilized and

- Establish models and/or simulations to permit understanding and evaluation of the flow process (1,2,4,5,9,11)
- · Reduce the number of flow paths
- (1,4,5,9) Minimize inventory through all tiers of the value chain
- (1,2,4,9,11,12) • Reduce setup times
- Implement process owner inspection throughout the
- (1,2,3,4,6,9,11) Strive for single piece flow (1,2,9,12)

ASSURE **SEAMLESS** INFORMATION FLOW

"Provide processes for seamless and timely transfer of and access to pertinent information "

METRICS

- * Commonality of
- Information retrieval * Information sharing

between customers & suppliers

- flows visible to all stakeholders (1,2,4,5,9,11)Establish open and
- communications, among all stakeholders (1,2,4,5,6,7,8,9,12)
- unplanned Link databases for kev functions throughout the value chain (1,2,4,5,9,12)
 - Minimize documentation while ensuring necessary data traceability and (1,2,4,5,9,11)

OPTIMIZE **CAPABILITY AND** UTILIZATION OF PEOPLE

METRICS

* Output / employee

ENABLING PRACTICES

"Assure properly trained people are available when needed "

- * Training hours / employee

Establish career and

- skill development programs for each **ENABLING PRACTICES** employee (3,6,10) Make processes and Ensure maintenance,
 - certification and upgrading of critical skills (2,3,4,10,11)
 - Analyze workforce capabilities and needs to provide for balance of breadth and depth of skills/knowledge (1,3,5,8,10,11)
 - Broaden jobs to facilitate the development of a flexible workforce (1,3,4,5,10,12)

MAKE **DECISIONS** AT LOWEST **POSSIBLE LEVEL**

"Design the organizational structure and management systems to accelerate and enhance decision making a the point of knowledge application, and need.

METRICS

***** # of organizational

ENABLING PRACTICES

- Establish multidisciplinary teams organized around processes and products (1,4,5,9,12)
- Delegate or share
- Empower people to make decisions at the point of work
- Minimize hand-offs

- responsibility for decisions throughout the value chain (2,4,5,6,8,12)
- (2,3,4,5,6,8)
- and approvals within and between line and support activities (1,2,3,4,5,6,9)
- Provide environment and well-defined processes for expedited decision making (2,4,5,11)

5 IMPLEMENT INTEGRATED **PRODUCT AND PROCESS** DEVELOPMENT

"Create products through an integrated team effort of people and organizations which are knowledgeable of and responsible for all phases of the product's life cycle from concept definition through development, production, deployment, operations and support, and final

METRICS

- # of engineering changes (change traffic) after initial design release
- ▲ IPT continuity through development
- Total product development cycle time from concept to launch

for potential growth

stakeholders early

in the requirements

definition, design

and development

• Use the "Software

Factory" Process

Implement design

to cost processes

Maintain continuity

process (5.6.7.12)

of planning

product

throughout the

development

(2,4,5,6,7,12)

& adaptability

IPTs (4.5.6)

Involve all

process

(1,5,11)

▲ Supplier involvement in IPTs

ENABLING PRACTICES

- Use systems · Design in capability engineering approach in product design and development Establish effective (2,5,11,12)
- Establish clear sets of requirements and allocate these to affected elements of the product and (1,2,5,6,7,12)
- Definitize risk management • Incorporate design
- for manufacturing, test, maintenance and disposal in all engineering phases (1.2.4.5.7.9.11)

BASED ON MUTUAL TRUST AND COMMITMENT

relationships within the extended enterprise, encompassing both customers and suppliers.

METRICS

- total # of direct suppliers
- # of projects w/customers on IPTs
- * \(\bigwedge \) % of procurement dollars purchased under long-term supplier
- # of years of relationship with
- ▲ Existence of formal communications

ENABLING PRACTICES

- cooperative relationships internally and externally
- Establish labormanagement partnerships (3,6,8)
- Strive for continued employment or employability of the workforce (3,6,9,10)
- Provide for mutual sharing of benefits from implementation of lean practices
- Establish common objectives among all stakeholders (6,7,9,10,12)

7 CONTINUOUSLY **FOCUS ON**

respond to the needs of the internal and external customers."

METRICS

- ▲ Customer access to supplier information
- ▲ % of projects w/ customers on IPTs
- source to point of use

▲ On time delivery from

ENABLING PRACTICES

Provide for continuous information flow and feedback with stakeholders

(2,4,5,7,9,11,12)

 Optimize the contract process to be flexible to learning and changing (6,7,9,10,11,12)

· Create and maintain

relationships with customers in requirements generation, product design, developmen and solution-based problem solving (5,6,7,9)

8 PROMOTE LEAN LEADERSHIP AT ALL LEVELS

"Align and involve all stakeholders to achieve the enterprise's lean vision.'

METRICS

▲ Lean metrics at all

ENABLING PRACTICES

- organizational levels (1.2.3.4.5.6.7.8.9.10.
- Instill individual ownership throughout the workforce in all products and services that are
- with lean principles
- Involve union leadership in promoting and practices

9 MAINTAIN CHALLENGE OF **EXISTING PROCESSES**

quantitative measurement and analysis to continuously improve processes.'

- 11.12)
- provided
- of enterprise strategy and practices (4,6,8,12)

10 NURTURE A

and growth of both organizations' and individuals support of attaining lean enterprise goals."

training programs

ENABLING PRACTICES

communicate and

(2.3.4.9.10)

benchmarking

interchange of

knowledge from and

network (1,6,9,10,11)

within the supplier

Perform

(9,10,11)

Provide for

apply experience-

generated learning

Capture,

METRICS

- Use of "lessons learned" system * Scrap, rework & repair ▲ Provision of supplied as % of cost
 - Software productivity

ENSURE

CAPABILITY AND

MATURATION

"Establish and maintain

processes capable of

consistently designing and

producing the key

characteristics of the produc

PROCESS

- # # of suppliers certified Engineering changes (change traffic)
- Lean practices

ENABLING PRACTICES

- Define and control processes throughout the value chain (1,2,3,4,5,9,11
- Establish cost beneficial variability reduction practices in all phases of product life cycle
- Establish make/buy as a strategic decision (11,12)

12 MAXIMIZE STABILITY IN A CHANGING **ENVIRONMENT**

"Establish strategies to maintain program stability in a changing customer driven environment."

- METRICS ▲ Schedule changes # of baseline changes /
- * Procurement quantity changes
- Program administration continuity

ENABLING PRACTICES

- enable continuous flow (1,6,9,12)
- Use multi-year contracting wherever possible (4,6,12)
- to externally imposed changes (1,9,12) • Structure programs
 - Establish incremental product performance objectives where possible (5,9,12)
 - developments off critical paths and/or provide alternatives (1,5,12)

The Lean Enterprise Model • Summary Chart with Enabling Practices • Reprinted April 2004 © Massachusetts Institute of Technology

Responsiveness to Change • Waste Minimization

Enterprise Principles

Right Thing at Right Place, Right Time, and in the Right Quantity

- FLOW TIME Order to Delivery Time in Months Product Development Cycle Time (Industry Comparative, % Reduction)
- ▲ STAKEHOLDER SATISFACTION On Time Deliveries Continuous Cost / Price Improvement
- * RESOURCE UTILIZATION Output / Employee Inventory Turns

DEVELOP **RELATIONSHIPS**

"Establish stable and on-going cooperative

- # of strategic alliances

- Build stable and
- (2,5,4,6,7,12)

THE CUSTOMER

"Proactively understand and

Flow-down lean

- principles, practices and metrics to all

 - (1,3,4,5,6,7,8,9,10,11) Assure consistency
 - implementing lean (1,3,4,5,6,8,9,10,11)

"Ensure a culture and systems that use

METRICS # # of repeat problems

▲ Customer assistance to suppliers

phases of the

practices (1,6,9,11)

- **ENABLING PRACTICES** Establish structured Set jointly processes for established targets generating, for continuous improvement at all evaluating and implementing levels and in all
- product life cycle (1,2,3,4,5,9,11) (1,4,6,7,8,9,11) Fix problems Incentivize initiatives for systematically using data and root beneficial, cause analysis innovative
- Utilize cost accounting management systems to establish the discrete cost of individual parts and activities (1,2,9)

(3,9,11)

improvements at a

LEARNING ENVIRONMENT "Provide for the developmen

★ ▲ Training hours /

- or service." METRICS
 - ▲ # of program

 - Level demand to
 - Minimize cycle-time to limit susceptibility
 - to absorb changes with minimal impac (5,11,12)
 - Program high risk