Lean Effectiveness Model for Products and Services:
Servicing Existing Systems in Aerospace and Technology

By

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Submitted to the Systems Design and Management Program
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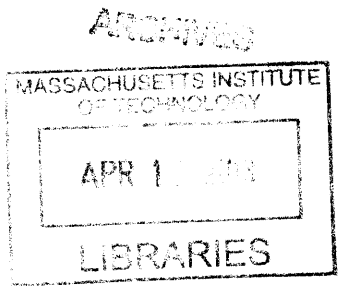

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By Tina Prabha Srivastava

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Abstract:

Enterprises undergo transformation for more efficient and effective performance and growth. The Lean Enterprise Self Assessment Tool (LESAT) is a product of the Lean Advancement Initiative (LAI) and the Massachusetts Institute of Technology (MIT). This tool is used by many enterprises to assess strengths, areas of improvement, and the enterprise's readiness to change. LESAT has been designed for enterprises that offer products only, not services. However, many of the principles and methodologies apply to servicing existing systems, which is a growing industry trend both in the private and public sector. Servicing existing systems accounts for 70% of the United States Department of Defense weapon system's total life-cycle cost. Many enterprises offer services to support, maintain, and upgrade their products. Many enterprises also rely on core internal systems that must be maintained and upgraded such as airline reservation systems or supply chain logistics tools. An extension of LESAT for Servicing Existing Systems is proposed as an assessment tool toward lean effectiveness for products and services. Collaborations with the International Council on Systems Engineering (INCOSE) In-Service Systems Working Group; three aerospace and technology enterprises Boeing, Pratt & Whitney, and Raytheon; as well as review of the literature are used in capturing best practices for success in servicing existing systems.

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1 Introduction

Motivation

The shift from products to services is being seen across industries and nations. Not only are enterprises adding services to their product suites, but there has also been an emergence of new business models to sell products as services, e.g. Software as a Service (SaaS). Many new services are offered on existing product systems. A large number of the systems we interact with everyday were not newly deployed, but may offer new services on an existing system. For example, Gmail, smart phone operating systems, and apps are constantly evolving as updates are rolled out. This trend is not exclusive to software. Due to the economic climate since 2007, there has been a shift in focus to life-extension of expensive physical systems. During this time, the U.S. Defense budget reduced the number of new procurement contracts granted and increased the number of sustainment contracts. These include performance-based-logistics (PBL) contracts that reward corporations for products that require lower maintenance costs. Many systems in operation today, from aircraft engines to public transit systems are being used well beyond their initial design lifetime. A colleague of mine in the International Council on Systems Engineering (INCOSE) In-Service Systems Working Group polled systems engineers at a conference and found that over 50% worked on existing systems rather than new systems. Repairing, upgrading, or servicing existing systems pose unique challenges compared to developing new systems. Some of these challenges include lack of documentation of system configuration, obsolescence of parts, compatibility with legacy technology, and lack of knowledge transfer between the workforce who designed the system and the workforce repairing it. As a systems engineer at Raytheon, I have come to understand the importance of servicing existing systems from the perspective of industry competition as well as meeting customer and end user needs.

Despite the industry shift from products to services on existing products, many systems engineering tools focus on new product development rather than the development of services for existing systems.

One of the core products of my MIT research group, the Lean Advancement Initiative (LAI) is the LAI Enterprise Self Assessment Tool (LESAT). This tool serves as a starting point in enterprise transformation to identify the current state of an enterprise, desired future state, and readiness to change. Part of the tool characterizes a mature enterprise. However, certain aspects of LESAT are described in terms of an enterprise that develops new products rather than services existing products. The motivation for my

research is to propose a new version of LESAT for Servicing Existing Systems (SES) that expands the scope of maturity questions and captures best practices from mission support leaders.

The proposed LESAT revisions described in this research were developed in collaboration with Raytheon, Pratt and Whitney, Boeing, and the INCOSE In-Service Systems Working Group. In 2012, Raytheon and Boeing were two of the largest contractors in the world. In 2012, Pratt and Whitney, a subsidiary of United Technologies Corporation (UTC), was recognized as a mission support leader by Raytheon and others in the aerospace industry. INCOSE is a non-profit organization whose mission is to share, promote and advance the best of systems engineering from across the globe for the benefit of humanity and the planet. INCOSE membership includes industry, academic, and government experts.

Overview

Section 2 makes the case for LESAT for Products and Services. Section 3 lays out a roadmap for development of a LESAT SES. Sections 4, 5, and 6 describe aspects of servicing existing systems and associated recommendations for LESAT SES. These aspects include terminology, the revenue model for servicing existing systems, and the life cycle. Section 7 provides details on the Raytheon case study of an enterprise transforming in realization of the growing services market area. Section 8 summarizes the changes from LESAT 2.0 to LESAT SES. Section 9 is the conclusion, and Section 10 discusses future areas of research.

2 The Case for LESAT for Products and Services

Background on the Service Economy

For decades companies have been selling services along with products. Even the Ford Model T came with a service warranty in 1914 (Ford, 2006). Many companies that traditionally have sold only products are transitioning to sell products and services. There is an increasing body of research in product-service systems and servitization. "Servitization" was first used by Sandra Vandermerwe and Juan Rada in 1988:

> *More and more corporations throughout the world are adding value to their core corporate offerings through services...Part of the surge in services is a more holistic approach by managers to their businesses and their customers' problems...We call this movement the "servitization" of business.* (Vandermerwe and Rada, 1988).

The authors also assert that this is not a local phenomenon, "'Servitization' is happening in almost all industries on a global scale." In 1988, companies were struggling with how to incorporate servitization into the enterprise strategy:

> *"Servitization" poses its own special challenges for top management. Mainly how to blend services into the overall strategies of the company. Up to now, services have not been sufficiently integrated into corporate competitive analysis and strategy design. It has been seen as part of the marketing effort and often an unpaid and expensive activity.*
> (Vandermerwe and Rada, 1988).

This concern is still seen in 2009. In the International Journal of Operations & Production Management in 2009, Tim Baines defines product-centric servitization as "the phenomena where a portfolio of services is directly coupled to a product offering" (Baines, 2009). This is a rapidly growing field, and "to succeed with servitization, a manufacturer will require new guiding principles, structures and processes for their production and support operations....This topic has yet to receive the detailed attention of researchers. Indeed, even contemporary management text books give insufficient treatment to the detailed integration of manufacture and services" (Baines, 2009).

Why do enterprises shift their offering from just products to both products and services? A common theme is to become more customer-focused. It can be argued that products and services enterprises are more customer-focused than products enterprises. A service resolves a customer need. A products enterprise inherently has an additional step: providing a product such that customers can use it to resolve their needs. The burden is placed on the customer to ultimately resolve their own needs. A second theme involves margins. Selling products may involve a capital-intensive business model. The value the customer places on products is closely tied to the cost of goods sold, resulting in the commoditization of products. However, with a service, there is no concrete anchor upon which to base the value. The value the customer places on services is directly related to the need that the service resolves. These two themes are illustrated in the following two examples, Charles River Laboratories and IBM.

Charles River Laboratories

One enterprise that has made the transition from a products enterprise to a products and services enterprise is Charles River Laboratories (CRL). Founded in Boston in 1947 by Hank Foster, CRL started as a small breeder of rats and mice for medical research (Kelly, 2004). The rats and mice were CRL's products. As with many products enterprises, the products became commoditized and had very low

margins. "The firm's ability to charge for these general-purpose mice, however, was limited; until the 1990s, the price was less than $20 per healthy mouse" (Meyer, 2007, p. 200). The low margins and a thirst for growth served as the trigger for change.

The first step in CRL's transformation was to become more customer-focused. In 2004, the CEO James Foster, son of Hank Foster, commented on CRL's approach: "In order to transform the company to the next level, we changed the value proposition" (Kelly, 2004). CRL investigated what their customers did with the research mice after purchasing them. Mice were analyzed for specific traits and characteristics because tests performed on mice with the same traits and characteristics tended to yield repeatable outcomes. CRL jumped on this opportunity and acquired "inbreds" from the National Institutes of Health and offered this product to its customers for a premium. Continuing on this path, CRL identified mutant mice in its inventory that might exhibit characteristics valuable to researchers, and sold them as "transgenics".

> *Transgenic models command premium prices: Spontaneously obese and diabetic rats go for $200 per animal compared to a standard animal model sold for $15. In the billion dollar pharmaceutical industry, Charles River adds value by easing the drug testing process.* (Kelly, 2004)

CRL repositioned itself from a products enterprise that sold research mice to an enterprise that helped accelerate time to market of drugs for its pharmaceutical customers. Leveraging the existing knowledge and infrastructure of CRL to care for research animals, CRL offered an animal care service to its customers. "Recognizing cash strapped biotech firms' demand for animal care, Charles River established 'animal hotels' to house and maintain research animals" (Kelly, 2004).

Figure 1: CRL's logo and tag line evolved to reflect the company's strategy and value proposition.

CRL did not stop there. "CRL's shift from products to services accelerated during the mid-1990's. Instead of delivering rats and mice, it was delivering the results of experiments and studies" (Meyer, 2007, p. 201). Foster, named CEO of the year by Fortune magazine, said, "'We do everything from simply breeding the animals to feeding, ageing, or dosing them with drugs. We also perform sophisticated laboratory tests...These services were all once performed by drug companies internally'" (Kelly, 2004).

In order to provide such services, CRL had to reevaluate their in-house knowledge and expertise as well as their organizational structure. From the knowledge perspective, CRL recognized the need for more scientists with advanced degrees. CRL recruited "veterinarians with postdoctoral training and laboratory science certification, molecular biologists, microbiologists, and medical doctors" (Meyer, 2007, p. 201). CRL also acquired companies in drug development and clinical services, which brought in knowledge, but also transformed the organization into a global network.

From an organizational and strategy perspective, CRL's ownership underwent significant changes. CRL went public on Nasdaq in 1968. Twenty years later, CRL was sold to Bausch & Lomb. But, the new strategy shift to services was not supported by Bausch & Lomb, and the parent company resisted offers from Foster to buy back CRL. Finally, in 1999, Foster led a $440M leveraged buyout of CRL. To pay down the debt, CRL went public on the New York Stock Exchange in 2000. This enabled CRL to continue the transformation to a products and services enterprise. By 2006, services dominated CRL's offerings, with the old business of rat and mouse products representing only a quarter of CRL's 2006 revenues.

IBM

IBM had a much more dire impetus for change than Charles River Laboratories. As shown in Figure 2: IBM Stock Price, in the period from 1987 to 1993, IBM's stock price dropped by over 70% ("IBM", Yahoo! Finance). Many attributed the "dark days" of IBM to the rise of the client-server that threatened mainframe technology. However, looking at the surrounding ecosystem, the mainframe market was still growing at this time; IBM was losing market share to lower cost alternatives (Meyer, 2007, p.13). IBM long time held the role of defining the computer industry and setting the standard for technology innovation and performance. Blinded by its status, IBM was slow to recognize that its ecosystem was changing as other companies entered the computer market and offered customers new, lower cost solutions. Following the 1987 stock market crash, lower cost was a key customer need. In the role of setting the industry standard, taking time to understand customer needs was, perhaps, considered unimportant compared to pursuing the next technological advance. What caused IBM to lose market share was arguably that it had lost touch with its customers.

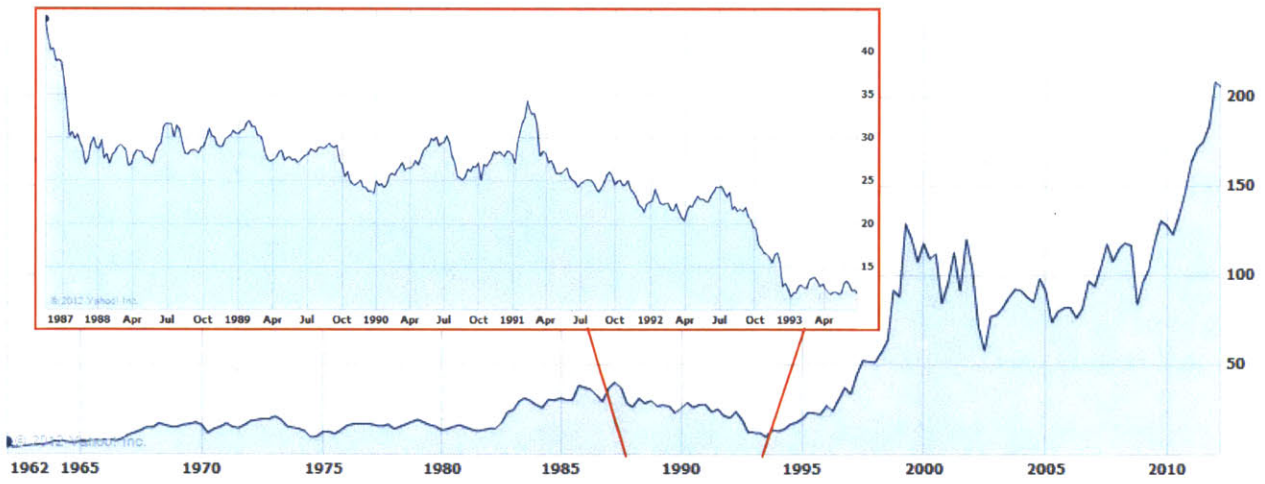

Figure 2: IBM Stock Price

IBM's customers were CIO's of large companies. As signaled by the launch of Amazon.com in 1995, the nature of these CIO's was changing. "There was a new breed of CIO…Web-focused, e-business aware, this new CIO didn't demonstrate the vendor loyalty that characterized his or her predecessor" (Meyer, 2007, p. 17). The knowledge of how to sell to the old type of CIO and the processes to make these sales did not apply to the changing customer base. It is important to understand the dynamic nature of stakeholders by asking "Who are your stakeholders and how do they change?" (Nightingale, 2012).

In recognition of IBM's situation, the board hired a new CEO in 1993, Louis Gerstner. This move was a deviation from IBM's traditional promotion processes to harness a new set of knowledge not contained within IBM. This is summed up by a 1993 news article announcing Gerstner's appointment: "The appointment marks the first time in IBM Corp.'s 79-year history that someone from outside IBM and the computer industry will lead the world's biggest computer company" (Fatsis, 1993).

Gerstner took several steps to reshape IBM from a product-focus enterprise to a customer-focused enterprise. This started with market segmentation. IBM's market segmentation had been product-focused in that technology performance and categories overflowed into how IBM sold its products.

	S/390	Unix	Cost
250 > MIPS			
30-250 MIPS			
0-30 MIPS			

Figure 3: IBM's "As-Is" Market Segmentation (Adapted from Meyer)

This ties back to the theme that offering services allows an enterprise to be more customer-focused. Products enterprises rely on the customer to resolve their own needs by means of the products.

> *A single customer might possibly use all of the products...This segmentation approach also encouraged product development silos, with one IBM division making large systems, another making mid-sized systems, another making small systems, and each making or licensing their own particular software. Integration between these different systems occurred largely at the customer site.* (Meyer, 2007, p. 19)

The siloed organization resulted in siloed products and a lack of information sharing about which customers were using which products. IBM's "To Be" market segmentation is customer-focused. This allows IBM to zero in on specific customer needs and understand the pain points their customers' experience. Similar to the case of CRL, understanding customer needs helped IBM to determine how it could provide services that resolved customer needs, and reap higher margins than with its products. Furthermore, IBM no longer relied on customers to integrate its products at their site, and now even provides services to integrate IBM products with other non-IBM products used by customers.

	Financial	Distribution	Cost	Mft	Telecom	Life Sciences
Fortune 1000						
Medium						
Small						

Figure 4: IBM's "To Be" Market Segmentation by customer size and industry (Adapted from Meyer)

IBM continued on the path of transforming from a products enterprise to a products and services enterprise when it sold is Personal Computer (PC) business to Lenovo in the mid-2000's. Margins played a role in this decision: "the deal will let IBM continue its shift from selling so-called commodity products to selling services, software and high-end computers. Although the company helped make PCs a global phenomenon, IBM makes little profit from PCs and often loses money" (Kanellos, 2004). IBM's sale of its PC business was also made in recognition of its global ecosystem, namely the fast-growing Chinese market. IBM's CFO, Mark Loughridge cited this as a reason for the sale to Chinese-based Lenovo: "'It will also allow the company to sell more services in China'" (Kanellos, 2004).

Returning to Figure 2: IBM Stock Price, IBM's stock price has skyrocketed since the sale of its PC business and its new focus on products and services.

As illustrated by the examples of Charles River Laboratories and IBM, the shift from products to products and services enables higher margins and closer customer relationships. This is summed up well in a New York Times article regarding recent changes in Xerox's strategy: "Services businesses also foster closer relations with corporate customers and often yield higher profit margins" (Xerox, 2009). This trend is being seen across technology sectors: "The game is indeed changing for big technology suppliers catering to corporate customers as they shift to depend less on products and more on services" (Fatsis, 1993).

The shift in enterprise strategy towards services must be reflected in systems engineering tools to stay current and inform enterprises of best practices. Therefore a new version of LESAT that addresses both products and services is necessary. Even the LESAT 2.0 Facilitators Guide calls for a service-oriented version: "The new version of LESAT focuses on manufacturing and product-oriented enterprises. LAI hopes to develop an additional variant for service-oriented enterprises in the future" (Lean Advancement Initiative. LESAT 2.0 Facilitator's Guide. 2012).

3 Roadmap for Development of LESAT for Products and Services

Core LESAT as a Foundation

The LAI Self-Assessment tool is an initial diagnostic an enterprise can use to determine its current state of "leanness," the future state desired by its leadership, and the enterprise' readiness to change. The first version, LESAT 1.0 was developed by MIT LAI in joint collaboration with industry, government, and the United Kingdom Lean Aerospace Initiative. LESAT 1.0 focused on the lean capabilities of an enterprise and offered prescriptive lean principles and specific techniques.

After over ten years of enterprise assessments and transformations, the tool was revised to reflect knowledge learned from research and experience. LESAT 2.0 focuses on the capabilities of an enterprise to transform into a high performing enterprise and sustain the transformation. This version moved away from a prescriptive tone toward descriptive general enterprise principles for effective processes for value delivery. LESAT 2.0 was released in early 2012.

Structure of the LESAT

LESAT is comprised of three sections: Enterprise Transformation/Leadership, Life Cycle Processes, and Enabling Infrastructure Processes. This is shown in Figure 5: Structure of LESAT 1.0 ("LESAT 1.0 Overview," 2001).

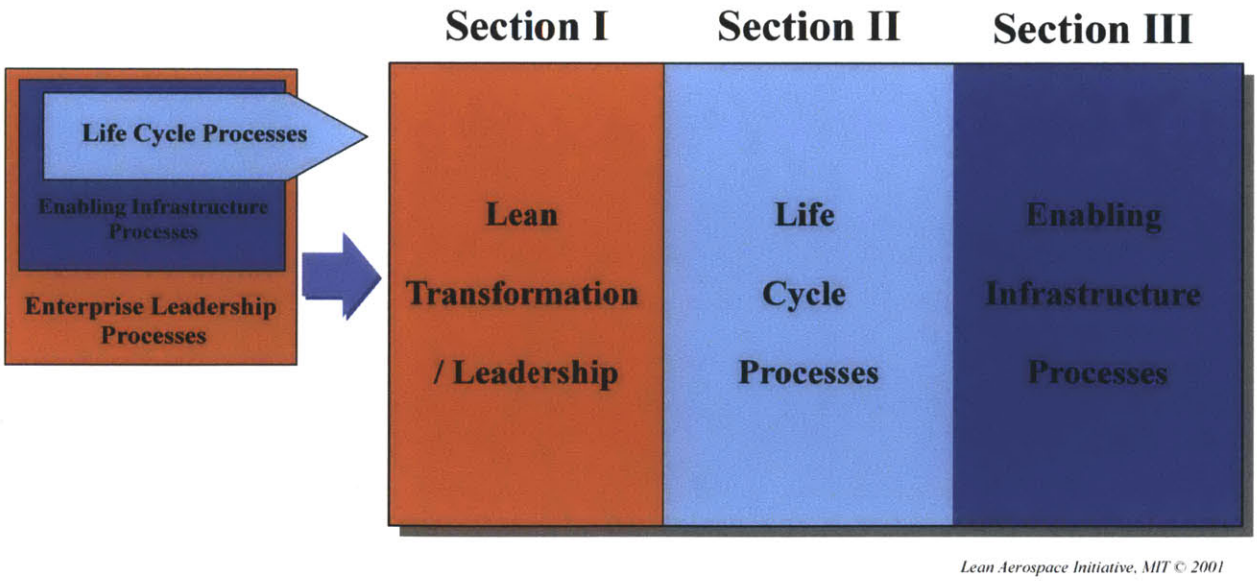

Figure 5: Structure of LESAT 1.0 ("LESAT 1.0 Overview," 2001)

Within each section, practices or competencies are rated on a scale of 1 to 5, similar to the Capability Maturity Model Integration (CMMI) process improvement approach ("CMMI", 2012). There is a practice maturity definition for each maturity level in each practice. The enterprise is given a score both for the current state and the desired future state. Note that the desired future state is not always a 5. "The desired state is based on a current transformation timeline and is designed to represent a realistic, achievable level of performance for the transformation timeframe" (LESAT 2.0 Guide, 2012, p. 18). The desired state can help to determine the executives' priorities on what needs to be transformed first. A description of each level 1 to 5 is shown in Figure 6: LESAT Process Capability Maturity Levels ("LESAT 1.0 Overview," 2001). Note that the maturity levels are not meant to be used as a scorecard or means of comparing enterprises. This qualitative, subjective assessment is used as a tool for executives and optionally facilitators to analyze an enterprise and plan for transformation.

Figure 6: LESAT Process Capability Maturity Levels ("LESAT 1.0 Overview," 2001)

For illustration, an excerpt of LESAT 2.0, the first practice under Section I: Enterprise Transformation/Leadership, is shown below. Please note that a definition of each section is provided below the section title, in addition to a glossary provided at the end of the tool. Each practice falls within a sub-section, "Determine Strategic Imperative" in this case. The Diagnostic Questions are used to guide

executives in rating the current and desired future state of the enterprise. The executive should circle the "C" in the capability level that reflects the current state and the "D" in the capability level that reflects the desired future state.

The descriptions of the capability levels 4 and 5, and the Indicators (Examples) provide best practices of mature and capable enterprises. The blank space after Evidence and Opportunities are intended for executives to note their thought processes for making the "C" and "D" capability level ratings.

SECTION I: ENTERPRISE TRANSFORMATION/LEADERSHIP

Definition: Develop, deploy, and manage enterprise transformation plans throughout the organization, leading to: (1) long-term sustainability, (2) acquiring competitive advantage, and (3) satisfaction of stakeholders along with a continuous improvement in all three outcomes.

I.A. Determine Strategic Imperative - The decision to pursue an enterprise transformation is strategic in nature and affects all organizational practices and processes in the enterprise. The enterprise is continually striving to eliminate waste and enhance relationships with all stakeholders.

Diagnostic Questions	• **Are enterprise leaders familiar with the dramatic increases in competitiveness that many companies have realized as a result of transforming?**
	• **Are enterprise leaders fully aware of the potential opportunities (i.e., growth, profitability, and market penetration) that can be realized within their own organization as a result of transforming?**
	• **Has a suitable strategy been identified to use resources freed up by improvements?**
	• **Does "stakeholder value" strongly influence the strategic direction?**
	• **Has full leverage of the extended enterprise stakeholders been incorporated into the strategic plan?**
	• **Has a common vision been communicated throughout the enterprise and within the extended enterprise?**
	• **Has a compelling case been developed for transformation?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	*Level 2*	*Level 3*	*Level 4*	*Level 5*
I.A.1	**Integrate Enterprise Transformation into Strategic Planning Process** *Transformation is a key enabler for achieving strategic objectives*	Enterprise transformation efforts are ad hoc. C D	Enterprise transformation is relegated to lower levels of the enterprise and application is fragmented. C D	Enterprise transformation plans are formulated, but not integrated into the strategic plan. C D	Coordination and synergistic relationship exists between transformation and strategic planning. C D	Strategic plans leverage the results of transformation improvements to achieve enterprise objectives. C D
	Indicators (Examples)	• Enterprise transformation implementation is included explicitly in the enterprise strategic plan. • Strategic planning makes allowance for anticipated gains from transformation improvements.				
	Evidence					
	Opportunities					

Figure 7: Excerpt of LESAT 2.0 ("Lean Advancement Initiative")

Adaptation Approach

The adaptation of LESAT is proposed to occur over two phases. The first is for enterprises that provide products and services. This version will be called LESAT Servicing Existing Systems (SES). The second is for enterprises that provide only services; LESAT for Services is proposed for future research.

Many services that products and services enterprises employ are to service existing products. This is the case for a range of services including Gmail updates, aircraft engine repair, telecom infrastructure, building repair and expansion (plumbing, electric, etc.), medical equipment, construction equipment, defense technology, information technology (IT), and utilities. Repairing, upgrading, or servicing existing systems pose unique challenges compared to developing new systems. Some of these challenges include lack of documentation of system configuration, obsolescence of parts, compatibility with legacy technology, and lack of knowledge transfer between the workforce who designed the system and the workforce repairing it.

Enterprises that are not included in servicing existing systems include restaurant services, hotel services, educational services, insurance, and financial services. However, it should be noted that a large part of these enterprises involve servicing existing systems and can leverage LESAT SES. For example, Walmart and Amazon.com rely on IT systems for supply chain and customer interface that are critical for their competitive advantage. Another example is airlines. Although the service that airlines provide is not a service to an existing system, two critical parts of the airline business depends on servicing existing systems: aircraft maintenance and the airline reservation system. Therefore LESAT SES serves as a solid stepping stone toward LESAT for Services, and LESAT SES greatly expands the applicability and industries that the LESAT product supports. The applicability of LESAT 2.0, LESAT SES, and the proposed LESAT for Services is shown in Figure 8: LESAT Enterprise Applicability.

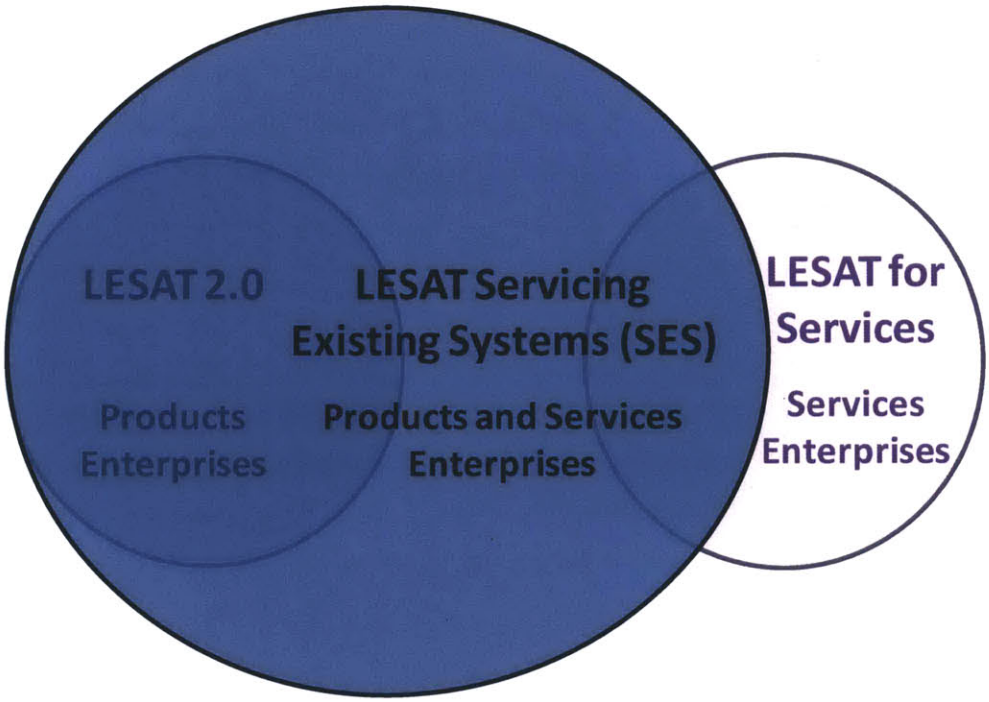

Figure 8: LESAT Enterprise Applicability

LESAT SES enables products and services enterprises to become more effective and efficient at servicing existing systems. In order to develop LESAT SES, research was conducted in collaboration with three enterprises that had formerly used LESAT 2.0 and offer both products and services: Boeing, Pratt & Whitney, and Raytheon. The Raytheon collaboration was particularly relevant as Raytheon was undergoing an enterprise transformation to better address a growing services market. In addition, research was conducted in collaboration with the International Council on Systems Engineering (INCOSE)

In-Service Systems Working Group (ISSWG) to reach a broader audience. Breadth of applicability as well as depth of analysis were both considered in the development of LESAT SES.

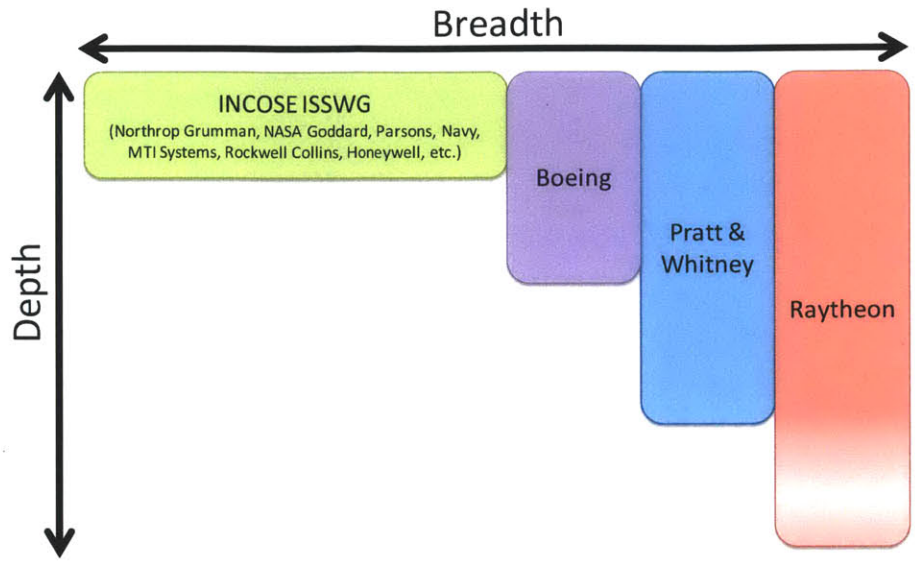

Figure 9: Research collaborations for LESAT SES

4 Terminology

One of the indicators of an emerging field is the lack of agreement on terminology. During interviews with stakeholders and meetings with research collaborators, a number of terms were used to represent servicing existing systems. These include:

- Depot
- MRO (Maintenance, Repair, and Overhaul)
- PBL (Performance-Based Logistics)
- *Not* new product development
- Sustainment
- Whole Life Engineering
- Services
- After-market
- Mission Support
- Upgrades
- Customer support
- In-Service Systems group
- Operations

The lack of agreement on terminology also results in confusion and misalignment within enterprises. The Raytheon depot transformation initiative, Raytheon Enterprise Mission Support/Depot Initiative, found communicating the size of the servicing existing systems business a challenge. Pratt & Whitney leadership, on the other hand, referred to servicing existing systems as "MRO" and was able to quantify

the size of the business: "Of Pratt & Whitney's $12.9B sales in 2010, over 50% were MRO (maintenance, repair, and overhaul) as opposed to OEM (original equipment manufacturing)." (Freiberg, 2011.) Despite being able to quantify the MRO business, Pratt & Whitney shared challenges with Raytheon regarding the terminology used. Pratt & Whitney and Raytheon leadership faced challenges with their employee's perceptions of MRO and depot terminology. The words "depot" and "maintenance" evoke unappealing images, and emerging leaders/high-potential engineers tend to opt for "design," which can connote more exciting and complex challenges.

However, historically, depot/maintenance/service was seen as an area where engineers were technically extremely well versed on the inner workings of a system and were resourceful and innovative in solving technical challenges. In fact, Henry Ford's beginnings were in servicing existing systems. In the late 1800's, Ford worked on servicing steam engines. Through this work he came to experiment with engines and conducted personal experiments on gasoline engines. This eventually led to the design of the Ford Model T and the creation of one of the largest automotive makers in the world. (Ford, 2006).

During 2012, Raytheon evaluated re-branding depot to a term with more appeal. This "perception architecting" exercise revealed that terms such as "integrated logistics" capture the essence of depot, emphasize the business impact and complexity of the field, and do not carry the negative connotations that "depot" does. Figure 11: Images associated with Integrated Logistics show the use of Google Image Search in May 2012 to determine the images that a term evokes.

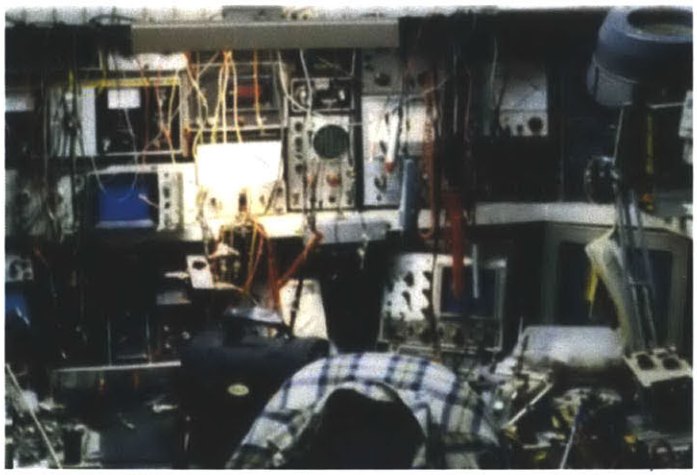

Figure 10: Image associated with Depot and Maintenance

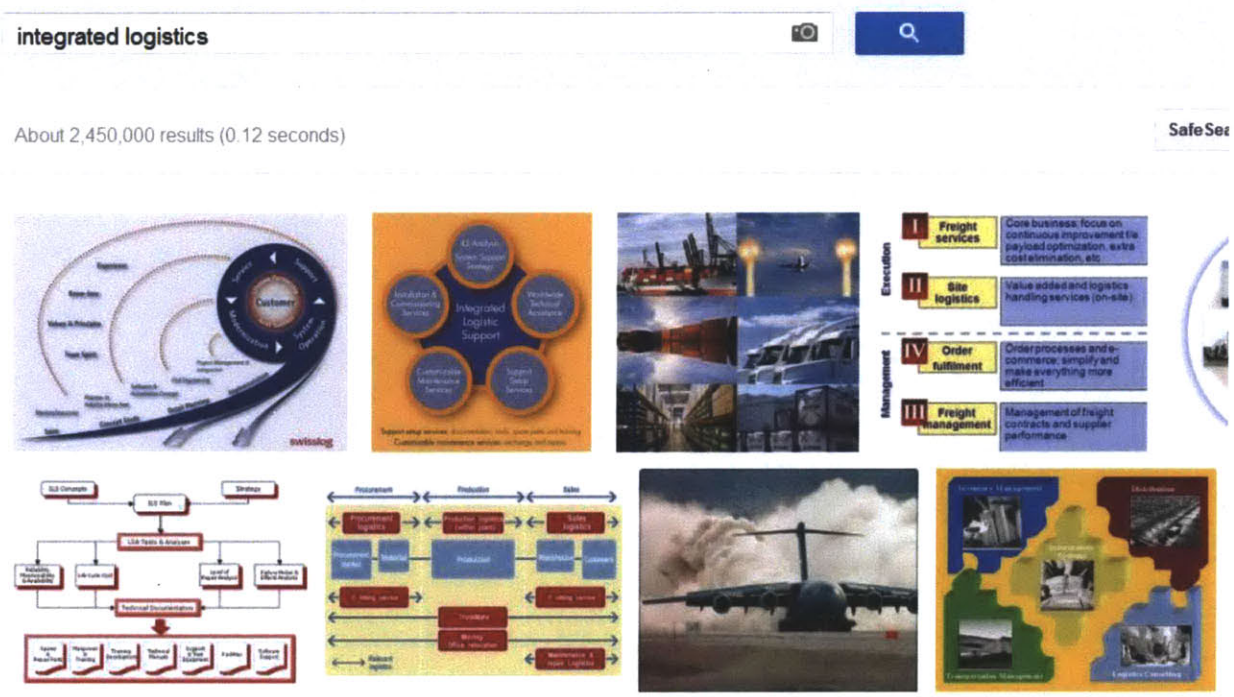

Figure 11: Images associated with Integrated Logistics

Recommendations for LESAT SES

The takeaways for LESAT SES from the terminology and employee perception discussions are summarized in the table below.

Table 1: Recommendations for LESAT SES resulting from Terminology Considerations

LESAT SES Section	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems
Enterprise Transformation/Leadership, Understand Current Enterprise State	• Is leadership able to define the organization and business impact of servicing existing systems? • Is there knowledge and best practices sharing across servicing existing systems organizations within the enterprise?
Enterprise Transformation/Leadership, Employee Perception	• Is there employee perception that the career path within servicing existing systems is as strong as within new product development? • Do leaders encourage high-potential engineers to work in servicing existing systems?

5 Revenue Model for Servicing Existing Systems

The revenue model for new product development can be quite different from servicing existing systems. "The growth of the service sector has brought about a paradigm shift from managing transactions to managing customer relationships" (Aflaki, 2011).

In the early 21st century, this paradigm shift is being seen in the aerospace and defense industry as well. In 2012, aircraft engine manufacturer and mission support leader Pratt & Whitney saw over 50% of its revenue from servicing existing systems. Services become a core part of the revenue of several engine manufacturers, and the emergence of services came with new branding and contract structures.

> *Engine manufacturers such as Rolls-Royce (R-R), General Electric and Pratt and Whitney, all offer some form of performance-based contracts with commercial airlines in which their compensation is tied to product availability and the capability it delivers (e.g. hours flown). R-R, in particular, have now registered trademarks for both "Power by the Hour" and the more inclusive "TotalCare" contracts. Such contracts provide the airline operator with fixed engine maintenance costs, over an extended period of time (e.g. ten years). In developing TotalCare, R-R is just one an example of a manufacturer that has adopted a product-centric servitization strategy (www.rolls-royce.com/service/civil).*
> (Baines, 2009)

In addition, some companies are changing their business model to capture revenue from servicing other companies' existing systems. Boeing is increasingly bidding on sustainment programs for other companies' products, such as Lockheed Martin. A study on the U.S. Department of Defense (DoD) Services Contract Spending cites the "DoD's efforts to encourage more competition" (Ben-Ari, 2012). In the past, service contracts were essentially automatically awarded to the system provider. However, increasing costs are driving the DoD to reevaluate this practice.

Due to the shrinking U.S. Defense budget, the number of new procurement contracts granted is reducing and the number of sustainment/services contracts are increasing. Services contracts in 2011 amounted to "nearly a third of the entire DoD budget" (Ben-Ari, 2012). "According to DoD officials, operating and support costs generally range from 60 to 80 percent of a weapon system's total costs, depending on the weapon system type... The Department of Defense (DoD) spends billions of dollars each year on operating and support costs for weapon systems, including for maintenance, engineering support, and personnel." (GAO-12-558, 2012).

In order to reduce services contract spending, the DoD is redefining the contract vehicles used. The popular cost plus contracts paid contractors for the number of repairs conducted. This resulted in misaligning the incentives of the DoD and contractors because the more unreliable a system and the more expensive the repair costs, the more revenue the contractors received. Both contractors and the DoD are pushing for an emerging contract type called performance-based-logistics (PBL) contracts. In these contracts, the DoD pays the contractor a fixed amount for services. If the contractor is able to service the system for less than the fixed amount, the remaining amount is taken as profit by the contractor. PBL contracts align the DoD and contractors towards reliable products that are designed with serviceability in mind to achieve low maintenance costs and short repair turnaround times.

PBL contracts required a cultural shift within the DoD and contractors. The revenue model for new product development is no longer similar to the revenue model for servicing existing systems. Contractors must reevaluate internal processes and how trade-offs between product development and services are made. Raytheon recognized servicing existing systems as a growing market area and formed an initiative for enterprise transformation. "The Raytheon Enterprise Mission Support/Depot Initiative has been formed in recognition that services is a growing market area, and that the processes and systems across Raytheon are not optimized to support this growing market area" (Garrett, 2012).

Recommendations for LESAT SES

The uniqueness of the servicing existing systems revenue model has implications for LESAT SES that are summarized in the table below.

Table 2: Recommendations for LESAT SES resulting from Revenue Model

LESAT SES Section	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems
Enabling Processes	• Are contracts for servicing existing systems afforded opportunities to deviate from the contract structure for new product systems?
Life Cycle Processes	• Are in-service groups part of the proposal and capture effort for the Operations and Maintenance of new product systems?

6 Life Cycle

System Life Cycle

It is important to understand where servicing existing systems falls within the system life cycle. The *INCOSE Systems Engineering Handbook* includes a generic life cycle from ISO 15288:2008 and the DoD system life cycle from DoD 5000.2, shown in Figure 12: System Life Cycle (*INCOSE Systems Engineering Handbook)*. A system becomes "existing" once it has been deployed, which includes the "Utilization Stage," "Support Stage," and "Retirement Stage" of the Generic Life Cycle and "Sustainment" in the DoD Life Cycle.

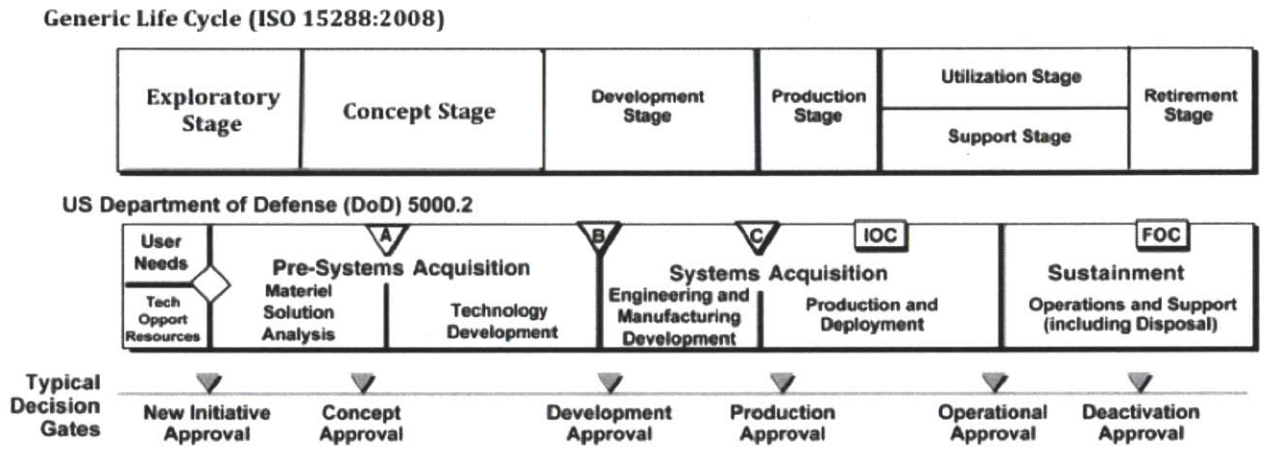

Figure 12: System Life Cycle (*INCOSE Systems Engineering Handbook)*

The proportion of the life cycle allocated to sustainment in Figure 12: System Life Cycle (*INCOSE Systems Engineering Handbook)* can be misleading in terms of the actual duration and engineering effort of sustainment as compared to the other stages (Hulse, 2012). As system lifetimes grow, many times beyond the designed lifetime, more and more engineers work in the Sustainment stage of the system life cycle. Many systems in operation in 2012, from aircraft engines to public transit systems are being used well beyond their initial design lifetime.

A 2007 U.S. Government Accountability Office (GAO) report discusses the increased lifetime of existing systems:

> *Recapitalizing and modernizing tactical air forces to meet the warfighter's needs within today's constrained budget environment is a formidable challenge. Our work in this area has shown that DoD has incurred substantial cost increases and delays in its acquisition of new*

> *systems. Further delays in delivering these aircraft, cost increases, and cuts in quantity could easily occur, meaning billions of dollars in additional investments could be needed to keep current (legacy) aircraft both capable and sustainable for longer periods of time than currently planned.* (GAO-07-415, 2007)

Several workshops were conducted in the first quarter of 2012 with the INCOSE In-Service Systems Working Group, Raytheon, Pratt & Whitney, and Boeing to better understand system lifetimes. During these workshops, systems engineers drew the system life cycle of their systems with associated durations. The system life cycle of three of these systems are shown in Figure 13: System Life Cycle with Durations. In these three aerospace examples, all of the stages in the System Life Cycle prior to Sustainment cumulatively represented less than 10% of the system's lifetime.

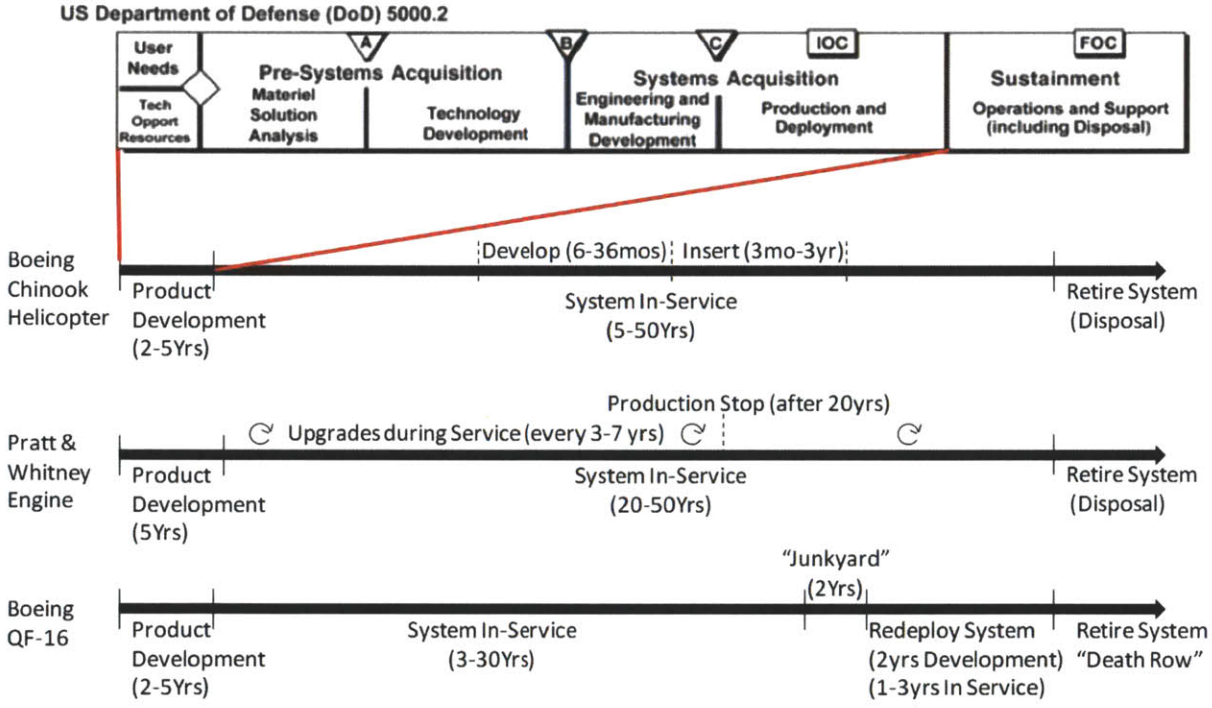

Figure 13: System Life Cycle with Durations

The first example is the Boeing Chinook, a twin-engine, heavy-lift helicopter. It was introduced in 1962 and was still in use in 2012, primarily by the US Army, Japan Ground Self-Defense Force, and the Royal Netherlands Air Force. The most significant upgrade was completed in 1982; the CH-47D included improvements to the engines, cockpit, electrical systems, and avionics.

The second example is generalized from a particular Pratt & Whitney engine to demonstrate the most common system life cycle. Substantial upgrades occur on engines every three to seven years for their up to fifty year lifetime.

The third example, the Boeing QF-16 is a particularly interesting case. United States Air Force (USAF) F-16's have been flying since 1976. Many of these aircraft were operated under different owners and maintained by multiple organizations. Some of the older aircraft sat idle in junkyards for an average of two years. In 2012, Boeing sought to redeploy these aircraft as target drones for the USAF QF-16 Air Superiority Target program. This example highlights an extreme in life extension, which comes with acute challenges in configuration management, lack of documentation, lack of knowledge transfer, and rebuilding supplier relationships.

It should be noted that during the System In-Services section of the timelines, in addition to continuous maintenance and repair, it is common to have substantial upgrades to "modernize" systems and extend their capabilities. These upgrade cycles are many times akin to an instantiation of the entire system life cycle with an exploratory stage, concept stage, development stage, production stage, and deployment stage. A Systems Engineering Staff Engineer at Honeywell described this observation: "What we have at Honeywell for an after-market life cycle follows fairly closely to a traditional problem solving cycle: problem definition, root cause analysis, solution option development, evaluation, and decision/agreement/authorization" (Lyells, 2012).

Processes for Continuous Maintenance and Repair

Since the processes for upgrades follows closely with new product development, research was conducted to determine what processes are common to continuous maintenance and repair that are not part of new product development. During working sessions with systems engineers at Pratt & Whitney and Raytheon, the depot/MRO processes were sketched out. It is important to note the difference in product variety between Pratt & Whitney and Raytheon, shown in Figure 14: Systems Represented by Collaborating Engineers. The majority of research collaborators at Pratt & Whitney serviced aircraft engines. However, the research collaborators at Raytheon ranged from servicing handheld soldier sensors to satellites to shipboard radars.

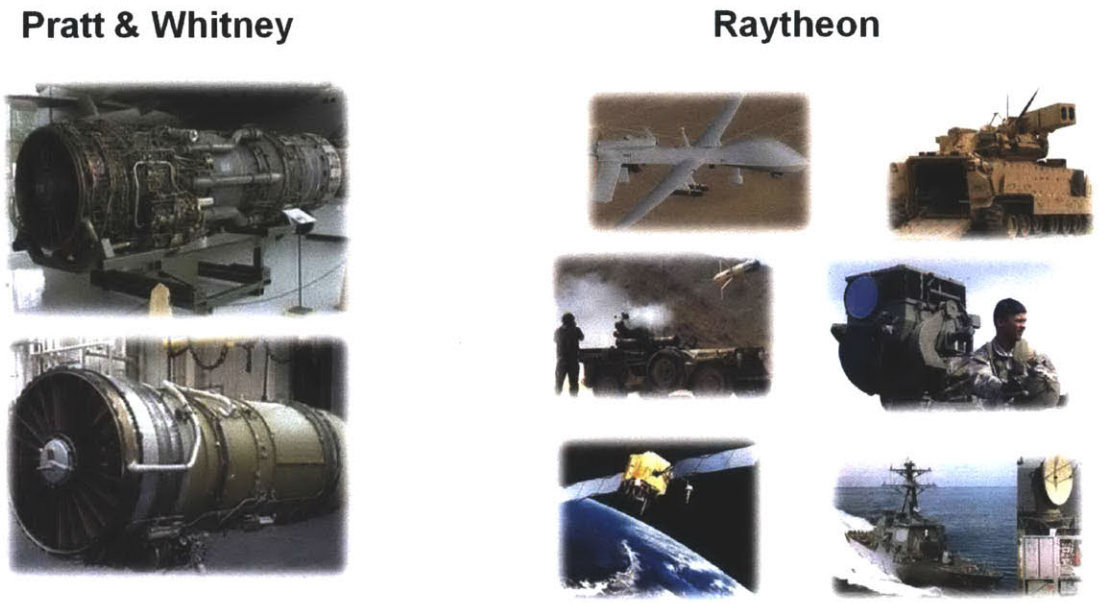

Figure 14: Systems Represented by Collaborating Engineers

Surprisingly, a common set of processes for servicing existing systems emerged, which are missing two important process steps that will be discussed later in this section. Despite the product breadth, the high-level depot processes are the same across Raytheon's depots and Pratt & Whitney's MRO organization. These processes are shown in Figure 15: Common Processes for Servicing Existing Systems.

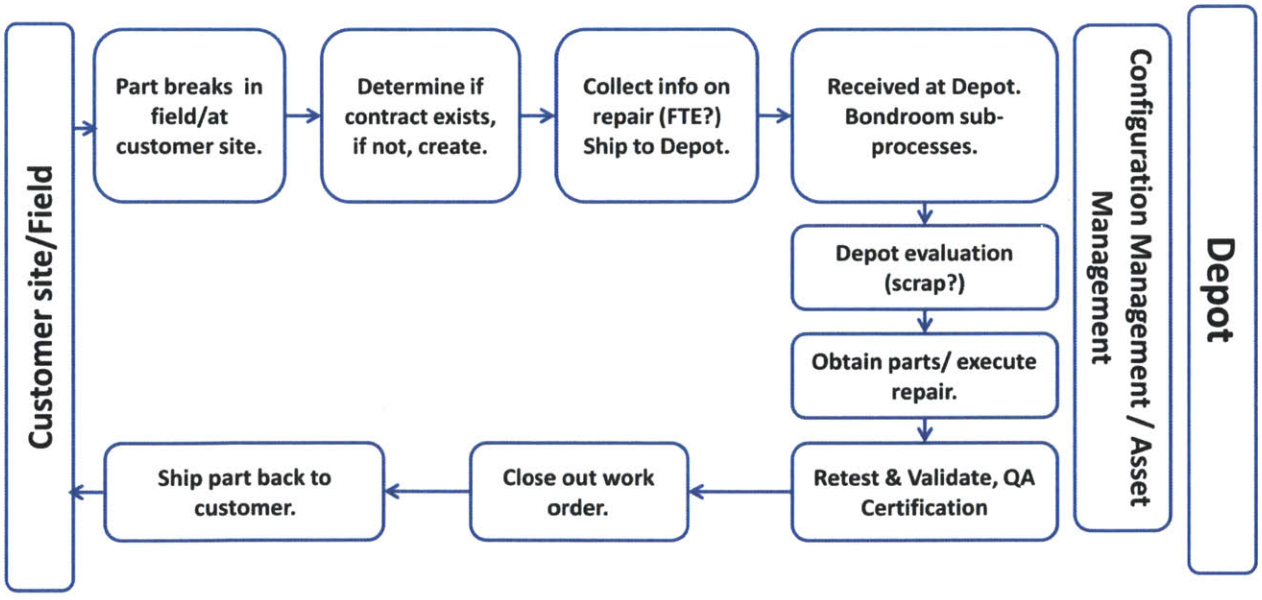

Figure 15: Common Processes for Servicing Existing Systems

Starting from the left, the first box represents the customer site where the system is deployed. This is also referred to as the field. This continuous process for maintenance and repair is initiated when the system goes out of service due to a part breaking in the field. The next step is determining whether the system has a maintenance contract in place, and if not, establishing a new one. Then, information regarding the failure is collected. In some cases Field Technical Engineers/Representatives (FTE) are at the customer site and can provide valuable information about the circumstances surrounding the failure and the specific failure that occurred. Often times this information allows the depot to ensure spares are on hand before the failed part arrives at the depot. Once the part arrives at the depot, a number of bondroom sub-processes take place involving registering the part. Also, during the entire time a part is at the depot, parallel processes of configuration management and asset management take place. After the bondroom, an evaluation takes place to determine if the part can be repaired and if the cost to repair exceeds the cost of replacement, in which case the part is scrapped. If the repair proceeds, spare parts are received and the repair is executed. Then testing is conducted to ensure the fix meets specifications, and if necessary, a quality assurance (QA) certification is conducted. Finally, the work order is closed out and the part is shipped back to the customer.

Literature supports the finding of commonality of depot processes. Building on the theme that service systems are an emerging field, in an IBM Systems Journal, Alter suggests that "the concept of a service system is not well articulated in the service literature" (Alter, 2008). Alter puts forth a unified view of service to a situation-specific problem. In Figure 16: Service Value Chain Framework, Alter describes processes very similar to Figure 15: Common Processes for Servicing Existing Systems. Once there is a need, a service request is made. Similar to determining if a contract exists, Alter indicates the need to negotiate commitment. The service delivery involves provider setup, which occurs in the bondroom of DoD contractors, and the service request is fulfilled. The unified framework proposed validates not only the depot process, but also that similarities should exist across depots and enterprises for service fulfillment.

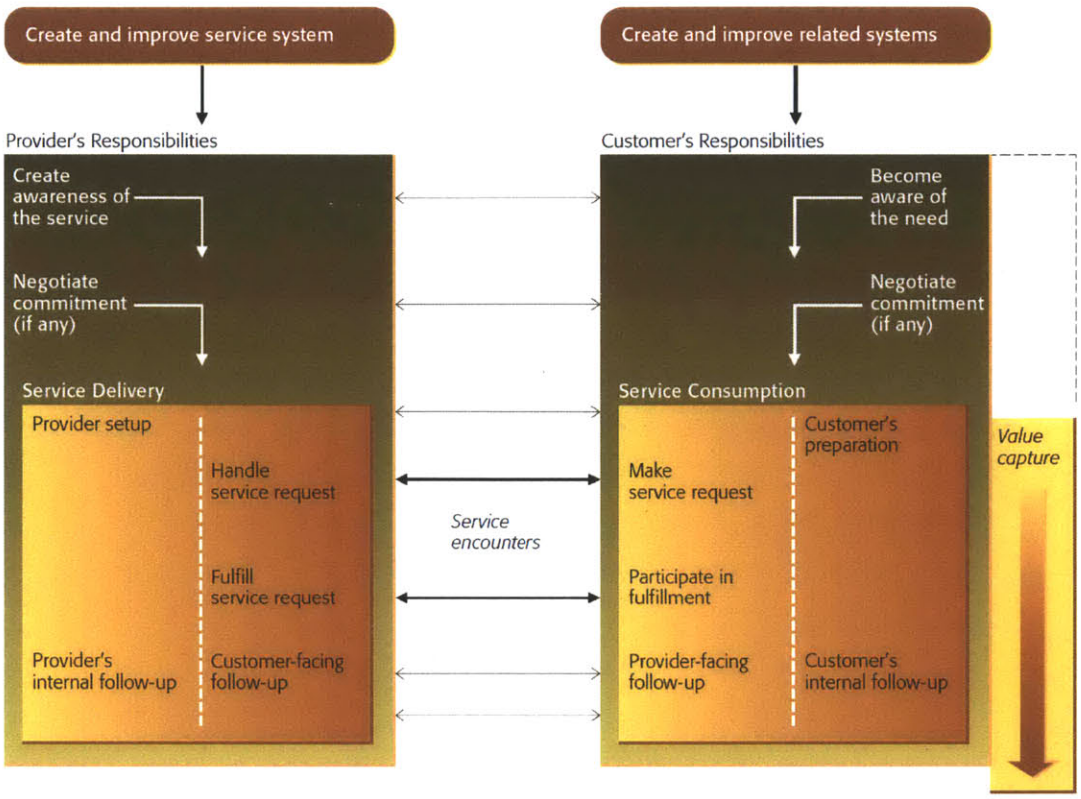

Figure 16: Service Value Chain Framework

Alter also includes an arrow on the right of the figure for value capture. This is missing from the definition of core depot processes in Figure 15: Common Processes for Servicing Existing Systems. Two specific ways to capture value are proposed for incorporation.

First, a process could be included to recommend upgrades to the system (outside of the repair contract's scope) in light of the failure. This would enable the creation of new business and encourage innovation. Furthermore, it would demonstrate recognition of the customer's need and action being taken in response to the customer frustrations being experienced due to the failure. Sometimes the failure is occurring due to the system being operated outside of the design envelope. An understanding of the trend of how a system is being used can help reveal customers' latent needs.

Secondly, a process could be included to capture lead user innovation. In 1988, MIT Prof. Eric Von Hippel challenged the assumption that product innovation is typically done by an engineering company. Many times users of the system develop useful innovations because they are incentivized by being able to use the system, as opposed to engineering companies that are incentivized by sales and profits. This is illustrated in the example of a maintenance employee. The maintenance employee repaired bread

making machines that were designed to make 80 loaves of bread. On one customer repair visit, this employee found that the customer had modified the machine to make 180 loaves. Rather than embrace the innovation and share it with his company's research and development department, the employee became frustrated and voided the customer's warranty on the machine. The reason? He was incentivized by how quickly he could repair machines, and the modified ones take longer to fix because he first has to understand the configuration. When employees are penalized for long turn-around times on repairs and no process exists for capturing user innovation, these often valuable innovations are lost. (von Hippel, 1988).

Revisions to Life Cycle Processes for Servicing Existing Systems

The findings from this section have been combined with research inputs from INCOSE ISSWG, Raytheon, Pratt & Whitney, Boeing, as well as research from the literature in the following table. The primary source of research inputs are interviews and surveys conducted at the INCOSE Workshop in Jacksonville, Florida in January 2012. Interviewees and survey respondents include INCOSE members from Cassidian, Northrop Grumman, NASA Goddard, Parsons, United States Navy, MTI Systems, Rockwell Collins, MIT, Honeywell, and also members that did not affiliate with an organization.

The following table summarizes the indicators that an enterprise understands the importance of servicing existing systems. The indicators, organized by life cycle process, serve as best practices. The information in the right two columns feed into LESAT SES diagnostic questions, indicators, and descriptions of enterprise capability levels within the Life Cycle Processes section of the tool. The Life Cycle Processes of LESAT are processes that must be executed throughout the System Life Cycle to ensure that a system is capable of delivering value when it is initially deployed and continues to deliver value until it is retired. Program Management, Requirements Definition, Product Development, Supply Chain Management, Production, and Distribution and Sales are the life cycle processes that were defined for LESAT 2.0. For LESAT SES, Servicing Existing Systems/ Operations has been added to the set of life cycle processes.

Table 3: Revisions to Life Cycle Processes for LESAT SES

Life Cycle Process	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems	
	Diagnostic Questions	**Indicators/Metrics**
Program Management	• Is the after-market service organization participating in design and requirements development? • Do they have approval rights on the design or just an input role? • Is the mindset focused on optimizing product support structure?	• Maintenance costs are always factored in. • Small program office retained during sustainment and augmented as needed. • Customer satisfaction surveys, Award fee, repeat business
Requirements Definition	• Does the enterprise conduct operational analysis of the in-service part of the life cycle? • Is the concept of operations (CONOPS) for in-service support developed? • If so, does it influence the design architecture and requirements?	• Reliability and Logistics Requirements are Critical Parameters. • For existing or long term systems, reliability and maintainability requirements are developed based on failure modes analysis. • The requirements are available & maintained as changes occur.
Product Development	• Are in-service groups part of design reviews? • Are there prototypes built to support in-service maintenance & operations trials?	• Specialty engineers are key members of Cross Product Teams. • Thought is given in the design phase for ease of replacement. • Product performance metrics • Customer follow-on contracts

Life Cycle Process	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems	
	Diagnostic Questions	**Indicators/Metrics**
Supply Chain Management	• Are Reliability and Logistics requirements flowed to suppliers?	• The maintenance department communicates to suppliers when failure analysis reveals that a supplier manufacturing process could be modified to prevent failures in the field. • Manufacturing and in-service engineering personnel have defined coordination mechanisms to deal with issues. • Sub-contract satisfaction surveys, Award fees, overruns, # of late deliveries
Production	• Are there processes to pass what manufacturing engineering is learning to in-service engineering groups? Vice versa? • Are these processes regularly used by employees? Are they effective in knowledge sharing? Has the knowledge sharing resulted in changes?	• The results of Design for Manufacturing and Design for Serviceability efforts are evident in the product. • Schedule metrics, test results, margin (performance)

Life Cycle Process	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems	
	Diagnostic Questions	**Indicators/Metrics**
Distribution and Sales	• Are sales personnel familiar with the maintenance and support costs?	• In-service teams need in-depth understanding of the supply chain architecture and maintenance CONOPS that the customer is using in order to design any field repair approaches. • Product support design aspects are evident in marketing. • Increasing sales; distribution duration reduction

Life Cycle Process	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems	
	Diagnostic Questions	**Indicators/Metrics**
Servicing Existing Systems/ Operations	• Are in-service groups incentivized toward follow-on customer contracts?	• The after-market lifecycle follows fairly close to a traditional problem solving cycle – clear problem definition, good root cause analysis, solution option development, evaluations, and decision/agreement/authorization. • Field support engineers are deployed with the product to ensure maintenance is performed efficiently. • Technical documentation is readily available and easy to understand, or technical documentation is not necessary since the product is intuitive enough that maintenance is as easy as operation. • The key to modifications of in-service systems: Understanding that the system is the In-service System – not the piece being modified.

7 Raytheon Enterprise Transformation

Raytheon Company was founded in 1922 and is based in Waltham, Massachusetts. Raytheon is a high technology engineering company with 70,000 employees worldwide as of 2010. In 2012, it operated in six segments/business units: Integrated Defense Systems (IDS), Intelligence and Information Systems (IIS), Raytheon Missile Systems (RMS), Network Centric Systems (NCS), Space and Airborne Systems (SAS), and Raytheon Technical Services Company (RTSC).

Raytheon recognized services (maintenance, repair, overhaul, upgrades, etc.) as a "growing market area" but the processes and systems across Raytheon Depot were not optimized to support this growth opportunity.

The Raytheon Enterprise Mission Support/Depot Initiative was formed in 2011 to address this gap. The purpose of the initiative has been defined as follows: "Transform Raytheon Depot to enhance Raytheon capability, meeting growing Customer needs through improved turn-around, visibility, and availability via unified internal depot processes, enabling Raytheon's win anywhere, perform anywhere strategy".

In 2012, an MIT enterprise architecting team initiated an enterprise architecting project to transform Raytheon Depot, which includes maintenance, repair, overhaul, and upgrades for all six business units. The leadership of the Enterprise Mission Support/Depot Initiative served as Project Sponsors to the MIT team. This team began working with the Sponsors in Q1 2012 and met with them regularly and followed the MIT Enterprise Architecting Process, shown in Figure 17: MIT Enterprise Architecting Process (Nightingale, 2012).

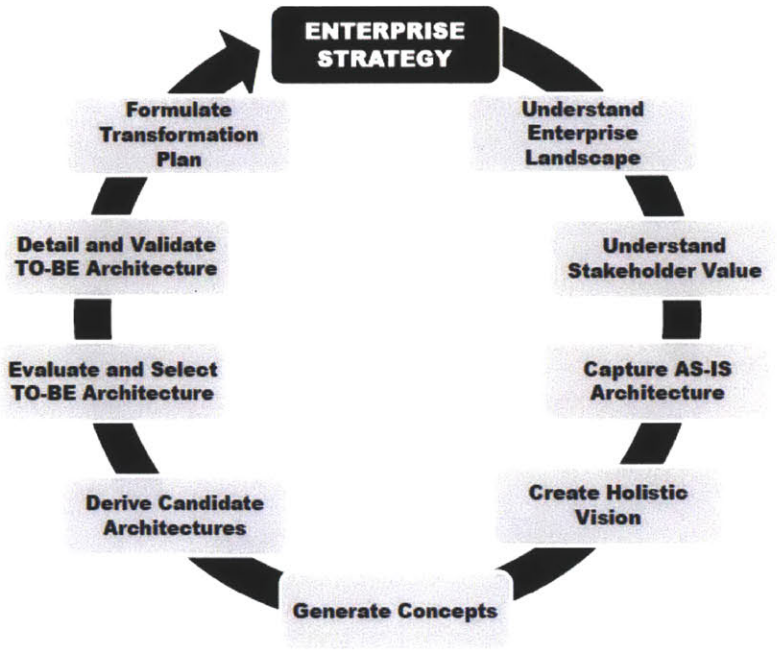

Figure 17: MIT Enterprise Architecting Process (Nightingale, 2012)

A number of in person and phone stakeholder interviews were conducted during the As-Is analysis phase. After the As-Is conclusions were discussed with the Sponsors, the future vision was defined. The MIT Team conducted a brainstorming session with the Sponsors and key stakeholders to generate future-state concepts. The concepts were developed into three candidate architectures, which were reviewed with the Raytheon VP of Operations and the Sponsors. After incorporating feedback, the future-architecture was developed and validated. A transformation plan was recommended to the Sponsors, and a follow-up meeting with the VP of Operations was scheduled at his request.

Enterprise Landscape

Ecosystem (External Landscape)

The external landscape was undergoing a great deal of change. The federal budget deficit was driving a reduction in defense spending. This resulted in a restructuring of regulation to evaluate the lifecycle costs rather than just the procurement costs of systems. There also was an emergence of performance based logistics (PBL) contracts that reward highly reliable systems with efficient repair rather than paying contracts based on the number of repairs conducted.

In response, many of Raytheon's competitors and collaborators increased focus on the after-market. Boeing was increasingly bidding on sustainment programs for other companies' products. Of Pratt &

Whitney's $12.9B sales in 2010, over 50% were MRO (maintenance, repair, and overhaul) as opposed to OEM (original equipment manufacturing).

Internal Landscape

Raytheon did not see depot/services as a key business focus. The key business focus was on products, and depot/services were seen as an unfortunate necessity that comes with selling products. There were also terminology problems. Over half of stakeholders interviewed did not identify with "Depot," but with Raytheon Enterprise Mission Support/Depot Initiative, RTN Depot, or one of the other terms discussed in the Terminology section.

Stakeholder Identification

The stakeholders of Raytheon Depot and their relationships (Input, Control, Output, Resources) are illustrated below.

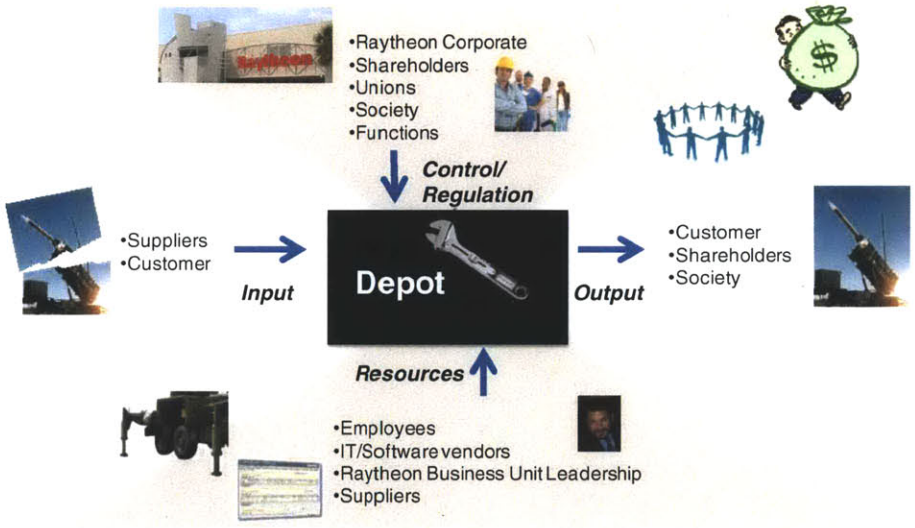

Figure 18: Raytheon Stakeholder Relationships

Stakeholder value assessment

Analysis was conducted to determine what value each stakeholder contributes to the enterprise and what value the enterprise contributes to each stakeholder. Assessments were also conducted as to the perceived performance by the enterprise and by the stakeholder of each value exchange. The following table summarizes the key findings from this analysis by stakeholder.

Table 4: Stakeholder Value Assessment

Key Stakeholder	Value Assessment Summary
Business Unit Programs	The primary stakeholder is Depot's customer, the Business Unit Programs. A phrase that came up frequently in the interviews is "spots of brilliance." With over 100 depots across Raytheon, the performance is variable.
Employees	Raytheon is frequently rated among the best places to work, so overall this is also not a key area of concern. However, there is a uniqueness of the employee/Raytheon relationship within and outside of Depot. There is a widely recognized perception by employees that the career path within new programs is better than within depot. High potentials, those employees with the greatest potential of career advancement, choose to work on new programs over depot.
Raytheon Corporate and Business Unit Leadership	Depot would like Raytheon Corporate and the Business Unit Leadership to play a bigger role in Depot. Although "Mission Assurance" is now part of Corporate strategy, specific emphasis on developing products for serviceability is lacking. Depots are still distributed across Raytheon, some reporting to Business Unit Leadership and some to Function Leadership. The lack of unified Depot leads to inconsistent performance, negatively affecting the Raytheon Brand.
IT/Software vendors	IT/Software vendors have a close relationship with Depot, but it is not positive. Raytheon Depot experiences frustrations with software and sees it as a time sink.
Suppliers, Raytheon Functions, and Unions	Suppliers, Raytheon Functions, and Unions have a fairly good relationship with Depot, and were therefore not the focus of the analysis.

"As-Is" Enterprise Analysis

Elements and Interactions

Nightingale and Rhodes propose a holistic approach to enterprise analysis in the MIT Enterprise Architecting course, Spring 2012. This approach involves analyzing the enterprise with eight view elements in addition to the ecosystem and stakeholders, as shown in Figure 19: Enterprise Architecting

View Elements (Nightingale, 2012). These views cannot be developed separately because the outcome of the analysis may not capture the enterprise behavior. It is also important to consider the interactions among the views as some views directly influence other views and some views serve as performance enablers.

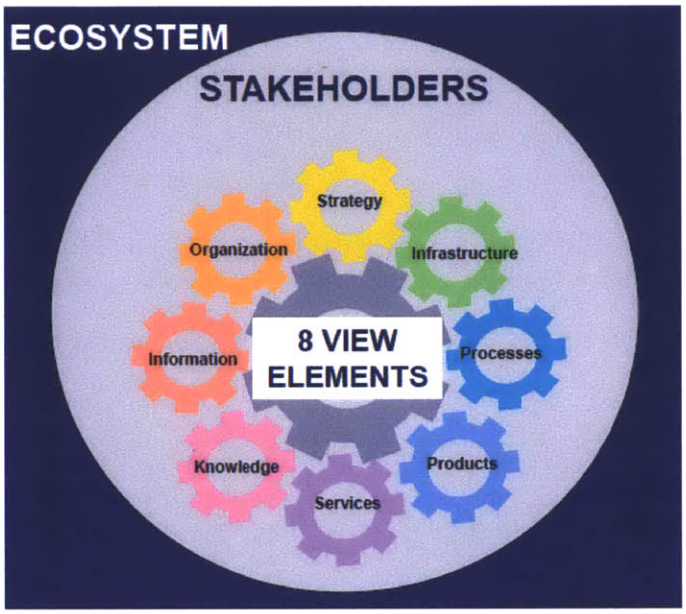

Figure 19: Enterprise Architecting View Elements (Nightingale, 2012)

Analyzing the interaction among products, strategy, and organization revealed that the breadth in products drives fragmented depots scattered across the organization and the lack of a unified "depot strategy." This is shown by the red dotted line in Figure 20: Interaction of Business Units, Functional Organizations, and Depot.

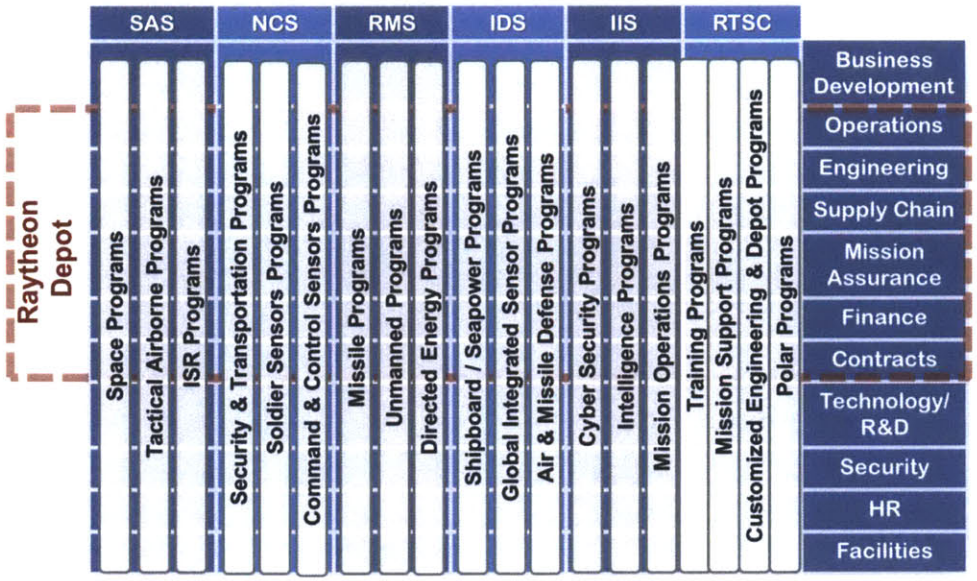

Figure 20: Interaction of Business Units, Functional Organizations, and Depot

Evaluation of the As-is enterprise revealed that Infrastructure is a dominant view in that it impacts the overall enterprise performance. The key findings were:

- "Lots of swivel chair": slang term for a common interface work-around that involves manually entering data into one system and then entering the same data into another system. The term is derived from the practice of the user turning from one system to another using a swivel chair.
- "80/20 rule": depot employees spend 80% of their time gathering data and entering it into the IT tools, and only 20% of the time analyzing the data and acting on the results. They need a better way to access the data they need. And, they need to reduce re-entering data (waste & leads to inaccuracies).

"As Is" Enterprise Conclusions

The "As Is" Enterprise conclusions are summarized in the table below.

Table 5: Summary of "As Is" Enterprise, Raytheon Case Study

Strategy and Organization	• There is no single Depot strategy or clearly defined organization because it is fragmented across the business units and functions • No financial freedom. Budget is allocated and controlled by Business Unit Programs.

"Spots of Brilliance"	• Performance not uniform across depots
Infrastructure	• Swivel chair • 80/20 Rule • Not standardized
Products	• Breadth of products poses challenge to cross-Depot collaboration
Raytheon Corporate & Business Unit Leadership	• Need Leadership to play larger role in including Depot in Raytheon's strategy
Employees	• Perception that career path for new programs is better than for depot
Terminology Problem	• Over half of stakeholders interviewed did not identify with the term "Depot"

The obstacles to success in the services area found at Raytheon overlapped with Pratt & Whitney and Boeing. Employees have a perception that the career path in new product development is better than in existing systems, so high-potentials chose to work on "exciting new programs." Also, the corporate strategy still supports a product focus. Depot and sustainment is fragmented across programs, and there is no clear depot strategy. All three enterprises felt the need to overcome a "misconception that service activities are unproductive and ought to be minimized" (Freiberg, 2012). Enterprise transformation advocates within the enterprises recommended the development of a framework for calculating the value of services, incorporation of service innovation into depot processes, and recognition from leadership that "service activities" should be recognized as a primary company focus and potential revenue driver.

Future Vision

The Raytheon Depot Initiative conducted an exercise to envision Raytheon Depot in five years. This vision is summarized below.

- To have people benchmark against us
- To be a mission support leader
- Depot is seen as a place where innovation and new business (upgrades) take place.

- Depot is critical to the customer relationship. R&D seeks Depot's input, and considers Depot at the beginning.
- Employees see a strong potential career path in Depot and high-potentials want to work here.

Desired Capabilities & Attributes, Value Gaps Identification

The Sponsors noted that Raytheon Depot is unique due to a widely variable environment, and therefore future-state architectures that work for other organizations with less variability such as Pratt & Whitney may not be applicable. The key capabilities and attributes of future architectures that might address the gaps were evaluated using the following questions developed during a detailed activity with Sponsors and Team members.

1) Efficiency
-Does it minimize redundancy and managerial overhead?
-Is it characterized by elimination of multiple entries?
-Is more time spent analyzing then gathering?

2) Manageability
-Does the candidate architecture allow for clear accountability in terms of compliance with guidance and timeliness?
-Does it facilitate the implementation, use and control of performance metrics?
-Are data sources integrated?

3) Agility
-Does it reduce cycle time of the product development process?
-Does it reduce constraints to internal communication among departments?
-Is it scale-able for the large variety of Mission Support programs?

Concept Generation and Deriving Candidate Architectures

Due to location constraints, only a teleconference was available for concept generation. The MIT Team leveraged innovative techniques to stimulate discussion and level the playing field so that everyone felt comfortable sharing ideas. The call started with everyone introducing themselves with names and favorite animal rather than titles or departments. During a single one-hour call with six key stakeholder groups and the MIT team, over 100 ideas were generated.

Examples of the ideas:

Have commonality of metrics and metric definitions in our contracts so we are all measuring the same thing. These metrics may include Availability (A0) and Repair Turn Around Time (RTAT).

Use virtual reality technology to enable depot engineers to help soldiers or field reps fix parts

Change the culture to view the end user or military as the customer rather than business unit programs

Use predictive data analytics to track trends. Our suppliers might even be interested in the data. We could be an Information Services company.

These ideas were then categorized by element view using a software program. Clicking on an element reveals the ideas associated with it. Screen captures are shown below.

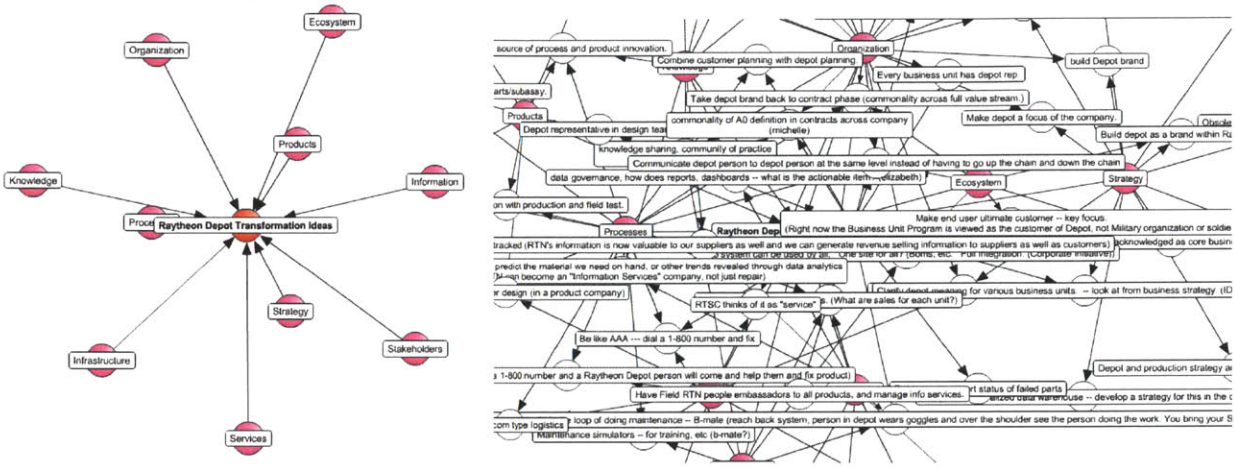

Figure 21: Idea Categorization

After conducting analysis, some emerging themes were identified. These common themes are shown below.

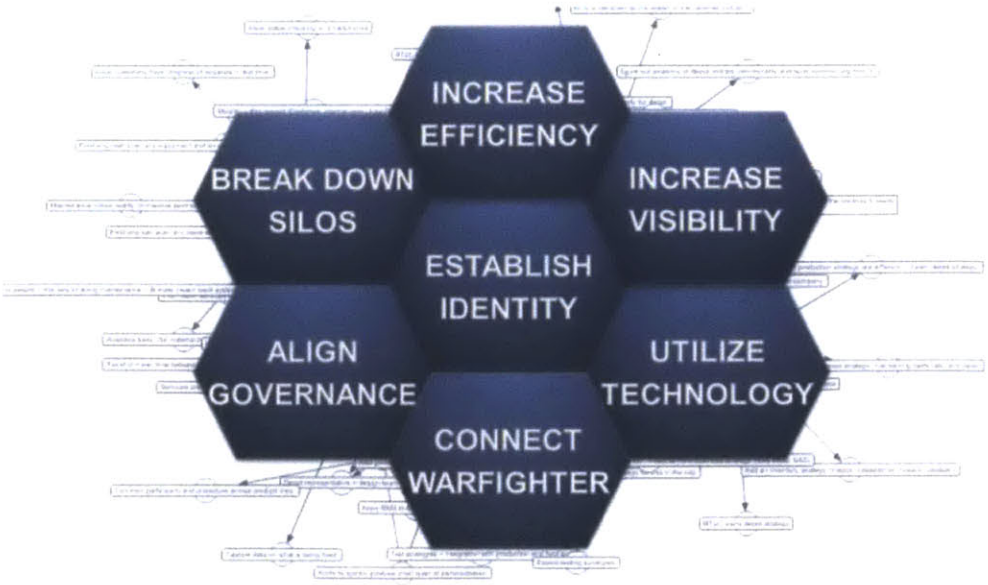

Figure 22: Emergent Idea Themes

Three candidates emerged:

1. Optimizing

In this architecture, all depots report to the Operations function and Operations incorporates the Depot Strategy into the Operations Strategic Objectives. There is an emphasis on setting performance goals, measuring them, and assigning accountability to meet those goals. In order to ensure future leaders embrace depot, require Operations Corporate Rotation Program to have at least one rotation in Depot.

2. Integrating

Create a council that has representatives from all business units and related functions. Each business and function should reference/incorporate this strategy to legitimize it. All Depots report to their Business Unit Program, then the Business Unit, and then to the Depot Council. Create a Community of Practice for sharing of best Depot Practices.

3. Competing

Create a Services Division that goes beyond servicing Raytheon products. Develop the Raytheon Brand as a Mission Support Leader. Explore options to provide new services (such as data analytics and prediction of repair turnaround time trends) to new customers (such as suppliers or other defense contractors). Have a brainstorming/jam session on how to improve depot processes and strategy.

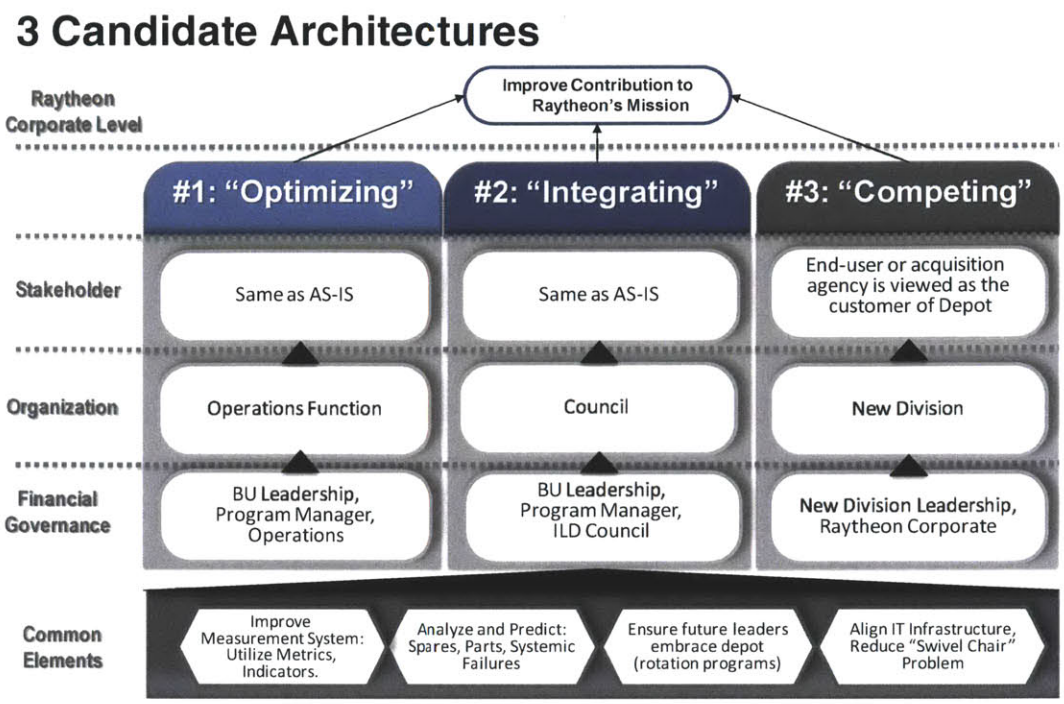

Figure 23: Three Candidate Architectures

Evaluation of Candidate Architectures

A number of evaluation techniques were used. For brevity, only the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is shown here.

Table 6: SWOT Analysis of Candidate Architectures

	Candidate #1: Optimizing	Candidate #2: Integrating	Candidate #3: Competing
Strengths	Easily implementable Fast return on investment for transformation Aligned with data driven logistics initiative of DoD acquisitions	Candidate#1 Strengths + Support of a formal authority during implementation (Depot/Integrated Logistics Council)	Increases communication and visibility of Depot performance since all Depots are in same organization Enhanced Depot/Integrated Logistics Brand

	Candidate #1: Optimizing	Candidate #2: Integrating	Candidate #3: Competing
Weaknesses	Depot is only represented by a single function even though it is part of many other functions -- this is not the reality Not symbolized by a striking change (compare it to Candidate #3 which suggests a new division). It may be essential to have one representative symbolic change to generate the excitement for change; otherwise it may be perceived as a continuous improvement initiative.	Depot/Integrated Logistics Council, being composed of representatives from different units, may have difficulty of alignment, or representatives may bring in agendas from their original divisions.	Difficult to implement. This option suggests a big organizational change before validating its assertions. Organizational change needs strong support from other elements such as strategy, process or information. Otherwise, its use may remain limited. Without strong leadership support, the responsibilities of this division versus others may be unclear or ill defined.

	Candidate #1: Optimizing	Candidate #2: Integrating	Candidate #3: Competing
Opportun-ities	Metrics driven and increased visibility approach may be very well received by DoD acquisition agencies and further opportunities may arise, such as implementation of the system for Army organic depots. Analytics driven approach may identify more efficient logistic chains, suppliers, and service and product offerings.	Better of both worlds: Depot/Integrated Logistics Council and this approach can serve as an intermediate step from Candidate#1 to Candidate#3 architecture. If the less risky Candidate#1 succeeds, the Council can generate momentum and push toward larger corporate visibility, as in Candidate #3.	Well positioned to capture new, growing services market. Be able to bid-in depot & maintenance related contracts of other company products, increasing business potential.

	Candidate #1: Optimizing	Candidate #2: Integrating	Candidate #3: Competing
Threats	This option, being a moderate and safe architecture alternative, may fail to raise enough excitement for transformation. This option may not adequately position the enterprise for success in the new services market, allowing competitors to gain market share in this space.	Since the Depot/Integrated Logistics Council must work across Business Units, it may be hard to secure IP on innovative processes developed, allowing competitors an advantage.	May take too long to implement and miss market opportunity. Organizational and cultural shift required to pull depot out of existing structure and make it another individual entity. Threats due to servicing non-Raytheon products: -Servicing non-Raytheon products creates dependence on externally originated product knowhow and may require training. -IP protection may limit opportunities in this space.

It should be noted that the MIT Team separately developed three IT Infrastructure candidates. These are separate from the other candidates because the future-architecture frameworks are not inherently paired with a particular IT approach.

1. Point-to-Point Integrations

Point-to-Point integrations require all new software vendors to integrate point-to-point with existing systems. This is less costly than requiring integration among existing vendors, however since the integration occurs only as new software vendors are introduced, it can take a long time to implement, and therefore is not an effective solution in the short term.

2. Standardize on Depot Software

Standardizing the set of software products used across all depots can be costly, but since the selected software products are tightly integrated, it can be quite effective. Many software companies such as IBM offer implementation services. These services make the implementation process easier, but may slightly limit effectiveness if certain IT products are not supported.

3. Web-Based Open Integration Platform

A web-based platform with standard interfaces and methods can enable software products to access data housed and managed by other software products. There would also be a standard integration process experienced across different software products. This can be very effective because depot/Integrated Logistics employees can enter one system to access data via web user interfaces. This system could also enable data analytics. However, it would be costly to implement as it would require implementing standard interfaces to every piece of software used.

A summary of the findings on the three IT Infrastructure candidates is shown in Figure 24: Three IT Infrastructure Candidates. Given the potential large revenue gains from supporting the services space, effectiveness and implementability were prioritized over cost, leading to the selection of standardizing on the depot/Integrated Logistics software.

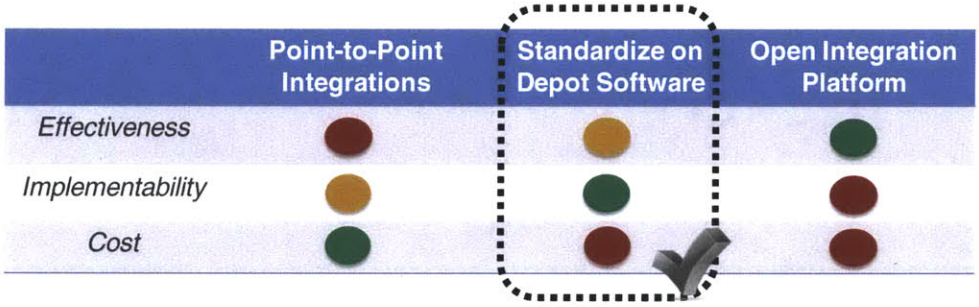

Figure 24: Three IT Infrastructure Candidates

Selected Architecture

The selected future-state architecture is #2 "Integrating" and "Standardize on Depot Software" for the IT architecture. In Figure 25: Selected Architecture: "Integrating", ILD refers to the Integrated Logistics Division and BU refers to Business Unit.

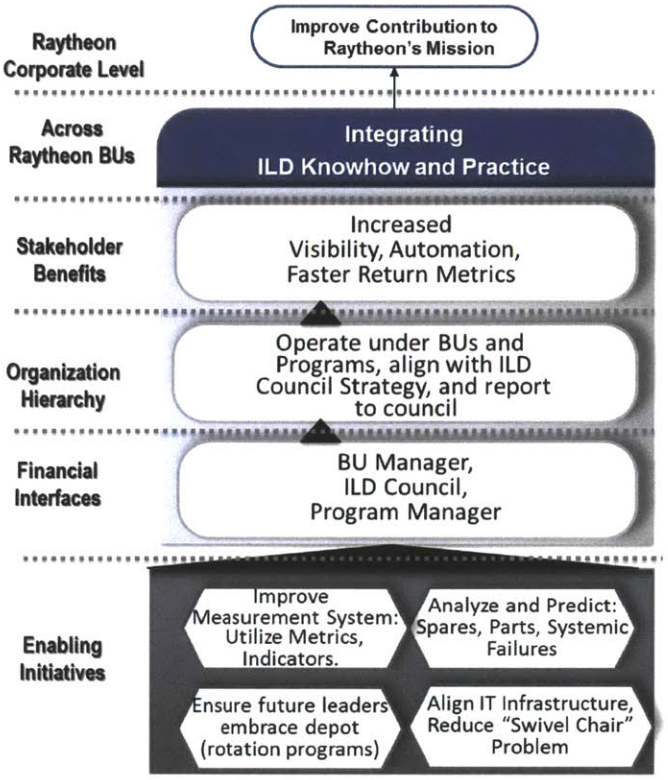

Figure 25: Selected Architecture: "Integrating"

Validation of the selected architecture by numerical methods or evaluation of uncertainty is challenging. One method used was future-proofing. In a possible future scenario, potential competitors penetrate and try to obtain market share in maintenance of DoD equipment. In the AS-IS case, or Candidate #1 case, all of the Depots are focused on their product platform and do not feel the need to monitor external market conditions. And also parts of business units that monitor market conditions do not consider depot or equipment maintenance as a core target, so they may ignore the new competitors. However, in the case of Candidate #2, there exists a central body, the Depot/Integrated Logistics Division (ILD) Council, which is purely focused on depot, maintenance and logistics aspects. This council has the broad view which can enable them to identify a potential attempt to enter market and coordinate related Raytheon depots/ILDs to position against threat.

Another possible scenario is the high market growth case, where many maintenance or integrated logistics projects are initiated by acquisition agencies. In this case, size of the business may be too big to be manipulated by the Depot/Integrated Logistics Council. Coordination of businesses may require a centralized new division or business unit to be established. However, without Candidate#2 solutions (e.g. Council), it would be very hard for Raytheon to find a single-body of contact to assist establishment

of new business. In addition to this, as Candidate#2 suggests integrating depots/ILDs within Raytheon (even if not under same department or same location; but in terms of processes, practice and communication), the initiative for new business unit will benefit from the progress made in transforming to Candidate#2.

Transformation Plan

The transformation plan summarized in Figure 26: Transformation Plan was proposed along with defined exit/completion criteria for each phase. In 2012, the ILD Council would be formed. Also, to gain the support of future leadership, the Corporate Leadership Rotation Programs within Raytheon could require rotators to have at least one rotation in ILD. However, it is important that these rotations are in fact representative of ILD and expose the rotator to the excitement of ILD. If not, this could have possible negative effects, and therefore this could be postponed until the ILD vision has been formed and understood across the enterprise. In 2013, initiatives are established; the details are not described here, but they include commonality of metric definitions and standardization of depot/Integrated Logistics software. There is also a "jam-session" or enterprise wide brainstorming to signal the upcoming transformation to employees and other stakeholders across the enterprise. It is important that all of the Business Units incorporate the depot/Integrated Logistics strategy into their own; this is a key indicator of success. The Business Unit strategy is tied to employee performance objectives, and therefore this would demonstrate a commitment to depot/ILD. 2015 is focused on completing the initiatives launched in 2013. In 2016, a decision point is indicated to reassess the size and growth rate of the services market and the enterprise's ability to capture market share. If the market is continuing to grow, it is possible to initiate a re-evaluation of Candidate #3 for 2017.

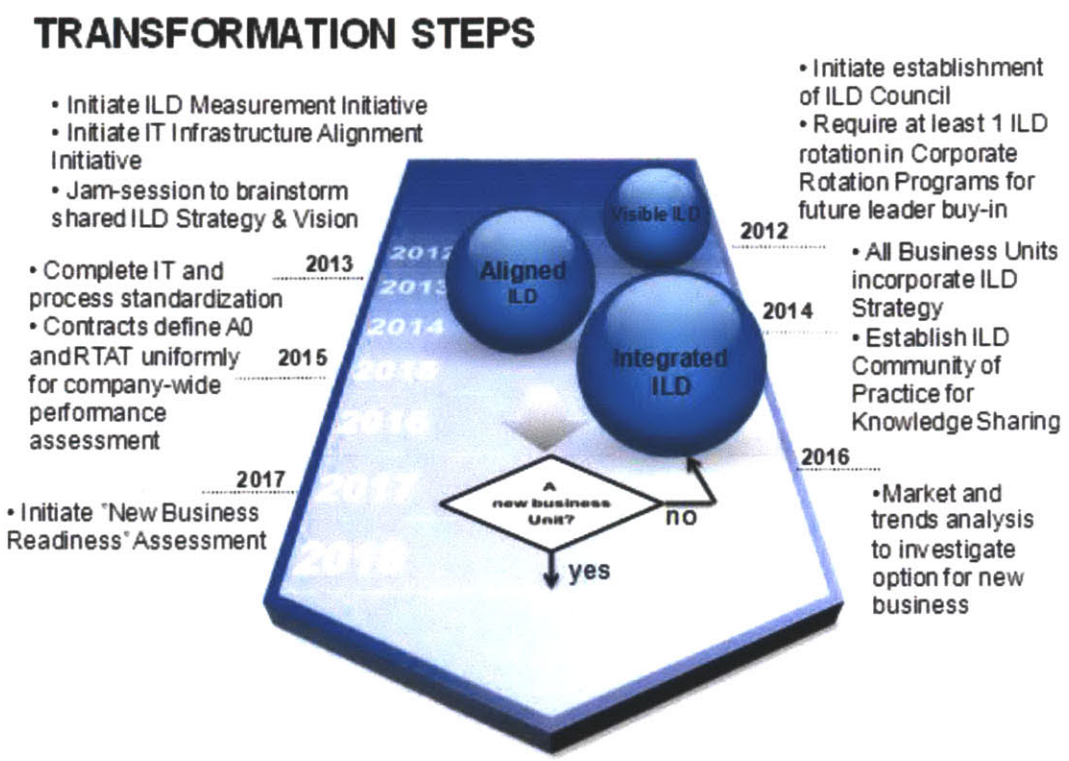

Figure 26: Transformation Plan

Conclusion from Raytheon Enterprise Transformation Study

In conclusion, Raytheon is a large aerospace defense company in a changing ecosystem. The market trend is toward mission support, maintenance, and repair services. Raytheon is not optimized to meet this growing market area. The As-Is analysis revealed terminology problems, a fragmented strategy and organization, and inconsistent performance negatively affecting the Raytheon brand. The future vision is to be a mission support leader. The selected future-state architecture is "Integrating," which involves re-branding from "Depot" to "Integrated Logistics;" creating a council with representatives from all business units and related functions; each business and function reference/incorporate strategy to legitimize it; and having the council involved in financial governance. The transformation plan focused on leadership buy-in, current and future. The recommendations also included continuous measurement and re-assessment; clear exit criteria/completeness indicators; and a decision point on the establishment of new division.

The Project Sponsors had consistent involvement with the MIT Team throughout this process. Their feedback on the initial three candidates led to discussions and development of financial governance recommendations. Subsequent meetings with Project Sponsors led to presentations to the Raytheon

PRISM Council and Raytheon OPS Council in May and June 2012. Two efforts slated to be pursued in the near term included the re-branding of Depot to Integrated Logistics and an emphasis on engineering not to tailor out process steps dedicated to design for supportability under cost pressures.

Recommendations for LESAT SES

The recommendations for LESAT SES from the Raytheon Enterprise Transformation case study are summarized in the table below.

Table 7: Recommendations for LESAT SES resulting from Raytheon Case Study

LESAT SES Section	Indicator of Enterprise Efficiency and Effectiveness at Servicing Existing Systems
Contracts, Enabling	• Ability to define service related metrics consistently across enterprise.
Product Development, Life Cycle	• Engineering should not tailor out processes related to servicing or supportability under cost pressures during development.
Leadership	• The revenue from depot/service must be quantifiable. • Employees should be incentivized to work in servicing existing systems. • High potentials and emerging leaders should be encouraged to take roles in servicing existing systems. • Knowledge sharing activities and communities of practice should be leveraged among in-service groups.
Enterprise Transformation	• The business case for servicing existing systems must be understood by leadership. • Cross-business and cross-functional mechanisms must be in place to address service, which is trans-organizational multi-disciplinary.

8 Summary of Revisions for LESAT SES

The previous sections highlighted proposed changes to LESAT 2.0 in order to develop LESAT SES and make the LESAT model applicable to products and services enterprises. Specific best practices for servicing existing systems have been captured in the tool's diagnostic questions, indicators, and Level 5 enterprise capability definitions. The revisions are summarized by section below. The full proposed LESAT SES is in Appendix B.

Section 1 – Enterprise Transformation/Leadership

In Section I: Enterprise Transformation/Leadership, the proposed changes focus on the leadership's ability to define the organization and business impact of servicing existing systems. This enables the definition of a strategy to address the market area of servicing existing systems. Also, it is important to have knowledge sharing of best practices within in-service groups across the company.

Three practices have proposed changes:

> I.C. Understand Current Enterprise State – Understand how value is delivered to key stakeholders, define current enterprise state, and perform enterprise assessment.
>
> I.D. Envision and Design Future Enterprise – Identify capabilities and deficiencies by defining enterprise vision, defining "To-Be" state, and performing gap analysis.
>
> I.E. Develop Enterprise Structure and Behavior – Organization infrastructure must be assessed and modified throughout the transformation to achieve the future state. Organizational structure, incentives, policies, and processes must be aligned and coordinated, eliciting the desired behavior to support the transformation and sustain the change.

Practice I.E also focuses on employees and should address the employee perception of the career path in new product development as opposed to servicing existing systems. The Level 5 enterprise capability definition I.E.3 Align Incentives is proposed to include the best practice of encouraging emerging leaders to take on roles in servicing existing systems. In addition, the Level 5 enterprise capability definition I.E.6 Establish Open and Timely Communications highlights knowledge sharing activities among in-service groups to establish and share best practices within the enterprise.

Section 2 – Life Cycle Processes

There are a number of proposed additions to the indicators in the life cycle processes described in Section II. It is important that the in-service organizations play an approval role and not just an input role in program management, requirements definition, product development, supply chain management, production, and distribution and sales. Furthermore, Servicing Existing Systems/Operations is proposed to be added as the seventh life cycle process. Indicators have been included.

Practice II.A Align, Develop, and Leverage Enterprise Capabilities emphasizes the value of new opportunities building upon existing enterprise capabilities and developing new capabilities. The Level 5 enterprise capability definition for this practice is proposed to include making in-service groups part of the proposal and capture effort for opportunities on new and existing systems.

Section 3 – Enabling Infrastructure

The enterprise' Enabling Infrastructure is also critical to servicing existing systems. With regard to measurement, the Design for Supportability efforts should be evident in the product and marketing. Metrics on customer satisfaction and retention are critical given the uniqueness of the revenue model for servicing existing systems. Furthermore, it is important that supporting functions such as contracts understand the unique model and are empowered to have unique processes for enabling new product development versus servicing existing systems. Having the enterprise' organizational and process enablers aligned to support servicing existing systems can prove to be a competitive differentiator.

Summary of Revisions

The proposed changes to LESAT 2.0 for LESAT SES enable products and services enterprises to use the tool. The most evident change to enable this is adding Servicing Existing Systems/Operations to the life cycle processes. However, the tool also now contains a wealth of best practices on servicing existing systems and better definitions on mature and capable enterprises for each practice area.

9 Conclusion

An extension of LESAT 2.0 for Servicing Existing Systems is proposed for products and services enterprises. The modifications capture best practices in the form of diagnostic questions, indicators, and the description of mature and capable enterprises. There is also a proposed addition to the life cycle processes: Servicing Existing Systems/Operations. These modifications were developed through collaborations with the International Council on Systems Engineering In-Service Systems Working Group,

Boeing, Pratt & Whitney, and Raytheon as well as review of the literature. LESAT SES enables products and services enterprises to assess strengths, areas of improvement, and readiness to change. It also serves as a stepping stone for LESAT for Services.

10 Recommended Future Work

LESAT Servicing Existing Systems greatly expands the applicability and industries from what LESAT 2.0 supports by addressing product and services enterprises. The next step is to develop LESAT for Services to address services enterprises such as restaurant services, hotel services, educational services, insurance, and financial services. The proposed audience of LESAT for Services versus LESAT SES is shown in Figure 8: LESAT Enterprise Applicability. LESAT for Services can leverage LESAT SES as a stepping stone as many services enterprises involve servicing existing systems. LESAT for Services should be applicable to inventory-less business models.

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Appendix A: Definitions

Enterprise: A complex, integrated, and interdependent system of people, processes, and technology with a distinct mission that creates value as determined by its key stakeholders based on that mission. An enterprise typically consists of multiple organizations (e.g., departments, suppliers, partners, regulators) rather than a single corporation, division, or government unit. In addition to core value chain activities, the enterprise includes all supporting activities (e.g., profit and loss responsibility, information technology, human resources). (Lean Advancement Initiative, 2001).

Stakeholder: Every person who has an interest in an enterprise, its activities, and its achievements. These may include customers, partners, employees, shareholders, owners, the government, and regulators. (Lean Advancement Initiative, 2001).

Value stream: The specific activities required to design, order, and provide a specific product, from concept to launch, order to delivery, and raw materials into the hands of the customer. (Womack, 1996)

Appendix B: LESAT SES

LAI ENTERPRISE
SELF-ASSESSMENT TOOL
(LESAT)
SERVICING EXISTING SYSTEMS
(SES)

July 2012

STRUCTURE OF LESAT ASSESSMENT MATRICES

The enterprise-level assessment architecture is the basis for the LAI Enterprise Self-Assessment Tool (LESAT). It provides classification for the generic processes found in all enterprises. These classifications provide organizational structure for LESAT. The assessment is organized into three sections:

I. *Enterprise Transformation/Leadership* – processes and leadership attributes nurturing the transformation to enterprise principles and practices
II. *Lifecycle Processes* – processes responsible for the product from conception through post-delivery support
III. *Enabling Infrastructure* – processes that provide and manage the resources enabling enterprise operations

Section I contains practices pertinent to the enterprise transformation process with emphasis on enterprise leadership and change management. Section II contains practices pertinent to the lifecycle processes of an enterprise, i.e., those processes involved in product realization. Section III contains practices pertinent to the infrastructure support units. ***It is important to remember that all practices in these three sections are expressed at the enterprise level.***

The LESAT maturity matrices are organized as shown in Figure 1.

LESAT INSTRUCTIONS

As a respondent, you should score each practice on two dimensions. First, provide a current score based on your perception of the enterprise's present performance. Each practice has five capability levels that provide guidelines and evidence to help assess the appropriate score. Next provide a desired score based on what the enterprise should achieve after the predetermined period (often, the time selected aligns with the enterprise strategic planning process). The intention is not to set all desired scores at the highest possible capability level but to prioritize those practices that you think are both achievable and have a high payoff.

Other key guidelines:

- Make sure to define the **enterprise** and select a consistent **time horizon** as a group before starting.
- Consider the defined enterprise when assessing each practice.
- Attempt to assess every practice; leave a blank only if it is not applicable or if you do not know.
- For the current level of each practice mark the box labeled "C". For the desired level, mark the box labeled "D".
- Read each practice from left to right starting with the practice and indicator. When scoring a practice, every capability level assumes that all lower capability levels have been fulfilled (i.e., you should only select level three if you meet the criteria set out in level two as well).
- If you believe the enterprise is between levels, select the lower level.
- When possible note evidence for the current capability level selected.
- Identify opportunities to achieve the desired capability level.
- If you have questions, seek clarification or assistance from the assessment facilitator.

Section I – Enterprise Transformation/Leadership

- I.A. Determine Strategic Imperative (3 enterprise practices)
- I.B. Engage Enterprise Leadership in Transformation (3 enterprise practices)
- I.C. Understand Current Enterprise State (2 enterprise practices)
- I.D. Envision and Design Future Enterprise (2 enterprise practices)
- I.E. Develop Enterprise Structure and Behavior (8 enterprise practices)
- I.F. Create Transformation Plan (2 enterprise practices)
- I.G. Implement and Coordinate Transformation Plan (4 enterprise practices)
- I.H. Nurture Transformation and Embed Enterprise Thinking (6 enterprise practices)

Section II – Lifecycle Processes (each practice assessed across lifecycle stages)

- II.A. Acquire, Develop, and Leverage Enterprise Capabilities
- II.B. Optimize Network-Wide Performance
- II.C. Incorporate Downstream Customer Value into Enterprise Value Chain
- II.D. Actively Engage Upstream Stakeholders to Maximize Value Creation
- II.E. Provide Capability to Monitor and Manage Risk and Performance

Section III – Enabling Infrastructure

- III.A. Organizational Enablers (5 enterprise practices)
- III.B. Process Enablers (3 enterprise practices)

Figure 1. Organization of LESAT Maturity Matrices

LESAT Maturity Matrices

Section I: Enterprise Transformation/Leadership

I.A. Determine Strategic Imperative

I.B. Engage Enterprise Leadership in Transformation

I.C. Understand Current Enterprise State

I.D. Envision and Design Future Enterprise

I.E. Develop Enterprise Structure and Behavior

I.F. Create Transformation Plan

I.G. Implement and Coordinate Transformation Plan

I.H. Nurture Transformation and Embed Enterprise Thinking

The Enterprise Transformation and Leadership section consists of eights groups of practices, and each group corresponds to a primary activity that the enterprise must undertake at some point in the transformation process. These primary activities are organized based on the LAI Enterprise Transformation Roadmap (see Figure 2), which provides a framework for effective and efficient transformation strategy, planning, and execution. The Roadmap also serves as a guide for enterprise leaders when they consider the critical strategic, cultural, and operational changes that are required to transform an enterprise. Creating an enterprise capable of transformation and fostering a future vision and strategy throughout the enterprise leadership enable the enterprise to increase value delivery to stakeholders.

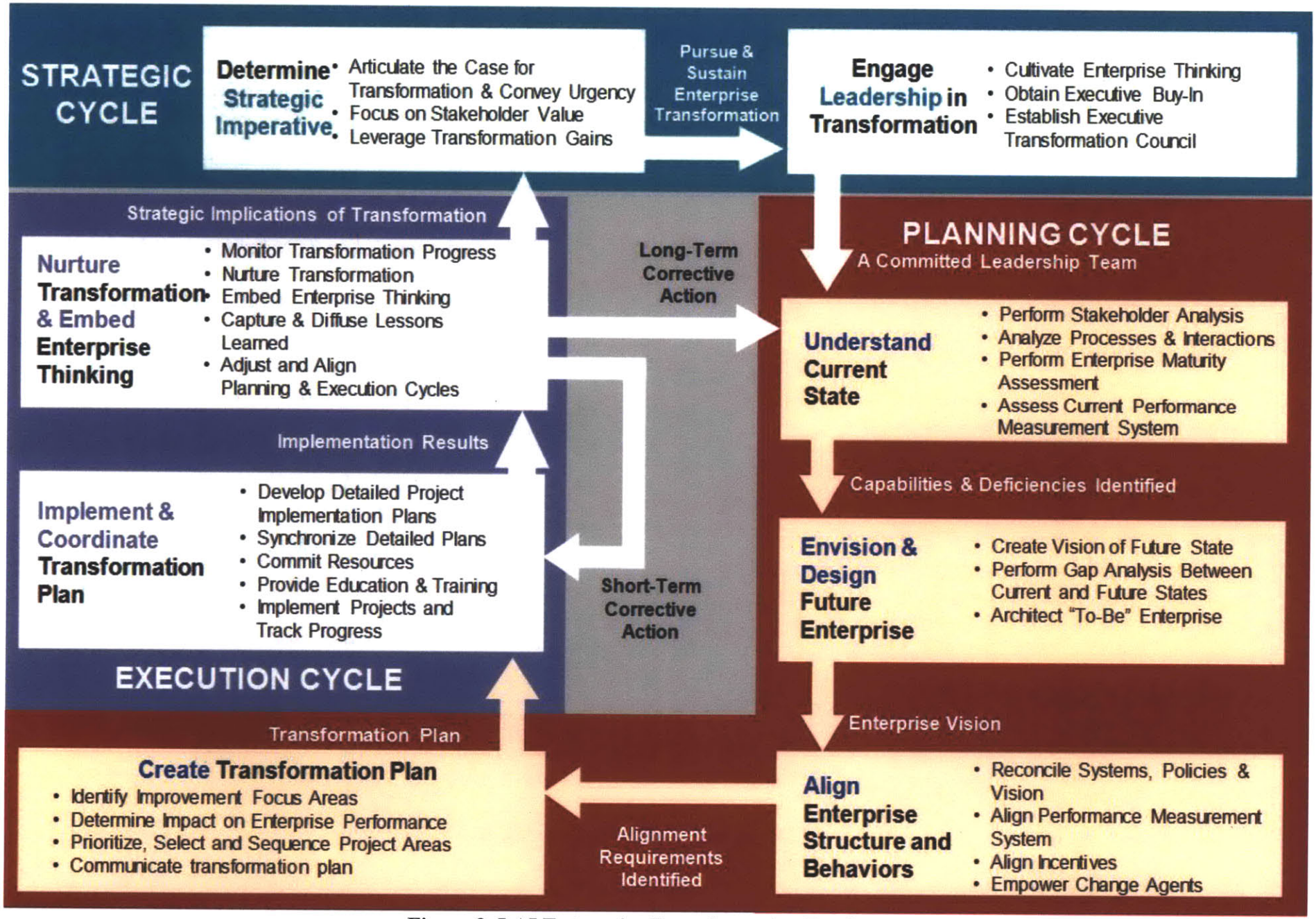

Figure 2. LAI Enterprise Transformation Roadmap

SECTION I: ENTERPRISE TRANSFORMATION/LEADERSHIP

Definition: Develop, deploy, and manage enterprise transformation plans throughout the organization, leading to: (1) long-term sustainability, (2) acquiring competitive advantage, and (3) satisfaction of stakeholders along with a continuous improvement in all three outcomes.

I.A. Determine Strategic Imperative - The decision to pursue an enterprise transformation is strategic in nature and affects all organizational practices and processes in the enterprise. The enterprise is continually striving to eliminate waste and enhance relationships with all stakeholders.

Diagnostic Questions	• **Are enterprise leaders familiar with the dramatic increases in competitiveness that many companies have realized as a result of transforming?** • **Are enterprise leaders fully aware of the potential opportunities (i.e., growth, profitability, and market penetration) that can be realized within their own organization as a result of transforming?** • **Has a suitable strategy been identified to use resources freed up by improvements?** • **Does "stakeholder value" strongly influence the strategic direction?** • **Has full leverage of the extended enterprise stakeholders been incorporated into the strategic plan?** • **Has a common vision been communicated throughout the enterprise and within the extended enterprise?** • **Has a compelling case been developed for transformation?**

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.A.1	**Integrate Enterprise Transformation into Strategic Planning Process** *Transformation is a key enabler for achieving strategic objectives*	Enterprise transformation efforts are ad hoc. C D	Enterprise transformation is relegated to lower levels of the enterprise and application is fragmented. C D	Enterprise transformation plans are formulated, but not integrated into the strategic plan. C D	Coordination and synergistic relationship exists between transformation and strategic planning. C D	Strategic plans leverage the results of transformation improvements to achieve enterprise objectives. C D
	Indicators (Examples)	• Enterprise transformation implementation is included explicitly in the enterprise strategic plan. • Strategic planning makes allowance for anticipated gains from transformation improvements.				
	Evidence					
	Opportunities					
I.A.2	**Focus on Stakeholder Value** *Enterprise creates value for all stakeholders*	Strategy prioritizes outcomes (e.g. revenue or market share) over stakeholder value considerations. C D	Strategic decisions reflect the value proposition of a subset of stakeholders. C D	A formal process is in place to identify how well the enterprise delivers value to stakeholders. Recognized opportunities for improving value delivery influence the strategic direction of the enterprise. C D	Enterprise leadership employs stakeholder analysis process to balance mutual needs of stakeholders and establish a win-win value relationship between stakeholders. C D	Constant engagement with key stakeholders is part of the way of doing business. Value becomes the predominant driving force throughout the extended enterprise. C D
	Indicators (Examples)	• The enterprise employs a formal process for identifying stakeholders (e.g., customers, users, suppliers, partners, regulators, employees, etc.) and the value that they receive from or deliver to the enterprise. • The enterprise understands what constitutes success for its stakeholders, and a formal process exists to measure and assess stakeholder satisfaction. • Stakeholder value strongly influences policies, practices, and behavior.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.A.3	**Articulate the Case for Transformation** *Communicate burning platform*	Inconsistent communication of and lack of consensus on the case for transformation. C D	The executive team has a shared understanding of the case for transformation. C D	A well-defined and motivating case for transformation has been communicated throughout the enterprise. C D	Enterprise stakeholders speak with one voice regarding the case for transformation. C D	Enterprise internal and external stakeholders have internalized and support the case for transformation. C D
	Indicators (Examples)	• Enterprise leadership emphasizes the case for transformation at all opportunities. • Line employees can explain rationale behind transformation effort. • Multimodal messaging reiterates the crisp and clear case for transformation.				
	Evidence					
	Opportunities					

I.B. Engage Enterprise Leadership in Transformation – Transformation requires a significant modification to the business model of the enterprise. It is imperative that the enterprise leadership understands and buys into enterprise thinking because they will be required to create a vision for doing business, behaving, and seeing value in fundamentally different ways.

Diagnostic Questions	• **Do enterprise leaders and senior managers holistically understand *efficiency and value creation* at the enterprise level?** • **Do enterprise leaders and managers understand the benefits of cross-functional coordination and cooperation?** • **Do all senior leaders and management enthusiastically support transformation?** • **Is the transformation process being effectively coordinated across parts of the enterprise? Is enterprise leadership overseeing it?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.B.1	**Cultivate Enterprise Thinking among Leadership** *Leaders think holistically*	Lack of enterprise perspective leads to rigid boundaries that foster local optimization. C D	Leaders understand and promote the interaction and relationship across boundaries. C D	Leaders are working across boundaries, and their work is evaluated based on enterprise performance. C D	Leaders focus on enterprise-level value creation, and demonstrate "enterprise thinking" through their practices and behavior. C D	Leaders leverage the synergies across the extended enterprise for the benefit of all stakeholders. C D
	Indicators (Examples)	• A formal transformation education process for enterprise leaders has been established. • Majority of enterprise leaders have received significant exposure and education in enterprise transformation principles, practices, and behavior. • Enterprise leaders regularly apply and use lessons learned in "enterprise thinking". • Enterprise leaders contribute to the development/refinement of the body of knowledge about enterprise transformation.				
	Evidence					
	Opportunities					
I.B.2	**Obtain Senior Leadership Commitment** *Enterprise leadership personally lead transformation*	Level of commitment among senior leaders and management is variable – some endorse while others may actively resist. C D	Senior management buys into group commitment and engages in the transformation process. C D	Senior managers personally and visibly lead enterprise transformation. C D	Senior leaders are championing the transformation within the enterprise. C D	Senior leaders and management mentor and foster transformation champions internally and throughout the extended enterprise. C D
	Indicators (Examples)	• There is a consensus commitment supporting an enterprise transformation. • Enterprise leadership and management provide support and recognition for positive actions. • Senior leaders are champions in transforming the enterprise.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.B.3	**Establish Executive Coordination and Oversight** *Leaders choreograph the transformation*	Leaders recognize that strategic coordination and oversight is needed to support enterprise transformation. C D	The enterprise leadership team formally defines coordination and oversight roles and responsibilities. C D	Coordination and oversight functions are staffed and engaged with the enterprise leadership team. C D	The structure and processes for coordination and oversight of the transformation are operating effectively and being continually refined. C D	Coordination and oversight become intrinsic to the day-to-day actions and decisions of the enterprise leadership team. C D
	Indicators (Examples)	• Enterprise transformation council established and functioning. • Enterprise leadership team plays an integral role in orchestrating the transformation.				
	Evidence					
	Opportunities					

I.C. Understand Current Enterprise State – Understand how value is delivered to key stakeholders, define current enterprise state, and perform enterprise assessment.

Diagnostic Questions	• **Does the enterprise understand clearly how it currently delivers value to stakeholders?** • **Is a formal process used to explicitly determine "value to the stakeholder"?** • **Have the value streams of all stakeholders been mapped, integrated, and balanced?** • **Does the enterprise understand how material and information flow throughout the various elements of the enterprise?** • **Are enabling infrastructure processes being aligned to value stream flow?** • **Is leadership able to define the organization and business impact of servicing existing systems?** • **Is there knowledge and best practices sharing across servicing existing systems organizations within the enterprise?**

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.C.1	**Analyze Enterprise Processes and Interactions** *Understand process interdependencies*	There is no understanding or a limited understanding of the need for process mapping and analysis. The documented process flow differs from the actual flow. C D	Core enterprise processes are mapped and have been analyzed. C D	Mapping and analysis of current processes allows the identification of critical interactions. Significant opportunities for eliminating waste and creating value are identified and aligned with the strategic objectives. C D	Depth and breadth of knowledge of enterprise processes exposes interdependencies across the enterprise. C D	Continuously evolving enterprise processes and their interdependencies are evaluated across the extended enterprise. C D
	Indicators (Examples)	• The practice and language of process analysis (such as value stream mapping) are used to understand important enterprise processes. • Current value streams of major customers/product lines have been mapped, and hand-off points and interfaces clearly defined. • Enterprise leadership actively manages processes that have interactions across functions. • The revenue from servicing existing systems is quantifiable.				
	Evidence					
	Opportunities					
I.C.2	**Ensure Stability and Flow Within and Across the Enterprise** *Seamless flow of materials, information and resources*	Material and information flows are disjointed and "optimized" process-by-process. "Push" mentality prevails. C D	Some processes have been stabilized by reducing variability. C D	Processes are simplified and aligned to the value stream(s), which allows material, information, and resources to flow as required. Variability is actively managed to enable predictable flow of material, information, and resources. C D	Material, information, and resources flow seamlessly throughout the enterprise. Enterprise inputs are controlled in order to enable better flow and predictability of internal processes. C D	Actively working with extended enterprise to balance inputs to enterprise capabilities. Material, information, and resources flow seamlessly and responsively throughout the extended enterprise. C D
	Indicators (Examples)	• Information flows have been rationalized to assure interoperability among enterprise elements. • Material, information, and resource flow paths have been simplified and shortened to enhance flow. • Material, information, and resource flows are responsive to stakeholder needs.				
	Evidence					
	Opportunities					

I.D. Envision and Design Future Enterprise – Identify capabilities and deficiencies by defining enterprise vision, defining "To-Be" state, and performing gap analysis.

Diagnostic Questions	• **Do the enterprise leaders and stakeholders have a shared vision for the future of the enterprise?** • **Does a future enterprise design exist to guide the transformation process?** • **Is the enterprise designed to deliver value to all stakeholders?** • **Is organizational structure designed for flexibility and responsiveness to changes in the external environment?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.D.1	**Envision the Enterprise Future State** *Create a shared vision of the future enterprise*	Senior leaders have varying points of view regarding the future state of the enterprise. **C** **D**	Senior leaders have a common vision of the future state of the enterprise. **C** **D**	The enterprise vision has been communicated and is understood by most employees. **C** **D**	A common vision of the future state of the enterprise is understood by key stakeholders (e.g., customers, suppliers, etc.). **C** **D**	Stakeholders have internalized the enterprise vision and are an active part of achieving it. **C** **D**
	Indicators (Examples)	• A vivid description of the future enterprise includes processes, organization, information flow, interactions with stakeholders, etc. • The future enterprise vision considers the views of internal and external stakeholders. • The business case for servicing existing systems is understood by leadership.				
	Evidence					
	Opportunities					
I.D.2	**Architect the Future Enterprise** *Redesign enterprise to meet the shared vision*	Management understands that the present processes do not meet the future enterprise objectives. **C** **D**	A concept for the future enterprise has been created based on balanced stakeholder requirements. **C** **D**	Future enterprise processes have been developed and reflect future goals and satisfy stakeholder requirements. **C** **D**	Future enterprise processes are refined to accommodate a changing environment. **C** **D**	Future enterprise processes are refined to dynamically accommodate a changing environment across the extended enterprise. **C** **D**
	Indicators (Examples)	• The future enterprise processes reflect new and improved ways to realize value and minimize non-value adding activities. • Future enterprise designs have been generated and evaluated for the primary value stream(s) and their supporting processes.				
	Evidence					
	Opportunities					

I.E. Develop Enterprise Structure and Behavior – Organization infrastructure must be assessed and modified throughout the transformation to achieve the future state. Organizational structure, incentives, policies, and processes must be aligned and coordinated, eliciting the desired behavior to support the transformation and sustain the change.

Diagnostic Questions	• **Has an organizational structure been implemented that focuses on core processes along the customer value stream?** • **Are relationships with stakeholders based on mutual respect and trust?** • **Have policies and procedures been revised to promote and encourage enterprise behavior?** • **Have incentives been developed that are consistent with the behavior desired?** • **Has decision-making been delegated to the lowest practical level?** • **Is prudent risk taking encouraged?** • **Are change agents positioned and empowered to provide guidance and leadership for the transformation?** • **Is there employee perception that the career path within servicing existing systems is as strong as within new product development?** • **Do leaders encourage high-potential engineers to work in servicing existing systems?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.E.1	**Reconcile systems, policies, and vision** *Align systems and policies to the future vision*	Systems and policies are in conflict with each other and with desired enterprise behaviors. C D	Systems and policies that most closely relate to the strategic objective have been revised to remove barriers to achieving the enterprise vision. C D	Systems and policies have been defined, rationalized, and standardized to support the enterprise vision. C D	Enterprise systems and policies are designed to align with and support the achievement of the enterprise vision. C D	Enterprise systems and policies are fully aligned and drive the future vision. C D
	Indicators (Examples)	• Systems and policies and are consistently reviewed and adjusted to reflect only what is necessary. • Systems and policies are standardized throughout the enterprise to support desired behavior. • Example systems and policies include: contracting, information, program management, and human resources. • Cross-business and cross-functional mechanisms are in place to address service, which is trans-organizational multi-disciplinary.				
	Evidence					
	Opportunities					
I.E.2	**Align Performance Measurement System** *Performance measures drive enterprise behavior*	Performance measures are *ad hoc*, inconsistent, and focused on functional areas rather than the enterprise. C D	Many performance measures are being collected, but they do not allow adequate assessment of strategic goals. C D	Key measures have been selected to align with enterprise strategic goals. Performance measurement guidelines encourage reviewing metric selection regularly. C D	Performance measurement system uses a critical few measures tied to strategic objectives. Measures are available throughout the enterprise in a timely manner. C D	Measurement systems and target setting pulls performance improvement throughout the extended enterprise. Metrics evolve as the enterprise matures. C D
	Indicators (Examples)	• A balanced and minimal set of performance measures are used to track transformation progress. • Performance measures assure that local and enterprise measures are aligned.				
	Evidence					
	Opportunities					

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.E.3	**Align Incentives** *Reward the behavior you want*	There is sporadic use of incentives, and awareness that some incentives elicit localized optimization and harm interactions across functional boundaries. C D	Parts of the enterprise have implemented incentives that reward and encourage achieving enterprise goals by working across boundaries. C D	Executive compensation and employee incentives are linked directly to attainment of enterprise objectives. C D	Incentive systems successfully contribute to achievement and sustainability of enterprise objectives. C D	Enterprise incentives are deployed, with measurable success across the extended enterprise. High potentials and emerging leaders are encouraged to take roles in servicing existing systems. C D
	Indicators (Examples)	• Incentives include a balance of monetary rewards, non-monetary rewards and recognition to encourage transformation activity. • Incentives are based on performance measures that encourage transformation activity. • Incentives encourage local improvements that will benefit multiple processes and/or value steam performance. • Incentives encourage employees to work in servicing existing systems.				
	Evidence					
	Opportunities					
I.E.4	**Empower Change Agents** *Enable key people to inspire and enact change*	Change agents are sporadically distributed but do not have change authority. C D	There is formal identification of change agents, along with role definition, delegation of authority, definition of roles, and provision of training/education for all change agents. C D	Appropriately skilled change agents are assigned to key areas with the authority to effect changes. C D	Change becomes self-generating, initiated by employees as well as change agents. C D	Change agents are providing a critical resource of enterprise knowledge, skill and experience in transforming the extended enterprise. C D
	Indicators (Examples)	• Change agents have been designated and empowered. • Change agents operate throughout all areas and cross-transfer transformation implementation experience. • Process for developing transformation process owners and other change agents has been established.				
	Evidence					
	Opportunities					
I.E.5	**Promote Relationships Based on Mutual Trust** *"Win-win" vs. "we-they"*	Relationships tend to be determined by organizational role, resulting in a "we-they" perspective. C D	Selective application of an enterprise perspective results in breaking down of organizational barriers and developing mutual trust. C D	Stable and cooperative relationships exist across the enterprise; cooperative relations are established with some enterprise partners. C D	Mutual respect and trust exists across the extended enterprise with equitable sharing of benefits from continuous improvement initiatives. C D	Stakeholders modify behavior so as to enhance extended enterprise performance (win-win). C D
	Indicators (Examples)	• Communication barriers based upon organizational position have been significantly reduced. • Stable and cooperative relationships exist with most enterprise stakeholders.				
	Evidence					
	Opportunities					

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.E.6	**Establish Open and Timely Communications** *Right information at right time*	Communication is largely top-down, limited, and lagging. C D	Basic communication mechanisms are employed but are not uniform; communication strategy is under development. C D	Enterprise leaders are accessible and visible, developing two-way communications in open, concise, and timely manner. C D	Communication processes are undergoing continuous refinement and information is exchanged or can be pulled as required. C D	Comprehensive system of two-way communication is employed throughout the extended enterprise. Knowledge sharing activities and communities of practice are leveraged among in-service groups. C D
	Indicators (Examples)	• Open and timely communications exist among stakeholders, i.e., regular meetings with employees, newsletters, etc. • Technology has been leveraged to speed communications flow and accessibility while filtering unnecessary communications. • Employee input is valued and plays a key part in decision-making.				
	Evidence					
	Opportunities					
I.E.7	**Empower Employees** *Decision-making at lowest possible level*	Centralized decision-making occurs in a hierarchical structure with limited delegation of authority. C D	Appropriate structure and training is being put in place to enable empowerment. C D	Organizational environment and management system supports limited decision-making at point of use. C D	Decision processes are continually refined to promote increased accountability and ownership at point of use. C D	Decision-making across the extended enterprise is delegated to the point of use. C D
	Indicators (Examples)	• Managers and supervisors serve as mentors and educators, promoting lower level decision-making. • The extent and types of empowerment are tailored to match the environment and people empowered. • Empowerment enables swift and effective decision-making closest to the point of use.				
	Evidence					
	Opportunities					
I.E.8	**Encourage Innovation** *From risk aversion to risk rewarding*	Innovation initiatives are sporadic and *ad hoc*; security, stability, and risk aversion drive most decision-making. C D	Initial efforts are under way to develop systems, processes, and procedures for fostering innovation. C D	Innovation initiatives are under way in selected areas; measures for assessing impact are in use. C D	Innovation initiatives are flourishing across the enterprise; prudent risk taking is encouraged and rewarded. C D	A comprehensive innovation program is implemented and positive results recognized across the extended enterprise. C D
	Indicators (Examples)	• The review process for suggestions has been streamlined and gives clear visibility of the progress of each suggestion. • Suggestion programs have been properly incentivized to give recognition to originators of innovative ideas.				
	Evidence					
	Opportunities					

I.F. Create Transformation Plan - Identify, prioritize, and sequence a comprehensive set of transformation initiatives that collectively constitute the plan for achieving the desired transformation.

Diagnostic Questions	• **Is the enterprise level transformation plan prioritized and aligned with strategic objectives?** • **Has the transformation plan been communicated and adopted throughout the enterprise?** • **Is the progress of transformation being showcased and discussed at all levels of the enterprise?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.F.1	**Create Enterprise-Level Transformation Plan** *Chart the course across the extended enterprise*	Individual planning efforts are mostly bottom-up initiatives with little priority or coordination established at enterprise level. C D	Enterprise-level planning identifies transformation projects, which are prioritized to meet short- and long-term strategic objectives. C D	Enterprise improvement plans are coordinated and prioritized across enterprise value stream(s) with a timeline for expected measurable results. C D	Transformation plan is continuously refined through learning from implementation results and changing strategic requirements. C D	Transformation plan balances mutual benefits of stakeholders across the extended enterprise. C D
	Indicators (Examples)	• A process is in place to incorporate lessons learned into the enterprise-level transformation plan. • The milestone targets of the transformation plan are broken down by section and deployed across the enterprise. • Plans balance short- and long-term stakeholder objectives for the best overall solution.				
	Evidence					
	Opportunities					
I.F.2	**Communicate Plan** *Communicate transformation efforts across the enterprise*	Details (e.g., vision, objectives, projects) of the transformation plan are not known at all levels of the enterprise. C D	Senior enterprise leadership presents the transformation plan, but some or all of the following emerges: only few stakeholders understand the plan, behavior of some enterprise leaders does not support the plan, stakeholders doubt successful outcome of transformation. C D	Enterprise leaders clearly and regularly explain the transformation plan to enterprise stakeholders and demonstrate its implementation through behavior and examples. C D	All communication channels existing in the enterprise (e.g., company newsletters, management meetings, training courses, etc.) are used to discuss the transformation plan and progress of its implementation. C D	All enterprise stakeholders understand the transformation plan, actively participate in its implementation and promote the plan within and outside the enterprise. C D
	Indicators (Examples)	• Multiple communication channels (e.g., staff meetings, newsletters, speeches, etc.) regularly provide examples of implementation of the transformation plan throughout the enterprise. • Enterprise employees and other stakeholders at various levels explain and promote the transformation plan through media and events (e.g., meetings with clients, conferences, interviews, etc.).				
	Evidence					
	Opportunities					

I.G. Implement and Coordinate Transformation Plan – Flow down the enterprise-level plan into specific actions, programs, and projects that are executed within each process organizational area and determine how they are integrated at the enterprise level.

Diagnostic Questions	• **Has the enterprise level transformation plan been translated into detailed execution projects?** • **Has a uniform system been established to track the progress of transformation initiatives with respect to the overall plan?** • **Do transformation initiative plans contain a feedback mechanism for revision and for sharing lessons learned?** • **Have adequate resources been provided to facilitate transformation?** • **Does the current education and training program adequately support the strategic direction(s) and transformation?**

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.G.1	**Develop Detailed Plans Based on the Enterprise Plan** *Coordinate transformation efforts*	Improvements are generally optimized for individual areas and employees cannot clearly see the links between localized and enterprise goals. C D	Most employees understand key goals of the enterprise transformation plan. Process owners are involved in developing detailed plans linked to the goals/strategic objectives of the enterprise plan. C D	Detailed transformation plans supporting the enterprise level plan are developed and coordinated across processes. C D	Detailed transformation plans accounting for any interdependencies are refined and integrated across the enterprise. Best practices are shared. C D	Implementation plans from extended enterprise are coordinated with and support the transformation plan. C D
	Indicators (Examples)	• Detailed implementation plans are aligned to milestone targets of the enterprise-level plan. • A process is in place to incorporate lessons learned in detailed implementation plans. • Detailed improvement plans are coordinated throughout the enterprise where shared implications exist.				
	Evidence					
	Opportunities					
I.G.2	**Commit Resources for Transformation Efforts** *Resource the transformation*	Few or no resources are provided for process improvement or waste elimination. C D	Limited enterprise-level resources are committed and often applied to the symptom rather than the root cause. C D	Resources are allocated as required for execution of the transformation plan and prioritized across the value stream. C D	A pool of earmarked resources is provided for transformation initiatives with minimal justification required. C D	A pool of earmarked resources is provided for transformation initiatives across the extended enterprise. C D
	Indicators (Examples)	• Resources are committed to support the level and speed of transformation required. • Time to build on improvements through personal contribution is given at all levels. • The procedure to apply for improvement resources has been simplified and gives priority to improvements that benefit multiple areas.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.G.3	**Provide Education and Training** *Continuous enterprise learning develops transformation capabilities*	Education and training programs are not coordinated with the transformation plan and needs. C D	Education and training focuses on just-in-time delivery of skills required for specific transformation projects. C D	Education and training program is comprised of a balanced and sequenced set of elements to support the coordinated transformation plan. C D	An evolving education and training program is used across the enterprise in support of transformation efforts. A common vocabulary results from a standardized approach. C D	Education and training, as a part of human capital development program, focuses on skills and capabilities that support the upcoming needs of the extended enterprise transformation plan. C D
	Indicators (Examples)	• Education and training programs, including refreshers, are provided on a just-in-time basis for the needs of specific transformation projects. • Education and training curriculum supports varying levels of skill necessary for transformation efforts. • A common vocabulary for transformation is used across multiple sites of the enterprise. • A common education and training program facilitates successful transformation efforts and continuous enterprise learning.				
	Evidence					
	Opportunities					
I.G.4	**Track Detailed Implementation** *Assess actual outcomes against goals*	Results of process improvement initiatives are observed but not quantified. C D	Process is under development to permit tracking and quantification of progress of the detailed implementation. Data from some projects is being reviewed. C D	There is a project management process implemented to track progress of detailed transformation projects against milestones and feedback is provided to enterprise level. Appropriate corrective action is initiated within individual projects. C D	The project management process can readily assess detailed plans and can accommodate revisions mandated by changes to the enterprise level transformation plan. C D	The project management process is deployed across the extended enterprise to enable real-time tracking. C D
	Indicators (Examples)	• Transformation initiatives are coordinated and tracked, and the individual results are "rolled up" and assessed against enterprise-level milestones and targets. • The responsibility and accountability for improvement success is assigned locally to enable fast corrective action on deviations from the plan. • Changes to processes/value stream map(s) are documented and updated regularly.				
	Evidence					
	Opportunities					

I.H. Nurture Transformation and Embed Enterprise Thinking – Successful execution of enterprise implementation plan forms the basis for further improvement. The improvement process is monitored and nurtured, lessons learned are captured, and improved performance becomes a strong driving force for future strategic planning by enterprise executives.

Diagnostic Questions	• **Are guidelines for continuous improvement sufficiently developed for effective facilitation of enterprise-wide transformation plans?**
	• **Are enterprise participants being challenged to build on and sustain existing improvements?**
	• **Are senior managers actively involved in monitoring progress of enterprise transformation implementation at all levels?**
	• **Is appropriate support and encouragement being provided to all participants in the transformation process?**
	• **Are lessons learned being captured in a consistent, systematic manner?**
	• **Have lessons learned and best practice been effectively incorporated within transformation planning?**
	• **Are transformation implementation results impacting strategic planning?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.H.1	**Monitor Transformation Progress** *Assess progress toward achieving enterprise objectives*	Enterprise leaders are not actively involved in the review of overall transformation plan progress. C D	Transformation implementation plan progress is reviewed against enterprise level milestones and success criteria, for some projects. C D	Enterprise leaders use a formal methodology to analyze the overall progress of all transformation projects. Projects are adjusted based on learning. C D	Aggregated review across transformation projects permits reallocation of resources and adjustment of plans to ensure ongoing alignment with strategic objectives. C D	Transformation progress is collaboratively monitored throughout the extended enterprise. The transformation plan is proactively adjusted to achieve outcomes for extended enterprise. C D
	Indicators (Examples)	• Enterprise transformation progress is judged by the aggregate benefits rather than individual or localized improvements. • Enterprise leaders actively participate in monitoring implementation progress and addressing deficiencies within the transformation plan. • Transformation project progress reviews are documented in a common format and disseminated. • There is a standard process for tracking and modifying transformation efforts				
	Evidence					
	Opportunities					
I.H.2	**Nurture the Transformation** *Engage executives*	There is minimal support for the transformation effort from enterprise leadership. C D	Some members of enterprise leadership and management are providing encouragement, support, and recognition of the transformation. C D	Enterprise leaders and managers actively seek to identify and remove barriers to transformation. Teams and individuals who successfully implement improvements are recognized and rewarded. C D	There is enthusiastic encouragement of the transformation by enterprise leaders, managers, and other members of the organization. C D	Enterprise leaders are continuously in tune with the pulse of transformation and proactively inspire transformation ownership throughout the extended enterprise. C D
	Indicators (Examples)	• Enterprise leadership and management actively support and are involved in ensuring the success of improvement projects. • Positive actions and the effort taken are recognized and rewarded even if improvements are not fully successful. • To track and incentivize improvement enterprise records include information about improvement projects and outcomes.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.H.3	**Capture and Diffuse Lessons Learned** *Build from success; learn from failure*	Lessons learned from transformation activities are not documented and reside only in the memory of participants. C D	Lessons learned in some areas are documented and maintained, but are not readily accessible throughout the enterprise. C D	A formal process for readily capturing and communicating lessons learned is being applied. Employee contributions are actively sought. C D	Lessons learned are consistently captured, communicated and regularly used in a structured manner. An enterprise knowledge base exists. C D	A formal knowledge management process is adopted. Lessons learned are routinely and explicitly incorporated into the formulation of new initiatives. C D
	Indicators (Examples)	• Best practices, suggestions, and lessons learned are maintained in a concise and clear standard format. • A formal process has been established throughout the enterprise for capturing and reusing lessons learned. • Lessons learned are periodically reviewed to maintain relevance of information kept.				
	Evidence					
	Opportunities					
I.H.4	**Impact Enterprise Strategic Planning** *Results lead to strategic opportunities*	Results of transformation efforts are not fed back to strategic planning process. C D	Benefits of transformation efforts are beginning to influence the strategic planning process. C D	Enterprise leadership actively considers impact of transformation efforts on the strategic plan. C D	Current and forecasted improvements from transformation efforts are incorporated into enterprise planning and budgeting decisions. C D	Enterprise leadership leverages current and forecasted results of transformation efforts for the creation of new strategic opportunities. C D
	Indicators (Examples)	• Overall enterprise performance reflects improvements resulting from transformation efforts. • Strategic planning makes allowance for anticipated gains from transformation improvements. • Gains realized from the transformation are leveraged to achieve strategic objectives.				
	Evidence					
	Opportunities					
I.H.5	**Embed Enterprise Thinking Throughout the Organization** *Enterprise perspective is ingrained*	Actions are informed only by local considerations. C D	An enterprise culture has been established that enables people to think beyond local considerations. This is reflected in action to some degree. C D	Enterprise leadership is actively engaged in promoting, mentoring, and incentivizing cross-boundary action throughout the enterprise. C D	An enterprise perspective is visible in decisions and actions at all levels of the enterprise. C D	An enterprise perspective is ingrained in the day-to-day decisions and actions of enterprise stakeholders. C D
	Indicators (Examples)	• Enterprise thinking is both verbalized and enacted. • An environment exists that supports considerations beyond local organization boundaries. • Training and/or management help foster a sense of place within the broader enterprise. • Actions (and consequences) span boundaries. Appropriate incentives are defined at the right level. • Leaders and managers translate the vision so it is understandable and applicable at all levels of the enterprise.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
I.H.6	**Institutionalize Continuous Improvement** *Systematic approach for improvement*	Improvement initiatives are *ad hoc* and not data driven. C D	An improvement process for the enterprise is broadly defined and being selectively applied. C D	A systematic, structured methodology for continuous improvement and value creation is developed and deployed across many areas. C D	A structured continuous improvement process is deployed at all levels across the enterprise and uses value analysis to target improvements. C D	A structured continuous improvement process is fully ingrained throughout the extended enterprise. C D
	Indicators (Examples)	• A consistent improvement/transformation approach is implemented and sustains improvements gained. • The continuous improvement process challenges people to tackle the root cause rather than the symptom. • Enterprise principles are being applied to most enterprise systems and processes using lessons learned.				
	Evidence					
	Opportunities					

LESAT Maturity Matrices

Section II: Lifecycle Processes

II.A. Align, Develop and Leverage Enterprise Capabilities

II.B. Optimize Network-Wide Performance

II.C. Incorporate Downstream Customer Value into the Enterprise Value Chain

II.D. Actively Engage Upstream Stakeholders to Maximize Value Creation

II.E. Provide Capability to Monitor and Manage Risk and Performance

Lifecycle processes are defined by the product lifecycle from initial conception through operational support and ultimate disposal. These processes directly determine the value provided to customers and stakeholders. How successfully an enterprise connects these processes to stakeholder value is a measure of its effectiveness and efficiency. Enterprise leadership provides the direction and resources to break down the barriers among and within the lifecycle processes that result in wasted resources and reduced value to customers and stakeholders. This section assesses the level of enterprise thinking and value creation demonstrated in the enterprise lifecycle processes.

Unlike in Section I and Section III, enterprise practices are assessed at different stages throughout the lifecycle process. Although these practices are important enterprise-wide practices, the level of maturity may vary between activities in the lifecycle process. As a result the five lifecycle practices must be scored for each of seven lifecycle activities:

1. Program Management
2. Requirements Definition
3. Product Development
4. Supply Chain Management
5. Production
6. Distribution and Sales
7. Servicing Existing Systems/operations

The glossary lists the specific steps in each lifecycle activity.

SECTION II – LIFECYCLE PROCESSES

Definition: Implement effective practices across the lifecycle for defining customer requirements, designing products and processes, managing the supply chain, producing products, distributing products and services, and servicing existing systems/operations.

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.A	**Align, Develop, and Leverage Enterprise Capabilities** *New opportunities build upon enterprise-enabled capabilities and lead to development of new ones*	Capabilities are understood only within individual enterprise elements. Improvements are *ad hoc* and focused on individual competencies. There is little apparent match between capabilities and enterprise strategy.		Potential opportunities arising from core capabilities have been recognized and acted upon within individual enterprise elements. Capabilities of individual enterprise elements are partially visible to the whole enterprise.		Capabilities of individual enterprise elements are understood and used across the enterprise. Enterprise strategy leverages existing capabilities.		Capabilities are integrated and enhanced across the enterprise with the focus on achieving an optimal combination of core competencies that are aligned with enterprise strategy to create competitive advantage.		Strategic plans and enterprise capabilities are dynamically aligned to ensure efficient creation of value for enterprise stakeholders over the entire product lifecycle. In-service groups are part of the proposal and capture effort for opportunities on new and existing systems.	
II.A.1	**Program Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• The portfolio of programs is a balanced reflection of the full range of core enterprise capabilities. • The program selection and management process benefits from knowledge of the competitive environment to identify and exploit opportunities arising from the enhanced capabilities of the enterprise.									
	Evidence										
	Opportunities										
II.A.2	**Requirements Definition**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Product and lifecycle requirements are defined in a clear and concise manner, based on needs of different stakeholders, the competitive environment, and capabilities existing across the enterprise.									
	Evidence										
	Opportunities										
II.A.3	**Product Development**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• The product development process realizes the enterprise strategy by delivering product designs that are timely and relevant. • The development process and product designs leverage distinctive enterprise capabilities.									
	Evidence										
	Opportunities										
II.A.4	**Supply Chain Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• The supplier network is defined and developed in line with the strategic plan and is flexible to quickly adapt to changing requirements and unanticipated disruptions. • Supplier expertise and capabilities complement core enterprise capabilities.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.A.5	**Production**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Production capability constitutes a major consideration in enterprise-level, long-term strategic planning.									
	Evidence										
	Opportunities										
II.A.6	**Distribution and Sale**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• There is constant feedback between demand and supply elements across the extended enterprise. • Customer needs for the delivery of products and customer support services are anticipated in enterprise strategic plans and fulfilled by adaptation and extension of capabilities already provided.									
	Evidence										
	Opportunities										
II.A.7	**Servicing Existing Systems**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Servicing existing systems is viewed as a core enterprise-level capability across the extended enterprise. • The after-market lifecycle follows fairly close to a traditional problem solving cycle – clear problem definition, good root cause analysis, solution option development, evaluations, and decision/agreement/authorization. • A holistic perspective is key to modifications of in-service systems: Understanding that the system is the In-service System – not the piece being modified.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.B	**Optimize Extended Enterprise Performance** *Breaking down functional silos enables seamless communication and value flow*	Utilization of resources (incl. people, assets, equipment, materials, etc.) is optimized within individual enterprise elements. There is no or little consideration of the values, competencies, processes and practices of other enterprise elements.		There is evidence of *ad hoc* cooperation between enterprise elements to eliminate waste and share resources. Key resources are narrowly guarded within enterprise elements. Improvements focus on local cost reduction.		Common objectives, responsibilities and points of interaction are established and communicated within the enterprise. Enterprise employs processes that leverage capabilities and balance allocation and sharing of resources with the focus on overall lifecycle implications.		Processes are optimized and synchronized across the enterprise. Cooperation among individual enterprise elements emphasizes high degree of resource-, information-, benefit-, and risk-sharing.		Enterprise processes are seamlessly integrated both internally and with the upstream and downstream stakeholders. They are dynamically optimized to ensure efficient value creation, build durable competitive advantage, and create flexibility and responsiveness to shifts in the marketplace.	
II.B.1	**Program Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Resources, personnel, and skills are continuously balanced across the portfolio of projects and programs, to aid maximum re-use and sharing of knowledge. • Program teams are composed of personnel with multi-disciplinary skills and expertise relevant to the program. • Resources and skills are easily and quickly shifted or divested to balance requirements across all program development efforts. • The after-market service organization participates in design and requirements development. They have approval rights, not just an input role.									
	Evidence										
	Opportunities										
II.B.2	**Requirements Definition**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• There is a process in place to determine clear and concise product and lifecycle requirements, based on needs of different stakeholders/customers. • Requirements are defined based on inputs from a range of stakeholders and reflect the multi-disciplinary nature of the project or program. • The requirements definition benefits from knowledge and previous experience available across the enterprise. Whenever possible requirements are re-used.									
	Evidence										
	Opportunities										
II.B.3	**Product Development**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Suitability and timing of design information released is matched to the requirements of subsequent processes. • Product and production processes are developed in tandem to ensure seamless integration of product flow both internally and across the extended enterprise. • There processes to pass what manufacturing engineering is learning to in-service engineering groups and vice versa. These processes are regularly used by employees; they are effective in knowledge sharing, and the knowledge sharing has resulted in changes. • • Engineering should not tailor out processes related to servicing or supportability under cost pressures during development.									
	Evidence										
	Opportunities										
II.B.4	**Supply Chain Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Production and delivery are synchronized throughout the supplier base to ensure continuous flow, with minimal waste. • Formal processes are in place for supplier assessment and approval. • Roles and responsibilities are clearly defined in contractual relationships, and the allocation of risks and rewards are acknowledged and agreed upon.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.B.5	**Production**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Work is performed only when "pulled" from subsequent "customers" in the value chain. • Product flow optimization has created stability and variation reduction in production allowing for in-process inventory levels to be decreased.									
	Evidence										
	Opportunities										
II.B.6	**Distribution and Sale**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Product distribution is reliable and timely and allows customers to pull products to the point and time of use. • Deliveries are synchronized to minimize goods in transit and to ease transportation requirements. • Point of use delivery to customers with minimal receipt validation has become a core competency.									
	Evidence										
	Opportunities										
II.B.7	**Servicing Existing Systems**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• The impact to serviceability after production stops is anticipated and supported by the extended enterprise. • Field support engineers are deployed with the product to ensure maintenance is performed efficiently and effectively.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.C	**Incorporate Downstream Customer Value into the Enterprise Value Chain** *Consideration of customer value drives enterprise behavior*	Customer needs are considered only at the beginning of the development process. Products and processes may be revised later in reaction to customer demand.		Customer feedback and product usage data are collected to inform product lifecycle decisions and improved value delivery.		Feedback is continuously collected from customers and other downstream stakeholders. Timely and regular review of the feedback enables improved product and process performance.		Downstream stakeholders are actively involved in enterprise processes to jointly improve the effectiveness and quality of products and processes flowing through the value chain.		The voice of customer is engrained in the extended enterprise culture. The enterprise plays an integral in the customer's business solution. Both current and future decisions proactively reflect customer values.	
II.C.1	**Program Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Program management actively adjusts the program based on changing downstream stakeholder needs and allows the stakeholders to make informed decision regarding the program (e.g., cost/benefit tradeoffs for changing requirements, renewal or extension of budgets, etc.). • The mindset is focused on optimizing the product support structure. Maintenance costs are always factored in. Metrics include customer satisfaction surveys and repeat business.									
	Evidence										
	Opportunities										
II.C.2	**Requirements Definition**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Customer feedback is actively sought and provided as input to the requirements definition process. • A knowledge base of product usage, maintenance, and disposal data is maintained and extensively used to establish future requirements definitions. • The enterprise conducts operational analyses of the in-service part of the lifecycle. • The concept of operations (CONOPS) for in-service support is developed. It influences design architecture and requirements.									
	Evidence										
	Opportunities										
II.C.3	**Product Development**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Customer inputs are sought and used actively throughout the development process. Designs satisfy customer value requirements without unnecessary functionality. • Customers, specialty engineering, and in-service groups are formally represented on Integrated Product Teams. • Downstream issues and processes are actively considered in the design process to ensure manufacturability, assembly, serviceability, and cost implications. • Prototypes are built to support in-service maintenance and operations.									
	Evidence										
	Opportunities										
II.C.4	**Supply Chain Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Suppliers receive and act on the detailed information about product demand and design iterations with sufficient lead time.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.C.5	**Production**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Production capacity and capabilities are aligned with current and future customer orders. • Defect free and on demand production maximizes customer value, by enabling on-time reliable product delivery.									
	Evidence										
	Opportunities										
II.C.6	**Distribution and Sale**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Product delivery and support systems are standardized and regularly reviewed against customer feedback. • Customer feedback is proactively collected and used to enhance product value and predict any emerging service issues. • Solutions to product and servicing issues are coordinated throughout the extended enterprise to find fast, cost-effective solutions. • Sales personnel are familiar with the maintenance and support costs. Product support design aspects are evident in marketing and sales artifacts. • In-service teams have an in-depth understanding of the supply chain architecture and maintenance CONOPS that the customer is using in order to design any field repair approaches.									
	Evidence										
	Opportunities										
II.C.7	**Servicing Existing Systems**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Service personnel view user innovation and product modification positively and share this information with product development and document the underlying customer need revealed. • Technical documentation is readily available and easy to understand, or technical documentation is not necessary since the product is intuitive enough that maintenance is as easy as operation. • The extended enterprise is committed to mission support excellence and incentives are aligned with downstream stakeholders.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.D	**Actively Engage Upstream Stakeholders to Maximize Value Creation** *Integrating upstream stakeholders allows value to flow seamlessly to customer*	Enterprise elements focus on internal capabilities. Earlier (upstream) lifecycle decisions, knowledge, and capabilities have little influence. Enterprise elements are reactive, acting only once the upstream outputs have been received.		Enterprise elements informally incorporate upstream stakeholders' knowledge and capabilities. Communication lines are established to allow exchange of relevant information.		There is substantial integration and knowledge sharing with upstream stakeholders. Multi-functional teams include some upstream disciplines and key suppliers. This allows enterprise elements to proactively respond to the needs of upstream stakeholders.		Upstream stakeholders are integrated into planning, design and manufacturing. Upstream priorities are quantified early in the product and process design, and used for evaluation and improvement. Real-time collection and dissemination of data occur throughout the value chain.		A common purpose and strategy permeates the extended enterprise. Seamless communication, knowledge sharing, and behavior allow maximization of customer value.	
II.D.1	**Program Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Programs are actively coordinated with contractors and suppliers to ensure timely implementation and proper allocation of workload and resources.									
	Evidence										
	Opportunities										
II.D.2	**Requirements Definition**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Stakeholder feedback is actively sought and provided as input to the requirements definition process. • Product and process requirements reflect capabilities of relevant upstream stakeholders.									
	Evidence										
	Opportunities										
II.D.3	**Product Development**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Product development incorporates innovation, knowledge, and technology from previous projects, suppliers, and the extended enterprise. • Metrics include product performance and customer follow-on contracts.									
	Evidence										
	Opportunities										
II.D.4	**Supply Chain Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Long-term collaborative relationships with suppliers are established and maintained whenever possible. • Processes to facilitate sharing and transfer of innovation, knowledge and technology are deployed. • A mutually beneficial continuous improvement process is established throughout the supplier network over the entire product lifecycle. Reliability and logistics requirements are flowed to suppliers. • The maintenance or in-service department communicates to suppliers when failure analysis reveals that a supplier manufacturing process could be modified to prevent failures in the field. • Manufacturing and in-service engineering personnel have defined coordination mechanisms to deal with issues. Metrics include sub-contract satisfaction surveys, award fees, overruns, and number of late deliveries.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.D.5	**Production**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Production processes incorporate knowledge, technology, and capabilities of upstream stakeholders. • Production has accurate and timely information about incoming components and materials to guide setting capacity and schedules.									
	Evidence										
	Opportunities										
II.D.6	**Distribution and Sale**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Customer orders reflect production schedule and capacity. • Post-delivery support services incorporate knowledge of suppliers' product and technology in order to deliver prompt and needed service. • Coordination between post-delivery support services and production/stakeholders ensures appropriate supply of needed components to customers throughout the product life.									
	Evidence										
	Opportunities										
II.D.7	**Servicing Existing Systems**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• The enterprise has the ability to perform obsolescence buys sufficiently in advance. Supplier decisions to discontinue a part do not come as a surprise. • The extended enterprise is committed to mission support excellence and incentives are aligned with upstream stakeholders.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.E	**Provide Capability to Monitor and Manage Risk and Performance** *Integrated performance management enables better enterprise decision-making*	Each enterprise elements manages its performance as an independent entity.		There is a management system to monitor and control performance. Regular reviews focus on schedule, budget and quality within individual enterprise elements.		Regular progress reviews assess performance (schedule, budget and quality) and risks within individual enterprise elements. Corrective actions are taken as necessary to manage risks. Common metrics are established and shared across enterprise elements.		Regular progress reviews assess performance and risks across enterprise elements resulting in appropriate corrective actions. Common metrics are used across enterprise elements.		Integrated risk and performance management system is used to optimize enterprise performance across the value chain.	
II.E.1	**Program Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Programs and processes are regularly reviewed throughout the lifecycle, and review information is used to inform corrective actions when necessary. • Programs and processes are reviewed in the context of the larger portfolio to optimize portfolio performance. • A risk management process is fully integrated across the enterprise and transparent to decision makers. • A small program office is retained during sustainment and augmented as needed.									
	Evidence										
	Opportunities										
II.E.2	**Requirements Definition**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Requirements specify an acceptable range for clearly measureable outcomes that allow requirements to be evaluated at different stages throughout the lifecycle. • The resource requirements, in terms of cost, schedule, manpower, facilities, and other resources, are formulated during the requirements definition process allowing for trade-offs to be considered. • The requirements are available and maintained as changes occur. • Reliability and logistics requirements are critical parameters. • For existing or long term systems, reliability and maintainability requirements are developed based on failure modes analysis.									
	Evidence										
	Opportunities										
II.E.3	**Product Development**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Progress monitoring uses appropriate measures throughout product development allowing proactive tracking of product requirements realization. Monitoring allows early identification of problems and need for re-work. • Progress measures are visible to downstream stakeholders allowing for plans to be adjusted according to shift in product development schedules.									
	Evidence										
	Opportunities										
II.E.4	**Supply Chain Management**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Enterprise performance measures are visible to suppliers fostering relationship of mutual trust and allowing suppliers to set and adjust their plans and processes. • Enterprise risk and performance management system accounts for risks and performance of suppliers.									
	Evidence										
	Opportunities										

EP #	Enterprise Practices	Capability Levels									
		Level 1		*Level 2*		*Level 3*		*Level 4*		*Level 5*	
II.E.5	**Production**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Production monitoring informs downstream stakeholders, including marketing, sales, and customers, about the production queue, schedule, volume, potential risks, and delays. • The results of Design for Manufacturing and Design for Serviceability efforts are evident in the product.									
	Evidence										
	Opportunities										
II.E.6	**Distribution and Sale**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• Continuous sharing of production, sales, and distribution data allows current and future capacity and capabilities to be aligned with demand. • Delivery information is accurate and visible to customers allowing them to set realistic expectations and avoid buffer stocks. • Risks and uncertainties are identified, modeled and mitigated throughout the enterprise to ensure timely delivery. • Metrics include increasing sales and distribution duration reduction.									
	Evidence										
	Opportunities										
II.E.7	**Servicing Existing Systems**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**	**C**	**D**
	Indicators (Examples)	• In-service groups are incentivized toward follow-on customer contracts. These metrics are shared with the extended enterprise for visibility, trust, and a common goal.									
	Evidence										
	Opportunities										

LESAT Maturity Matrices

Section III: Enabling Infrastructure

III.A. Organizational Enablers

III.B. Process Enablers

Enabling infrastructure supports the execution of enterprise leadership and lifecycle processes. These enabling processes provide the means for managing the resources to the organizations they serve as internal customers. Because they enable, rather than directly result, in enterprise success, they can be easily overlooked as a source of waste. Waste that is inherent in these processes can, however, negatively impact the enterprise as a whole in a way that is not clearly evident. This section addresses the level of transformation support provided by the Enabling Infrastructure.

SECTION III - ENABLING INFRASTRUCTURE

Definition: To achieve a successful enterprise transformation, the organization's infrastructure must enable other enterprise processes to achieve their transformation goals and objectives.

III.A. Organizational Enablers – The support units of an enterprise must themselves become efficient in executing their assigned function. In some cases, they must also redefine what they do to support effective implementation within the life cycle processes and the transformation/leadership processes.

Diagnostic Questions	• **Do the finance and accounting measures support enterprise transformation?** • **How well have the financial and accounting systems been integrated with non-financial measures of value creation?** • **Can stakeholders retrieve performance information as required?** • **Are human resource practices reviewed to assure that intellectual capital matches needs across the enterprise?** • **Are the information technology systems compatible with stakeholder communications and analysis needs?** • **Do processes minimize environmental impact?**

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
III.A.1	**Enterprise Performance Measurement System Supports Enterprise Transformation** *Transformation requires appropriate measurement*	Performance (e.g., financial, productivity, deliveries, innovation, etc.) is measured at the local rather than enterprise level. Measures are subjective in nature and data integrity is low. C D	Initial efforts are under way to adapt or modify performance measurement systems to compensate for the inadequacies of the scope or scale of the existing system. Data are objective. C D	Performance measurement system provides data to support and enable transformation at the enterprise level. C D	Performance measurement system scope is expanded to integrate with non-traditional measures of value creation (e.g., intellectual capital, balanced scorecard, etc.). C D	Performance measurement systems provide seamless information exchange across the extended enterprise and emphasize value creation for all stakeholders. Frameworks exist for assessing the performance of the enterprise, and metrics are continuously refreshed. C D
	Indicators (Examples)	• Measures that conflict with enterprise transformation activity are no longer used to measure progress and performance. • Enterprise performance measurement system handles a balanced set of financial and non-financial measures to assist decision-making. • Enterprise performance measurement system has been overhauled to ensure fast and efficient processing of information as required.				
	Evidence					
	Opportunities					

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
III.A.2	**Enterprise Stakeholders Pull Required Metrics** *Data on demand*	Lagging performance measures are reported through regularly scheduled standardized reports. What is shared may not be relevant or actionable. Specific requests for measures require extraordinary (often manual) effort. C D	Internal users actively provide traditional performance information to assist users in planning and programming activities. Emphasis is on metrics that indicate progress or activities (i.e., project status, number of initiatives, etc.) but ignore outcomes. C D	Internal users are able to directly access and use performance information to make trade-off decisions. There is a blend of progress and outcome measures. C D	Internal users are able to pull performance and other value creation information to support decision analysis in the format desired. External partners have access to the necessary metrics to support continuous improvement. Emphasis is on outcome metrics (productivity, cost reduction, etc.) rather than progress metrics. C D	Stakeholders across the extended enterprise generate and share timely enterprise performance data. Data reflect extended enterprise results. C D
	Indicators (Examples)	• Financial and performance measurement data can be accessed as needed in user-defined format. • Financial information can be extrapolated to forecast outcomes. • Enterprise performance measurement system provides up to date information on request and constantly refreshes information needs.				
	Evidence					
	Opportunities					
III.A.3	**Promulgate the Learning and Sharing Organization** *Learning and Sharing Organizations create a versatile workforce*	The human resources processes concentrate on recruiting, placement, and benefits. Personnel training is *ad hoc* and not responsive to organizational needs. C D	A well-defined personnel development process, aligned with organizational needs, is applied for selected employees. Training is not a high priority. C D	Personnel development process is extended to all employees and incorporates the anticipated future needs of the transforming enterprise. Resources and facilities are dedicated for learning. C D	A learning climate is promoted within the enterprise through ready access to information and input to strategy/policy making. Opportunities for extending learning experiences are provided. C D	A learning climate is promoted throughout the extended enterprise by the sharing of capabilities, knowledge, skills, and best practice. Continuous learning is a key element of employee performance appraisals. C D
	Indicators (Examples)	• Intellectual capital is regarded as a corporate asset. • Employees have individual training plans that are aligned to the current and projected skill base requirements. • Employees actively capture and incorporate lessons learned into future training and practices. • Employee performance takes continuous learning into account. • Sharing of materials, information, and resources includes tacit knowledge.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
III.A.4	**Enable the Enterprise with Information Systems and Tools** *Facilitate the flow of information and knowledge*	The information infrastructure consists mainly of stand-alone systems. The need for systems integration is recognized but no improvement plan exists. C D	Elements of a common information infrastructure have been determined, and an implementation plan is under development. Maintenance of legacy systems consume most IT resources. C D	The information infrastructure has been formalized and is in use in selected locations. Legacy systems are rationalized and aligned across the value stream. C D	An information infrastructure is deployed that supports seamless information exchange across the enterprise. IT organization integrates the needs of the extended enterprise. C D	Information systems are fully interoperable and the pertinent information is easily accessible and usable across the extended enterprise. IT organization is an enabler for knowledge management across the enterprise. C D
	Indicators (Examples)	• Compatible information systems and tools exist across the extended enterprise. • Information systems facilitate fast and effective transfer and retrieval of information required. • Information systems and tools complement enterprise processes and practices and are easily adapted to accommodate change. • Knowledge management is a core competency of the enterprise. • Enabling functions such as Contracts understand the unique model of servicing existing systems and are empowered to have unique processes for enabling new product development versus servicing existing systems.				
	Evidence					
	Opportunities					
III.A.5	**Integration of Environmental Protection, Health and Safety into the Enterprise Culture** *"Cleaner, healthier, safer"*	The enterprise complies with all known legal and regulatory requirements and reacts if issues are identified. C D	Means of mitigating conditions that cause environmental, health and safety issues are considered and addressed. C D	A process is in place to proactively identify environmental, health, and safety (EHS) risks and manage them appropriately, with a preference for source prevention. C D	Forward thinking solutions to potential lifecycle EHS risks are implemented early in product (service) design and throughout the value stream. Training is provided to relevant stakeholders, and employees are rewarded for making efforts to improve safety. C D	EHS risk prevention and mitigation is part of the natural way business is conducted across the extended enterprise, creating a sustainable environment and a competitive advantage. This is reflected in an enterprise-wide culture of safety. C D
	Indicators (Examples)	• Health and safety issues are routinely addressed in employee-driven improvement activities. • Processes and designs are proactively adapted to minimize environmental, health and safety issues at source. • Designs meet current environmental regulations and are capable of easy adaptation to meet projected changes over the lifecycle of the product.				
	Evidence					
	Opportunities					

III.B. Process Enablers – A number of enablers can facilitate enterprise transformation implementation via consistent application throughout the enterprise.

Diagnostic Questions	• **Have the full benefits from process standardization been realized across the enterprise?** • **Has process standardization and reuse been embedded in enterprise policies and procedures?** • **Are common tools and systems used throughout the enterprise?** • **Is process variation continually reviewed and reduced in all processes throughout the enterprise?**

EP #	Enterprise Practices	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
III.B.1	**Standardize Processes** *Strive for consistency and re-use*	Processes vary by program or product line. C D	Processes in the organization have been identified that could benefit from standardization, and initial efforts are under way to increase process consistency. C D	Selected processes are standardized across the enterprise. C D	Process standardization and reuse is consistently employed across the enterprise. Process standards are continually reviewed to ensure highest performance. C D	Extended enterprise interface processes have been standardized while allowing for flexibility in innovation in support of local needs. C D
	Indicators (Examples)	• The workforce plays a significant role in devising standard processes and practices that are adhered to and periodically updated. • Process improvements are documented in a concise and easy to use standard format and transferred. • Processes are standardized where applicable throughout the extended enterprise. • Process standardization does not over-constrain process innovation; new ideas from local initiatives are continuously incorporated into enterprise processes. Contracts for servicing existing systems are afforded opportunities to deviate from the contract structure for new product systems given the unique model.				
	Evidence					
	Opportunities					
III.B.2	**Common Tools and Systems** *Assuring compatibility, reducing costs*	Enterprise elements use different and/or incompatible tools and systems. C D	Enterprise elements have identified high leverage opportunities for implementation of common tools and systems; initial deployment in a few areas. C D	Plans are in place for achieving common tools and systems and have been implemented to varying degrees across the enterprise. C D	Common tools and systems have been implemented and are utilized throughout the enterprise. C D	Compatibility of tools and systems with those of enterprise partners in the extended enterprise. C D
	Indicators (Examples)	• Policies have been established and deployed that require the use of common tools and systems throughout the enterprise. • Common tools and systems provide easy access and reuse of knowledge across the product lifecycle. • Enterprise-wide use of common tools and systems provides enhanced compatibility between processes and aids employee transfer.				
	Evidence					
	Opportunities					

EP #	ENTERPRISE PRACTICES	Capability Levels				
		Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
III.B.3	**Process Variation Reduction** *Reduce uncertainty by reducing variation*	There is limited use of variation reduction tools and methods. There is some evidence of variation understanding in parts of the enterprise. C D	Sources of variation have been identified and analyzed. Initial efforts are under way to reduce variability. C D	A formal approach that balances customer value and variation reduction is implemented in many parts of the enterprise. C D	Considerable benefits are realized from reduced variation in processes and practices across the enterprise. C D	Benefits of reduced variation are realized across the extended enterprise. C D
	Indicators (Examples)	• Process ownership and visual displays of process variation enable quick and easy identification of adverse trends. • High levels of process stability are maintained by using mistake proofing and root cause identification techniques to the fullest. • Variation reductions achieved enable short predicable lead times for information, material, and people flow.				
	Evidence					
	Opportunities					

LESAT Glossary

Balanced scorecard: An analysis technique and management instrument that translates an enterprise's mission and strategy into a comprehensive set of performance measures to provide a framework for strategic action. The scorecard may gauge organizational performance across several perspectives including financial, customers, internal business processes, and learning and growth. (*Techniques for Enterprise Management*, 1999)

Best practice: A method of accomplishing a business function or process that is considered superior to other known methods. (*Techniques for Enterprise Management*, 1999)

Business case: Justification for a change. Serves as a decision package for enterprise executives. Typically includes an analysis of current problems or future needs, a proposed solution, assumptions and constraints, alternative solutions, lifecycle investment costs, quantified benefits, an analysis of costs versus benefits, and an analysis of risks involved. (*Techniques for Enterprise Management*, 1999)

Change agent: An individual who provides the catalytic force driving transformation/change by planning, managing, and championing the implementation process. The role can be either voluntary or selected by enterprise leadership, but the individual must have enterprise knowledge as well as a clear vision of the future vision, in order to motivate and educate individuals within the enterprise. (Womack and Jones, 1996)

Consensus: A state where group members support an action or decision, even if some do not fully agree with it. A consensus decision is made after aspects of an issue, both positive and negative, have been reviewed or discussed to the extent that everyone openly understands, supports, and participates in the decision. (*Techniques for Enterprise Management*, 1999)

Continuous flow: Items and/or information move through from one step in the process to the next one unit at a time. Each stage of the process acts on only the one piece that the next stage needs, and the transfer a single unit of material and/or information moves between processes. Also called "single-piece flow" or "one-piece flow." (Rother and Shook, 2000)

Continuous improvement: A culture of ongoing improvement of any and all elements within the enterprise, including processes, products, and services. Improvements seek to increase efficiency, effectiveness, and value-creation; and can be incremental (implemented over time) or can be breakthrough (implemented all at once). (ASQ, 2011)

Core competency: The particular capabilities (knowledge, demonstrated proficiency, and experience) of an enterprise that satisfy existing strategy and serves as the basis for growth or diversification into new lines of business. (*Techniques for Enterprise Management*, 1999)

Cross-functional management: a process designed to encourage and support interdepartmental communication and cooperation throughout an enterprise, as opposed to command and control through narrow departments or divisions. The purpose is to achieve enterprise targets such as quality, cost, and delivery of products and services by optimizing the sharing of work. (Dimancescu, Hines and Rich, 1997)

Culture: Shared characteristics such as values, behaviors, and beliefs that distinguish the members of one group from those of another. Organizational culture includes the common set of beliefs, sentiments, priorities, attitudes, perceptions, operating principles, and accepted norms shared by individuals within an organization.

Cultural change: A major shift in cultural characteristics (see previous) within the organization or enterprise. (*Techniques for Enterprise Management*, 1999)

Current enterprise state: A description of the present enterprise architecture, including the strategy, organization, policies, processes, products, services, knowledge, and information of the enterprise. This comprehensive description of the enterprise enables analysis of the enterprise as a whole.

Customer: A stakeholder who is a recipient of a product or service produced by an enterprise. Customers may be internal or external to the organization. External customers, those in the marketplace, are the reason an enterprise exists. Internal customers are the reason a functional area or department exists – an interdependent department, or a downstream user in the value chain. When services rather than products are provided, customers are often called clients. (*Techniques for Enterprise Management*, 1999)

Distribution and sales (a lifecycle activity): The final activity in the enterprise lifecycle process that addresses the distribution of products to customers and the provision of related services. This stage includes the following activities: sales, product distribution, post-sales services, post-delivery support and, any warranty/replacement services.

Downstream stakeholder: See "Stakeholder, Downstream."

Employees: All of the individuals employed by the organization including full time, part time, temporary and contract employees. Employees constitute an internal stakeholder. (The Excellence Model Glossary of Terms, 2009)

Enterprise: A complex, integrated, and interdependent system of people, processes, and technology with a distinct mission that creates value as determined by its key stakeholders based on that mission. An enterprise typically consists of multiple organizations (e.g., departments, suppliers, partners, regulators) rather than a single corporation, division, or government unit. In addition to core value chain activities, the enterprise includes all supporting activities (e.g., profit and loss responsibility, information technology, human resources). (Nightingale and Srinivasan, 2011)

Enterprise element: An internal component of the enterprise, defined either by artificial or abstract boundaries, often with local management, roles, responsibilities, and a specific goal or objective. Enterprise elements can include projects, programs, departments, divisions, or organizations (if the enterprise refers to a full supply chain).

Enterprise perspective: A holistic vantage of the enterprise and full value chain that enables holistic analysis of performance. An enterprise perspective allows individuals to understand their role and responsibilities in the larger enterprise context, and to make decisions that seek to optimize performance of the enterprise as whole rather than just its elements. See "Enterprise thinking."

Enterprise principles: Seven principles have been identified that are core to achieving enterprise excellent:

1. Adopt a holistic approach to enterprise transformation.
2. Secure leadership commitment to drive and institutionalize enterprise behaviors.
3. Identify relevant stakeholders and determine their value propositions.
4. Focus on enterprise effectiveness before efficiency.
5. Address internal and external enterprise interdependencies.
6. Ensure stability and flow within and across the enterprise.

7. Emphasize organizational learning. (Nightingale and Srinivasan, 2011)

Enterprise stakeholder: All stakeholders relevant to a specific enterprise (see "Stakeholders").

Enterprise thinking: The application of systems thinking to the enterprise. By taking a holistic and comprehensive view of the value chain (spanning organizational structural boundaries), enterprise thinking enables identification of opportunities for greater efficiency and greater value delivery. See "Systems thinking".

Enterprise transformation: Enterprise transformation concerns change, not just routine change but fundamental change that substantially alters an organization's relationships with one or more key constituencies. It can involve new value propositions in terms of products and services, how these offerings are delivered and supported, and/or how the enterprise is organized to provide these offerings. It can also involve old value propositions provided in fundamentally new ways. (Rouse, 2005)

Extended enterprise: All organizations along the multiple value streams that contribute to providing value to the enterprise stakeholders. The extended enterprise may include customers, suppliers, government, and other entities that might have indirect influence over enterprise activities. (Valerdi, Nightingale, and Blackburn, 2008)

External stakeholder: See "Stakeholder, external."

Flow: The progressive achievement of tasks along a value stream so that a product proceeds from design to launch, order to delivery, and raw materials into the hands of the customer with no stoppages, scrap, or backflows. (Womack and Jones, 1996)

Future vision: See "Vision."

Gap analysis: Analysis of the difference between a current state or position and a desired state or position. (*Techniques for Enterprise Management*, 1999)

Innovation: The practical transition of ideas into new products, services, processes, systems, and social interactions. (The Excellence Model Glossary of Terms, 2009)

Internal stakeholder: See "Stakeholder, internal."

Just-in-time: Producing or conveying only the items that are needed by the next process when they are needed and in the quantity needed. (Rother and Shook, 2000)

Lead time: The total time a customer must wait to receive a product after placing an order. When a production system is running at or below capacity, lead time and throughput time are the same. When demand exceeds the capacity of a system, there is additional waiting time before the start of production and lead time exceeds throughput time. (Womack and Jones, 1996)

Non-value added: Any product, process, or service that does not add value to the ultimate customer. (It is important to note that non-value added is not the same as "not necessary" because some activities are required by law or necessary for process control, such as inspection. These may not add value but are used to assess processes for control and improvement.) (Internal Glossary of Rockwell Collins Corp, 1999)

Performance measure: A dimension of an activity or process (quality, cost, or other characteristic) that can be used to judge the effectiveness or efficiency of the process against a target or standard value. (*Techniques for Enterprise Management*, 1999)

Performance measurement system: A system of metrics used to gather the performance data and information from throughout the enterprise that are needed to assess overall enterprise performance. (Nightingale and Srinivasan, 2011)

Process: A sequence of activities that adds value by producing required outputs from a variety of inputs. (The Excellence Model Glossary of Terms, 2009)

Process flow: The movement of materials and/or information through the steps in a process, during which activities are performed in a specific order.

Program management (a lifecycle activity): The management of groups of projects. Aspects of program management are concerned with risk diversification and with consolidation of the component projects for both directional, planning, and control purposes. Program management includes the coordination of resources to ensure the achievement of all projects in a specific group, as well as the planning and allocation of financial, material, and human resources and the organization of work needed to complete each of the projects. (Levene, 1999; *The Ultimate Business Dictionary*, 2003)

Product development (a lifecycle activity): A part of the lifecycle process during which the product and accompanying processes are designed, based on the requirements established in the requirements definition stage. This includes product engineering, testing, and manufacturing process design.

Product flow: The movement of products through the value chain from creation to final customer delivery.

Production (a lifecycle activity): A part of the lifecycle process when the product is created or assembled. This part of the lifecycle includes the production inventory management and the manufacturing or production process, which is based on the product and process design resulting from the product development activity.

Production system: The system used to coordinate internal and external supplier logistics, manufacturer parts, and assemblies into whole products and apply process knowledge to create and deliver products to the ultimate customer.

Productivity: An overall measure of the ability to produce a good or service. It is the actual output of production compared to the actual input of resources. Productivity is a relative measure across time or against common entities. In economics, the ratio of output in terms of dollars of sales to an input such as direct labor in terms of total wages. (Internal Glossary of Rockwell Collins Corp, 1999)

Pull system: A planning system based on communication of actual real-time needs from downstream operations, ultimately from the customer or the end user or the equivalent, as opposed to a push system. (Internal Glossary of Rockwell Collins Corp, 1999)

Push system: A planning system that schedules upstream operations according to some forecasted plan of downstream needs.

Requirements definition (a lifecycle activity): An activity that occurs continuously during the product lifecycle that assesses customer needs and values and translates them into requirement statements that form the basis for product and process design. Strange character embedded here.

Risk management: The process by which an enterprise methodically address the risks attached to each of their activities with the goal of achieving sustained benefit within each activity and across the portfolio of all activities. The focus of risk management is the identification and treatment of these risks, with the objective of adding to the maximum sustainable value of all activities within the enterprise. (The Risk Management Standard, 2002)

Servicing Existing Systems/Operations (a lifecycle activity): A part of the lifecycle process after the product has been deployed. This includes all processes related to operating the product or delivering the service, maintenance, upgrades, repair, and life extension.

Single-piece flow: See "Continuous flow."

Stakeholder: Every person who has an interest in an enterprise, its activities, and its achievements. These may include customers, partners, employees, shareholders, owners, the government, and regulators. (The Excellence Model Glossary of Terms, 2009)

Stakeholder, downstream: Stakeholder who has a role later in the lifecycle and/or production process. Specific stakeholders vary based on one's perspective (e.g., from the perspective of manufacturing, downstream stakeholders include customers and post-delivery/support services, among others). To help differentiate upstream and downstream, think of products as flowing from upstream suppliers to downstream end-user.

Stakeholder, external: Stakeholder located outside the enterprise boundaries. Examples of external stakeholders include customers, end users, shareholders, suppliers, etc.

Stakeholder, internal: Stakeholder located within the enterprise boundary. This includes both individual stakeholders (employees, etc.) and enterprise elements (product development, manufacturing, etc.).

Stakeholder, upstream: Stakeholder who has a role earlier in the lifecycle and/or production process. The specific stakeholders vary based on one's perspective (e.g., from the perspective of manufacturing, upstream stakeholders include engineers/product development and suppliers, among others). To help differentiate upstream and downstream, think of products as flowing from upstream suppliers to downstream end-user.

Stakeholder value – The value derived by a specific stakeholder from the enterprise. See both "stakeholder" and "value."

Strategic plan: A comprehensive statement of an organization's overall mission, objectives, and strategy. A detailed roadmap of the direction the organization intends to follow in conducting its activities. Provides direction, concentration of effort, consistency of purpose, and flexibility as a business moves to maintain and improve its competitive position. (*Techniques for Enterprise Management*, 1999)

Strategic planning: The top-level management decision process that focuses on the overarching, long-range direction of the enterprise and establishes the means by which that goal is achieved. Includes defining top-level and subordinate missions, goals, and supporting objectives, i.e., how the enterprise sees its purpose and where it wants to go. Provides the "big picture" along with a description of how goals and objectives are to be achieved and the indicators that will be used to measure performance and outcomes. (*Techniques for Enterprise Management*, 1999)

Systems thinking: A perspective of systems that acknowledges and integrates the following elements into the understanding and decision making process: holism, an ability to think about the system as a whole; focus, an ability to address the important system level issues; emergence, recognition that there are latent properties in the systems; and trade-offs, judgment and balance, which enable one to juggle all the various considerations and make a proper choice. (Allen et al., 2001)

Supply chain management (a lifecycle activity): A process that integrates of key business processes across the supply chain for the purpose of creating value for customers and stakeholders. During the lifecycle process, supply chain management involves a range of activities including sourcing, procurement, and logistics. (Lambert, 2008)

Upstream stakeholder: See "Stakeholder, upstream."

Value: A product or service's capability provided to a customer at the right time, at an appropriate price, as defined in each case by the customer. (Rother and Shook, 2000)

Value-added activity: Value-added is the difference between dollar sales and the cost of raw materials and purchased parts. Value-added activity is an activity or step in a process that adds value to an output product or service. Such an activity merits the cost of the resources it consumes in production. These are the activities that customers would view as important and necessary. A value-added activity contributes directly to the performance of a mission and could not be eliminated without impairing the mission. (*Techniques for Enterprise Management*, 1999)

Value chain: The sequence of activities a company performs in order to design, product, market, deliver, and support its product or service. (*The Ultimate Business Dictionary*, 2003).

Value delivery: The provision of value to one or more enterprise stakeholders. See "Value."

Value stream: The specific activities required to design, order, and provide a specific product, from concept to launch, order to delivery, and raw materials into the hands of the customer. (Womack and Jones, 1996)

Value stream mapping/analysis: Involves defining a product families'/business processes' material and information flows from beginning to end utilizing a visual representation of every process. This facilitates understanding of current state and the development of the proposed future state. The difference between the two states becomes the basis for the transformation plan.

Vision: A guiding theme that articulates the nature of the business and the enterprise's intent for its future. A description of what senior management wants to achieve. Usually refers to the medium to long term and is often expressed in terms of a series of objectives. (*Techniques for Enterprise Management*, 1999)

Waste: Any product, process, or service that does not add value to the ultimate customer. Waste in business processes/production can be broken down into seven types: waiting, unnecessary motion, processing, inventory, moving items, making too much, fixing defects. (Internal Glossary of Rockwell Collins Corp, 1999)

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