Enterprise Design for Services: A Systems Approach for the Boeing Next Generation Corporate Travel System Architecture

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Submitted to the MIT Sloan School of Management and the Engineering Systems Division in Partial Fulfillment of the Requirements for the Degrees of

Master of Business Administration
AND
Master of Science in Engineering Systems

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Abstract

Typically a company's second largest controllable expense, corporate travel affects many employees at Boeing. A challenge when implementing improvements in the travel and expense system, which is actually comprised of a system of systems, is the coordination of various solutions to ensure improvements in one area do not adversely affect the efficiency of other areas. Various systems along with the people, policies, and processes used to provide services to travelers must be coordinated both inside and outside Boeing in order for overall travel operations to function properly. The intent of this project is to establish a systems-based architecture for Boeing's Next Generation Travel System.

This thesis proposes re-designing the Boeing travel system using an enterprise architecting framework to select a future state architecture for a service organization. The analysis recommends a supplier integrated "off-the-shelf" software solution, employing the software as a service business model. Under this model the supplier is paid per transaction completed in the system; adoption of this metric aligns the system to reduce re-work costs, increase first-time pass quality, and improve usability. Additionally, new supplier software tools will allow the Boeing travel organization to transition from a process-focused to a more knowledge-focused service team.

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I would also like to recognize my faculty advisors, Charles Fine and Deborah Nightingale. Their contributions to the study of systems inspired my academic curiosity in my two years at MIT and have taught me to contemplate the world in ways I had never before fathomed. My association with them in this research is a huge honor, and I can only hope to humbly carry on their ideas in all my future work.

I am also grateful to the entire Boeing Travel and Expense Services organization. I considered myself fortunate to have a "dream-team" of two distinguished LGO alumni, Eric Kittleson and Quang Nguyen, as my project champion and supervisor respectively. Special thanks go to Quang for his mentorship and friendship in my time at Boeing, and for doing so much to create a memorable experience.

Finally, I would be remiss if I did not acknowledge the guidance and support of my family, particularly my father, Hector A. Silva. Although we did not agree on the timing, his dream for me to attend MIT is now fulfilled; my accomplishments here are in his honor, and I hope they make him proud.

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1 Introduction

This chapter discusses the major motivations behind the research, describes a brief overview of the project along with its goals and objectives, and provides an outline of the thesis structure.

1.1 Motivation for Thesis

In order to work with suppliers and provide products and services to customers in more than 90 countries, Boeing's travel spend is more per year than almost any company in the world. The Travel & Expense Services (T&ES) organization in the Boeing Shared Services Group (SSG) provides services for travel arrangements, expense processing, corporate credit cards, and enterprise travel reporting. In recent years, the increasingly competitive environment in the aerospace industry has driven the need for improvements across Boeing. The T&ES organization has implemented Lean strategies and plans to improve operational efficiency and effectiveness to help Boeing become more productive and competitive. The Next Generation Travel project was created to support these initiatives, encompassing the entire travel value chain.

1.2 Project Overview

This thesis represents research from a project completed between the months of June and December of 2009 at The Boeing Company's Travel and Expense Services organization in Renton, WA, in partnership with MIT's Leaders for Global Operations (LGO) program. The project occurs within dynamic and constantly changing phases of improvement initiatives for the Boeing travel system. Within the last year Boeing has undertaken many efforts to address performance issues within the travel organization and travel problems in the company at large; the largest of these initiatives include an organizational re-alignment as well as a major software system upgrade – the latter of which is still under way. As a result, the project must not only consider the longer term future state vision of the organization, but it must also synchronize a transition plan that continues building upon the improvements Boeing has achieved to date. Additionally within this context the project should also provide near term recommendations to ensure

that Boeing travel does not compromise not only the long-term vision, but also does not adversely impact the efficiency of the overall organization for the sake of optimizing just the travel component. Ultimately the motivation of this project is to ensure that Boeing makes "smart" travel decisions (i.e. not just slashing travel budgets) and provides high-quality service to its employees, thus improving the overall company's productivity and competitiveness.

1.3 Project Goals and Objectives

The primary goal for this project is to propose a systems-based strategy and implementation architecture for Boeing's Next Generation Travel System. Using Enterprise Architecture (EA) frameworks and System Dynamics modeling the project will focus on answering key questions to determine a systems strategy for Boeing, aligning the people, processes, policies, and tools to establish a future best-in-class corporate travel program. Starting with the strategic goals of increasing cost effectiveness, quality, and system usability, the project aims to address future tactical issues such as in-sourcing vs. outsourcing, best-of-breed vs. integrated system sourcing, and organizational infrastructure options.

In addition to providing Boeing a systems-based implementation strategy as well as a sourcing strategy for their Next Generation Travel System, the underlying framework developed to achieve these goals (consisting of EA view analysis and system dynamic modeling) could be replicated across any organization to address difficult issues such as when to in-source vs. outsource work, when to integrate systems and services or keep them modular, and how to architect a service oriented enterprise within a larger organization. Additionally, management questions such as leadership capabilities, management approaches, and organizational policies and dynamics are within the scope of this project, and the learning opportunities from this project also benefit future large-scale program implementations for Boeing.

1.4 Organization of Thesis

This thesis is organized into nine chapters as outlined below:

Chapter 1 - Introduction: Describes the major motivation and goals of the thesis.

Chapter 2 - Background: Provides context of the business environment under which this project was undertaken, as well as an overview of the corporate travel industry.

Chapter 3 – Research Methodology: Describes the academic framework for analyzing the problem from both the engineering and management perspectives, as well as the approach to defining the problem and exploring the possible solution set.

Chapter 4 - Evaluation of Current State of Travel System: Describes Boeing travel in detail and assesses its performance within the enterprise.

Chapter 5 – Evaluation Criteria – Key "-Ilities": Explores the criteria and sub-criteria used to evaluate the proposed future state travel system architectures.

Chapter 6 – Candidate Architectures for Next Generation Travel System: Provides an analysis of potential designs for the future travel system including the preferred future state enterprise architecture.

Chapter 7 - Transitioning to the Future State: Provides recommendations on how to achieve the future state vision along with an analysis of enablers and barriers to change.

Chapter 8 - Conclusion: Provides a summary of key takeaways and next steps for The Boeing Company.

2 Background

This chapter describes the background of The Boeing Company, the role of the Shared Services Group within the company, and the evolution of the Travel and Expense Services organization.

2.1 The Boeing Company

Boeing is the world's leading aerospace company and the largest manufacturer of commercial jetliners and military aircraft combined. Additionally, Boeing designs and manufactures rotorcraft, electronic and defense systems, missiles, satellites, launch vehicles and advanced information and communication systems. As a major service provider to NASA, Boeing operates the Space Shuttle and International Space Station. The company also provides numerous military and commercial airline support services. Boeing has customers in more than 90 countries around the world and is one of the largest U.S. exporters in terms of sales.

2.2 Boeing Shared Services Group (SSG)

The Boeing Company Shared Services Group, or SSG, provides the company's business units and Corporate Offices with innovative and effective common services that support the competitive design and manufacture of aerospace and defense products. By integrating services, Shared Services Group delivers greater value, creates "lean" processes and operations, and leverages buying power and simplifies access to services for all of Boeing.

2.3 Boeing Travel and Expense Services

The Travel and Expense Services organization at Boeing was formed as the combination of two historically separate operating organizations, Travel Accounting (TA) and Boeing Travel Management Company (BTMC) – an accredited travel agency acquired during the 1997 merger of Boeing and McDonnell Douglass. Boeing Travel, now an accredited Corporate Travel Department, is a full-service agency responsible for all travel reservations, bookings, ticketing, and travel-related support for Boeing as well

as a number of subsidiaries, partners, and other external accounts. Boeing Travel's responsibilities are generally referred to as "pre-travel" activities. With a slightly larger staff size, the Travel Accounting group is responsible for "post-travel" activities, such as expense report collection, auditing, financial allocation and reporting, and reconciliation. Additionally, TA is responsible for managing the operations of all corporate credit cards, including issuing new cards and suspending or cancelling cards for new or terminating employees. The following figure illustrates the historical division of labor between these two groups.

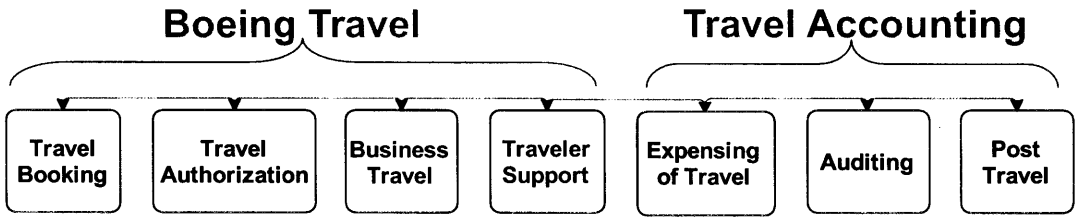

Figure 1 Boeing Travel and TA responsibilities

In recent years, the two groups that make up the travel organization have gone through a variety of changes. The resulting organizational transformation has attempted to dissolve the line between these two groups while also assigning teams to specific functional processes, while adding other teams to support and improve the overall process. The ultimate goal has been to align the organization to a more customer-centric model. The following figure highlights some of the major changes in the travel organization, along with the universe of systems that comprise the travel and expense system.

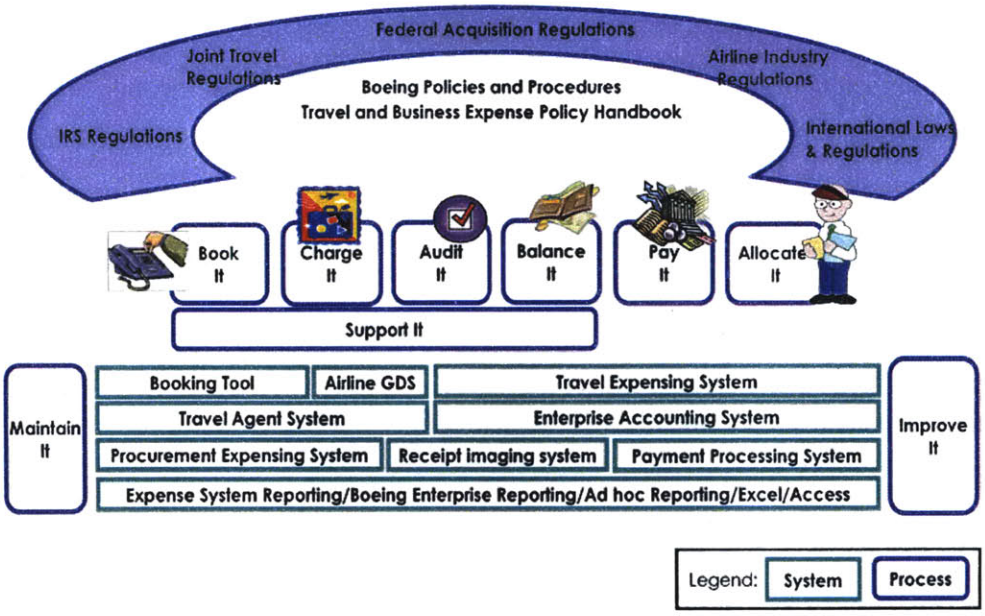

Figure 2 Boeing Travel and Expense Services Today

The following statistics highlight the scale of the operations for Travel and Expense Services:

- 100K+ travelers
- 300K+ trips per year
- 850K+ expense transactions processed each year
- ~$800M annual total value of travel spend

2.4 Corporate Travel Industry/Value Chain

Corporate travel is a multi-billion dollar industry, with the top 100 companies spending $10.3 billion in air tickets alone in 2008.[1] Although it can be perceived as a perk or unnecessary spending, corporate travel is an essential cost of doing business: whether visiting suppliers, obtaining new sales, or hosting internal meetings, company employees rely on corporate travel for the success of their various programs. A variety of firms exist in this supply chain, from airlines, hotels, and car rental companies to software firms that help track how employees spend company resources while on travel.

Most companies that engage in corporate travel typically assign a corporate travel manager to administer these activities, and this individual reports to either the

procurement or finance division of the company. To provide these managers the products and services required to satisfy a company's corporate travel needs, the industry consists of essentially three groups: Travel Management, Corporate Credit Card, and Expense Management companies. The following section briefly discusses these three types of companies, the products and services they provide, and their current role in the industry.

2.4.1 Travel Management companies

Travel management companies are typically associated with travel agencies, although their roles go beyond just this task. Including assisting with reservations and bookings, these companies also provide services to negotiate rates with airlines and hotels, monitor and support travelers during their travel, and enforce travel policy compliance. Additionally, they can provide other complementary services such as meetings and event management. In recent years this group has consolidated significantly. After the events of September 11th and the corresponding downturn in corporate travel, the largest firms in the industry began to acquire smaller firms that could no longer maintain profitability. As of 2009, the top three corporate travel management firms had sales greater than the next 30 firms combined.[2]

Closely related to the business of travel management is a group of firms that develop online booking tools (OBT) used to allow individuals to self-book travel reservations as opposed to going through a travel agent. Many travel management companies either provide their own proprietary OBT or will integrate automatically with a variety of commercial off-the-shelf (COTS) systems. These tools tap into the data available in Global Distribution Systems (GDS) that airlines use to post their available inventory; many online booking tools were off-shoots of various GDS databases and as a result common interfaces exist.

2.4.2 Corporate Credit Card companies

Much like personal credit cards help finance household expenses, corporate credit cards are used to manage and control employee expenses while on travel. The same firms that are known for providing household cards are also involved in the corporate credit

card industry; however for large companies a smaller number of firms exist that can handle such large accounts. In the overall corporate travel industry, these firms rest in between the travel management and expense management companies: an employee would use a travel management company to help book a plane ticket or hotel reservation on the credit card, the credit card would then be used to pay for these goods or services, and then the expenses charged to the card would then be reconciled using a separate expense management software. None of the major credit card companies offer software for expense management, although some are beginning to offer online services to review and track spending.

2.4.3 Expense Management companies

These companies offer either software solutions or outsourced business process handling for tracking, reconciling, and reporting employee expenses from travel. As stated earlier, credit card companies do not offer this type of service; typically an expense management company would receive a periodic data feed from a credit card provider to load all transactions into the expense management software. Although unfortunately there is not a common standard for these feeds, the credit card companies have developed proprietary standards that almost all expense software solutions are able to process. These transactions are then assigned to the employee that completed the travel to reconcile and track. Similar to travel management companies, in recent years larger firms have acquired smaller niche software competitors, and as a result this industry has also consolidated into a few key providers.

2.4.4 Industry consolidation and impact to customers

Using Charles Fine's[3] double helix framework to assess the current state of each industry, we can observe that in recent years both the Travel Management (i.e. travel and reservation agents) and Expense Management (i.e. software tools and services to management corporate expenses) industries have gravitated towards consolidation.

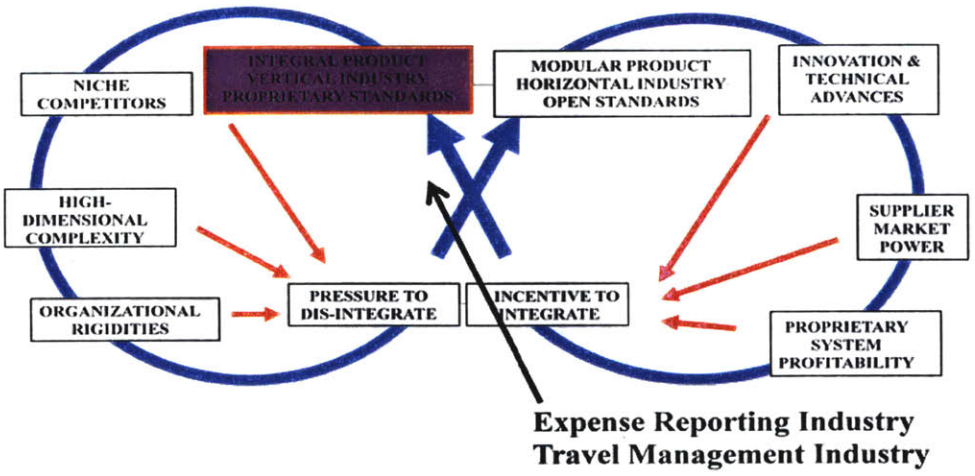

Figure 3 Corporate Travel and the Double Helix[4]

Beyond consolidation in each sub-group however, in the past two to three years there has also been a movement to consolidate and partner across sub-groups as well. Previously, travel management companies and expense management providers would develop integration solutions to accept a variety of different input file feeds from any other upstream entity. Recently however companies have begun to partner exclusively such that selecting a provider for one service would almost certainly require a corresponding partner for selection in another service (e.g. a travel management company would provide features compatible with only one expense management company). These partnerships were developed in the hopes of providing customers a more integrated solution. Some firms in the industry however have resisted such partnerships and have preferred to maintain a more open architecture. The impacts of these efforts will be discussed in more detail in the future state architecture section of this document.

3 Research Methodology

The academic strategy to approach the design of the Next Generation Travel system is a combination of Enterprise Systems Architecture and System Dynamics frameworks to assess the current state of the system and propose alternative architectures to select a preferred future state. These frameworks complement each other well for this type of analysis: Enterprise Systems Architecture focuses on the structure of the system while System Dynamics focuses on the related behaviors.

3.1 Enterprise Systems Architecture

In order to maximize value across interconnected stakeholders, a systems approach is needed when designing the modern enterprise[5]. Although generally considered specific to the realm of information technology, Enterprise Architecture is the practice of aligning processes and technology with organizational structure.[6] In order to understand the complex, interdependent networks and relationships of enterprises, Deborah Nightingale and Donna Rhodes of MIT propose a new framework, Enterprise Systems Architecture, to provide a more enriched view of enterprise systems. Nightingale and Rhodes define Enterprise Systems Architecture as "applying holistic thinking to design, evaluate and select a preferred structure for a future state enterprise to realize its value proposition and desired behaviors." Enterprise Systems Architecture uses eight views in order to understand the various dimensions of enterprise systems and subsequently engineer solutions to produce the most effective method for delivering value to stakeholders. The following figures document the eight different views as well as the interrelationships between the views.

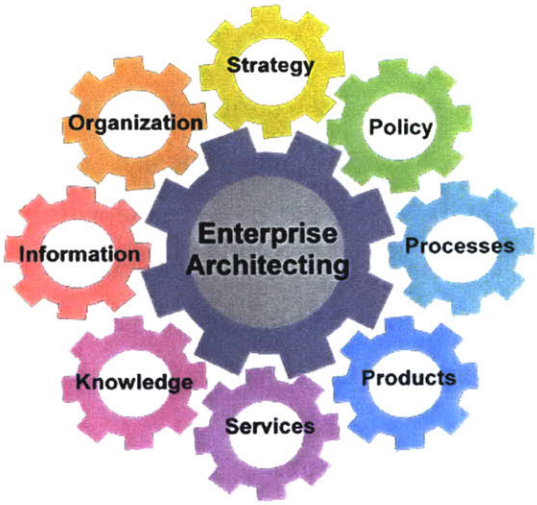

Figure 4 Enterprise Systems Architecture views

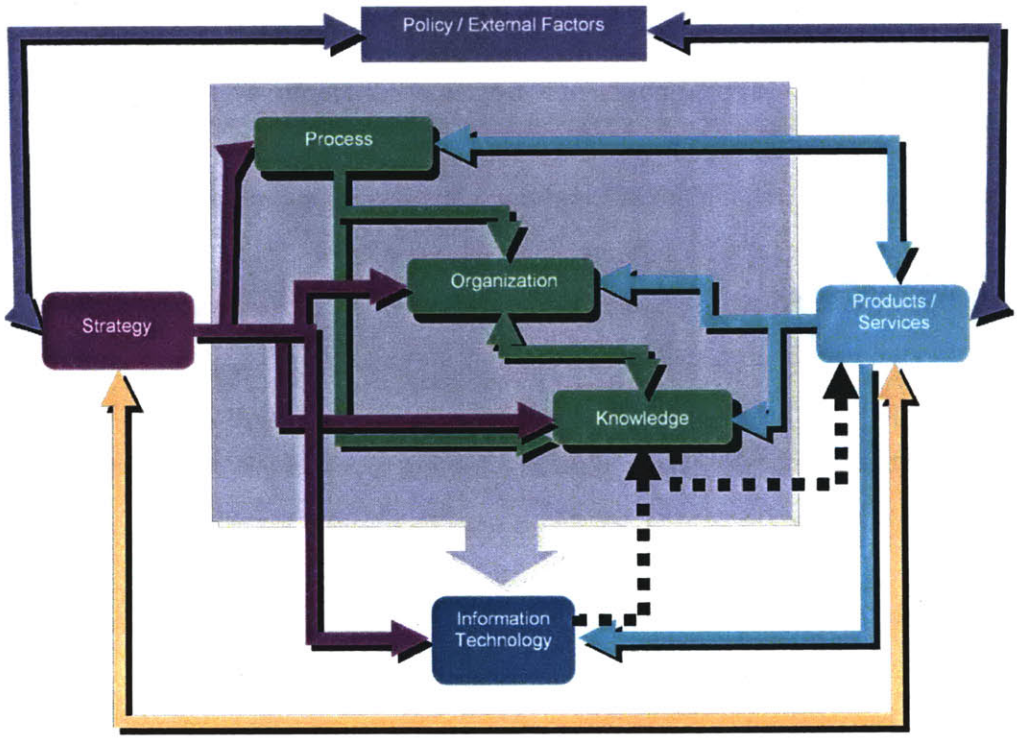

Figure 5 Enterprise Systems Architecture views and interrelationships[7]

Within the broader study of complex system theory there also exists a related framework that can be useful for modeling the behavior of the performance of enterprises

over time, based on their architectural design. Piepenbrock and Fine propose that the choice between *modular* and *integral* enterprise architectures contribute to the performance of an enterprise throughout their business life-cycle, and posit the evolution of "dominant designs" depending on the stage of the enterprise maturity.[8,9] The differences between modular and integral enterprise architecture design are found in terms of their objective functions, enterprise boundaries and stakeholder interfaces. Whereas modular enterprises are characterized by short-term profit-maximizing objectives, narrowly defined boundaries and arms-length relationships with stakeholders, integral enterprises focus on long-run system surplus, broad system boundaries, and closer relationships with stakeholders. The following figure illustrates these differences.

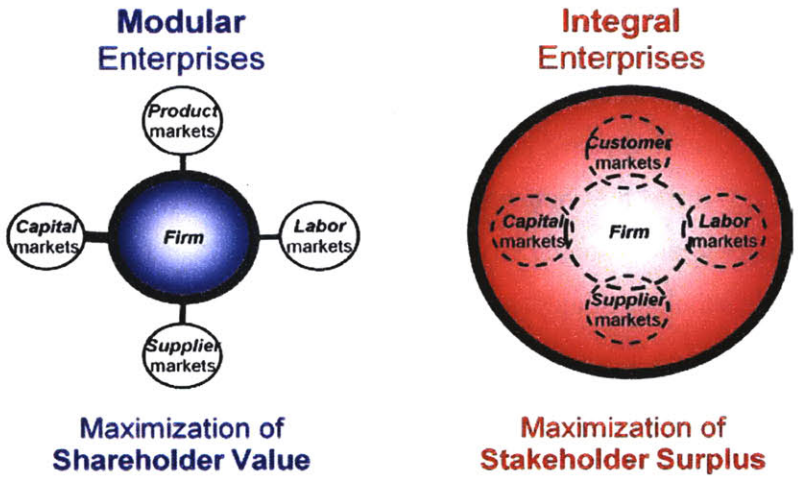

Figure 6 Typology of Enterprise Architecture

Not coincidentally, one of the companies in the Piepenbrock and Fine study is The Boeing Company, which is understood to exhibit a modular enterprise architecture design as a firm within the commercial airplane industry. One motivation for including this framework in the analysis of the Boeing travel and expense system is to explore the possibility of different enterprise system architectures existing within the context of a larger enterprise architecture, i.e. can the Boeing travel enterprise be designed with a more integral architecture within a larger modular organization, or does the macro-architecture of the firm dictate a modular design?

3.2 System Dynamics

In conjunction with the Enterprise Architecture approach for engineering an effective system, the field of System Dynamics[10] is useful for modeling the management issues that arise from developing and implementing a new system design in an organization. These issues include many of the common problems studied in the field of system dynamics, including policy resistance, work accumulation and backlogs, and other unintended behaviors arising from misunderstanding the true causes of (versus the correlation with) results from changes to system inputs or designs. In the case of the Boeing travel system, System Dynamics can also be used to understand the history and current state of the system as well as discover the greatest levers for affecting positive change going forwards.

Additionally, with respect to its position as a service organization for the Boeing enterprise, changes and improvement efforts to the Boeing travel system should be viewed under the lens of the challenge to achieve the seemingly contradictory goals of improving quality while reducing costs. Here we can use the insights from earlier System Dynamics models to understand how to approach managerial concerns such as investment justification, change management strategies (both up and down the organizational hierarchy), and the development of accurate system performance metrics. The following figure illustrates the interplay between the investment in improvement efforts (to increase quality to the customer) and the desire to keep expenditures low for a cost-centric organization (to reduce costs).

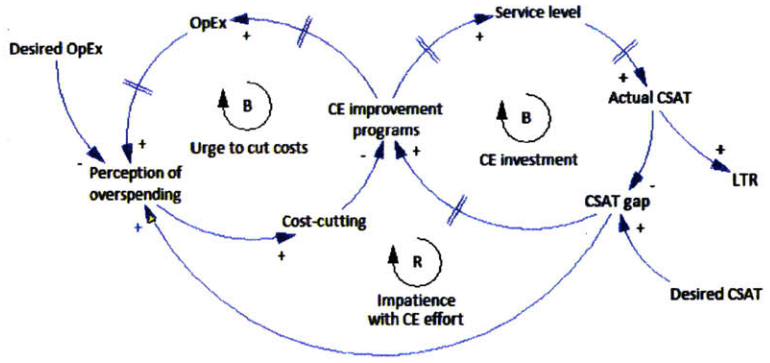

Figure 7 Causal Loop Diagram of the Structure Responsible for the Service-Level Seesaw[11]

3.3 Approach

The approach to the project research follows a basic DMAIC (Define-Measure-Analyze-Improve-Control) improvement framework, with a concentration on the definition, measurement, and analysis stages. The project occurs in the nascent stages of what is ultimately a three- to five-year initiative to overhaul the entire travel system, and as such the majority of project work and research consists of defining the as-is state of Boeing travel, measuring the financial and other quantifiable impacts to the organization in terms of productivity, service satisfaction, and quality, and finally analyzing the alternative methods to address the current system shortcomings and ultimately improve the T&ES organization.

With millions of transactions processed each year across the enterprise, the T&ES organization faces many challenges with respect to variability, process cycle times, and service quality. Using Enterprise Architecture and System Dynamics frameworks, the project will determine a travel and expense systems architecture for Boeing, aligning the people, processes, policies, and tools to establish a future best-in-class corporate travel program. Additionally, the project aims to leverage Boeing's existing Lean+ techniques and strategies to identify improvement opportunities to reduce variability and standardize processes.

4 Evaluation of Current State of Travel System

This chapter describes the Boeing travel system in detail and assesses the state of the system using the data obtained from benchmarking activities, process mapping, business case development, and the Enterprise Architecture views framework.

4.1 Benchmarking

Research for this project includes a Boeing-led benchmarking study with ten other companies in order to assess its performance relative to other travel systems. Participants in the benchmarking study varied with respect to industry, company size, geographic location, and other dimensions; however a number of participants were selected from Boeing's peer group of companies. The objective of the benchmarking study was two-fold:

- Research companies to learn best practices, processes and systems in areas of policy, operations, and sourcing
- Understand how benchmarked companies have achieved and sustained their performance levels in cost efficiency, end-user satisfaction, and functionality

The benchmarking study used a standard questionnaire to learn more about how different companies managed the following six main topics:

- **Operations**: General information about the system including size, scope of activities, international requirements, managerial concerns, etc.
- **Travel Reservations**: Pre-trip processes, booking tools, reservations operations, and use of internal or external travel agents
- **Travel Expensing**: Post-trip processes, expense reporting tools, financial management and reporting, account reconciliation and balancing
- **Credit Card Management**: Corporate credit card supplier management programs, credit card types, payment frequencies, etc.
- **Travel Policy**: Corporate policy in all areas of the travel system, including allowable expenses, employee benefits during travel, compliance monitoring, etc.
- **Travel IT System/Platform**: Software system architecture and methodology for managing and evaluating software suppliers

For purposes of honoring the confidentiality agreements with participating companies, the contents of the final detailed report of the benchmarking study cannot be shared in this paper. However, the following figure illustrates the type of information Boeing was

able to obtain about its relative position to other travel systems in the industry. In this case we notice that Boeing is in middle portion of the spectrum of in terms of level of software customization (i.e. how much the code changes from the off-the-shelf product) and software integration (i.e. how much the different IT systems "talk" to each other, e.g. the travel booking system can pass travel start/end dates or location to the travel expense system).

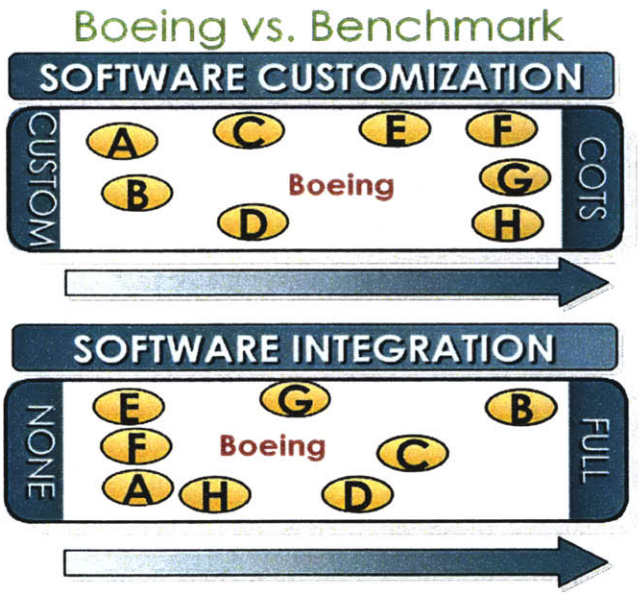

Figure 8 Benchmarking Travel IT System/Platform

The benchmarking activity ultimately discovered best practices utilized by other companies that if implemented appropriately could be utilized in the Boeing travel system. The main findings from the benchmarking study specific to the Boeing travel system include the following points:

- Visibility/reporting systems utilized by senior management at detail level (e.g. non-compliant employees listed to VPs, CFO) drives higher policy compliance
- Clear credit-card delinquency escalation policy and execution starting at 60 days past due drives higher policy compliance
- Staffing levels appropriate to support key functions such as expense report processing; companies do not provide support for credit-card reconciliation
- Corporate credit cards issued only to company employees, and not to contractors or interns

- Travel spend data used for improved negotiations with travel suppliers to reduce travel costs
- Electronic travel authorizations are a non-value added step in the pre-travel process
- User friendly lodging/airfare "wizards" to facilitate expense-data entry and auto-loaded credit card statement into the expense reporting systems minimize manual entry and reduces errors

The main findings from the benchmarking study with respect to all the participants include the following points:

- Participants were successful to varying degrees, but none were best-in-class across all functions
- All companies encounter similar issues in their travel system, including data visibility, policy compliance, and challenges from international operations
- Benchmarking identifies opportunities for improvement, but important to align policies and best practices that fit with company

4.2 Current State Value Stream Mapping and Business Case

Another step in capturing the As-Is state of T&ES involves the development of both a value stream map and a financial business case to create an internal review of the system performance (as compared to the external view found via benchmarking). These activities lead to numerous "Kaizen" opportunities for immediate improvement, as well as identifying systemic problems that can be addressed in a new system implementation. The following list highlights some examples of the findings from these activities.

- **Elimination of re-work resulting from faulty system interfaces**: in various steps of the expense report process data feeds from one system to another would not upload or process correctly, leading to manual re-work steps and home-grown systems developed for workarounds
- **Reduction of manual processes and data handling**: although most data is contained in file formats that can be automatically transmitted and loaded, some steps of the process required user intervention to handle files
- **Decrease of overall processing cycle time**: current processes were designed to reduce the cycle time of error-free and simple expense reports; exceptions to the standard process result in much longer cycle times and are the norm

4.3 System Dynamics Analysis of Current State

Throughout the Current State Value Stream Mapping activity, various contradictions surface that can best be explained through the framework of System Dynamics and system feedback thinking. One straightforward application involves the use of stocks and flows concepts in order to better understand backlog accumulations in credit-card reconciliations and expense reports to be processed. The value stream mapping activity reveals that the initial efforts to reduce the backlog concentrated on increasing the outflow rate as opposed to investigating the causes of inflow to reduce the incoming rate of new tasks. Here John Sterman's[12] bathtub model of System Dynamics proves useful in illustrating the point. If one imagines the bathtub is filled with pending credit-card reconciliations from out-of-balance credit cards (or similarly pending expense report transactions for processing), the only two ways to completely empty the tub are to drain all the existing reconciliations as well as to seal off the faucet of any new incoming credit-card reconciliations. The following figure is a visual representation of this model.

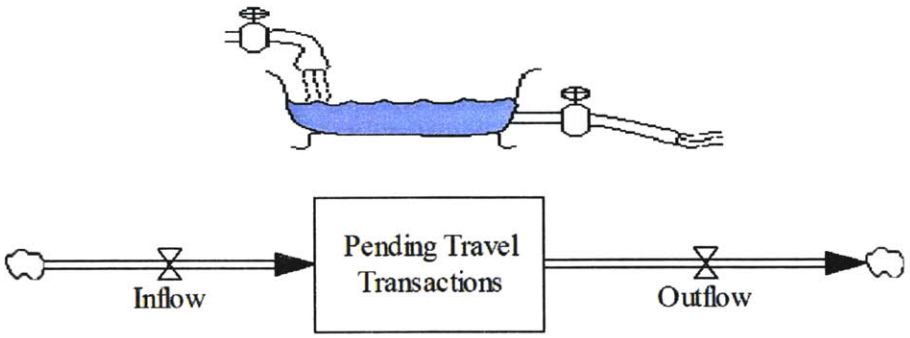

Figure 9 Bathtub model

As stated above, previous efforts to reduce the stock of pending transactions have concentrated mainly on committing time and resources to accelerating the rate of outflow and have come at a significant expense to The Boeing Company. By using this model to shift the focus over to the causes of inflow, we gain greater insights on how to address these issues in the new travel and expense system.

Another example of applying System Dynamics to the travel and expense system incorporates the concepts of feedback loops to account for unintended consequences in system behaviors. One application of this framework appears in the issues of timely expense report submissions. The Boeing Travel Accounting group has long struggled with getting expense reports to be entered correctly and in a timely manner in order to facilitate financial reporting and the allocation of costs. Within the group of employees that work in Travel Accounting, the best and only way to drive this compliance is by imposing tighter deadlines and imposing stricter measures for policy compliance, but this has not yielded the desired results. These behaviors exhibit classic linear thinking; making assumptions about the true causes of an action and approaching solutions in an event-oriented view of the world. A more appropriate model for understanding the actions and reactions of a system involves the incorporation of feedback into the understanding of how things work. In the case of timely expense report submissions, feedback loops play a role in explaining why previous countermeasures to late submissions have not yielded the results originally intended. By introducing feedback, one can assess the impact of shortening the days to submit an expense report in a more robust manner; reducing the time to submit only increases the level of frustration employees already have with the existing expensing system. By increasing this frustration employees are more likely to perceive they have little time available in their busy schedules to deal with filling out an expense report. The ultimate consequence is that the employee may hold off on entering the expense until they believe they have sufficient time to do so, but this may be well after the imposed deadline, and as a result, late submissions only increase. The following figure illustrates this difference between linear and systems thinking.

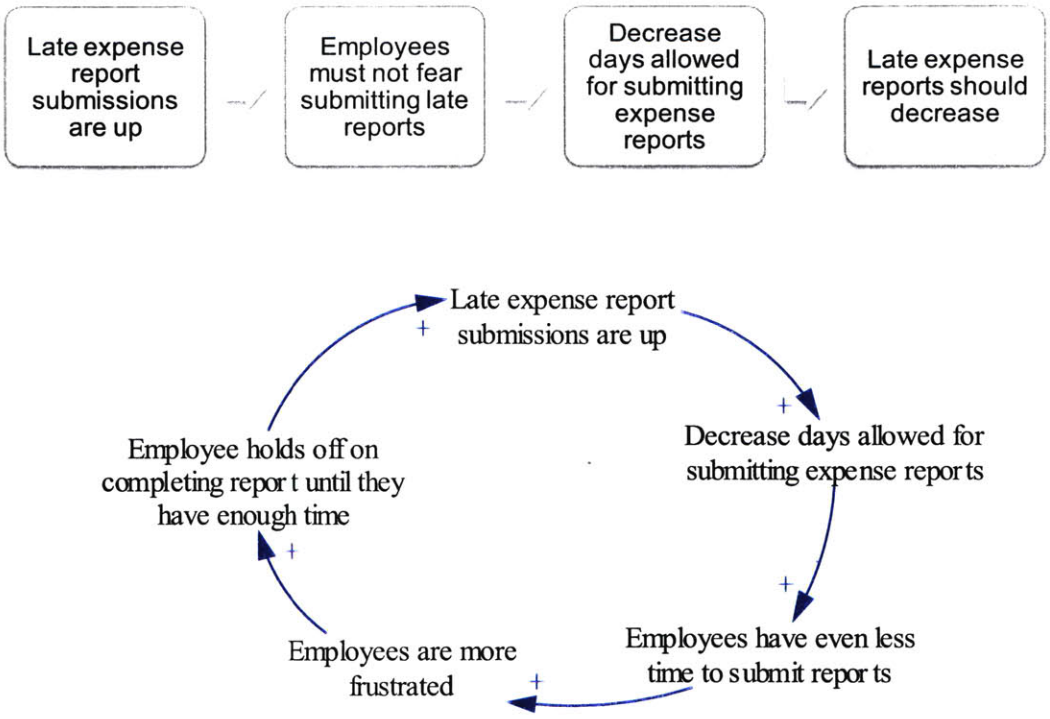

Figure 10 Linear vs. Systems Thinking

The previous figure is a highly oversimplified example of a loop diagram; indeed, this should not be confused for an appropriate system dynamics model. Instead, the previous figure represented a starting point for discussion. By introducing simple loop concepts first in an unsophisticated heuristic model, one is able to then expand upon these basic insights to develop a more-robust model that yields clearer results. The following section walks through the expansion of this notional loop into a more accurate assessment behind the causes of late expense submissions.

The first place to start in developing this model is the recognition of the gap that currently exists between the desired days to expense (referred to as DTE) and the actual days to expense. This gap is characterized in the following figure both in causal loop diagram (CLD) format as well as a simple timeline to illustrate the difference.

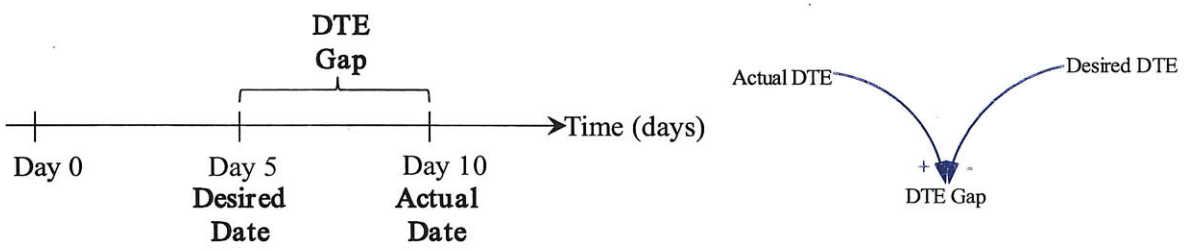

Figure 11 DTE Gap

In this example, a policy may dictate that expense reports must be submitted within 5 days of returning from a business trip. This is the desired DTE. The actual completion is 10 days, meaning on average employees take 10 days after returning from a trip to submit their expense report. The gap equals 5 days, and in the CLD format shown on the right, this gap increases as the actual DTE increases, and similarly increases as the desired DTE decreases.

From our linear-thinking model, we remember that the goal is to reduce the actual days to expense. Using linear thinking, holding all else equal one assumes that shifting the desired date to the left (or stated differently changing policy to decrease the required maximum number of days to expense) will consequently also shift the actual DTE to the left. We use a simplified example to assume that a two-day shift will subsequently cause all expense reports to be submitted on average two days earlier. The following figure summarizes the expected results of such a policy shift.

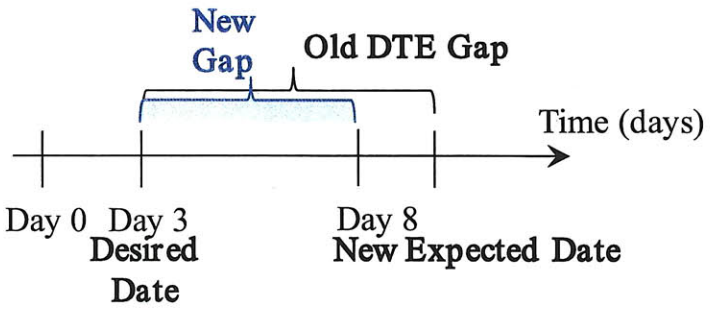

Figure 12 Linear Model and the DTE Shift

This basic linear model assumes among other things that if employees are faced with stricter policy and correspondingly strict penalties for violation of policy, that behavior will change accordingly to adhere to the new standards. The actual results however reveal a much different outcome; rather than decreasing the actual days to expense by changing policy, the actual DTE instead *increases* beyond the original average. The following figure illustrates the result of the policy change.

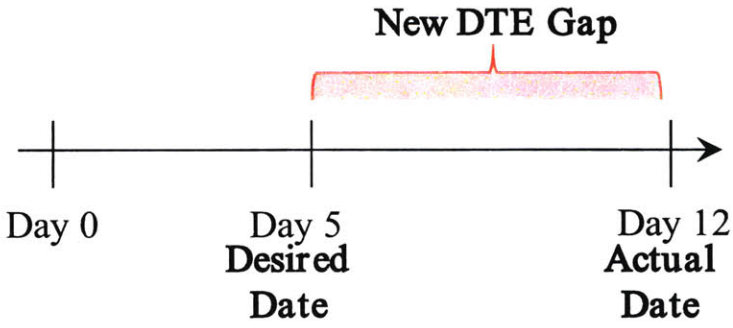

Figure 13 Actual DTE shift

So if enacting a tighter policy yielded unintended consequences, what were the causes behind such a counterintuitive outcome? Here we refer back to the simplified model to remember the overall affect of decreasing the desired DTE and now apply it more specifically to the changes in other variables in the system.

First, we start with the change in the DTE gap and the effect on actual DTE. Remembering the basic CLD from before, a change in the desired DTE will increase the gap between desired DTE and actual DTE. This increase in the gap results in an increase in work pressure, which in this example could either be externally motivated (e.g. management oversight) or internally motivated (e.g. commitment to compliance), or a combination of both forces that increase the stress level of an employee to complete a report. Consequently, the increase in policy pressure intensifies employee frustration with an expensing system that is extremely unfriendly for the user. Faced with the prospect of dedicating time and effort on a cumbersome system and process amid pressing work-related assignments, employees de-prioritize the completion of the expense report until they have enough time to deal with the frustrating task. In turn, this de-prioritization

decreases the rate at which expense reports are completed and submitted in a timely fashion, thus resulting in pushing back the actual date of expense and only widening the gap between actual DTE and desired DTE. The following figure illustrates this reinforcing loop we refer to as the "Put off until free" loop, or in more common parlance, "I don't have time to deal with this now."

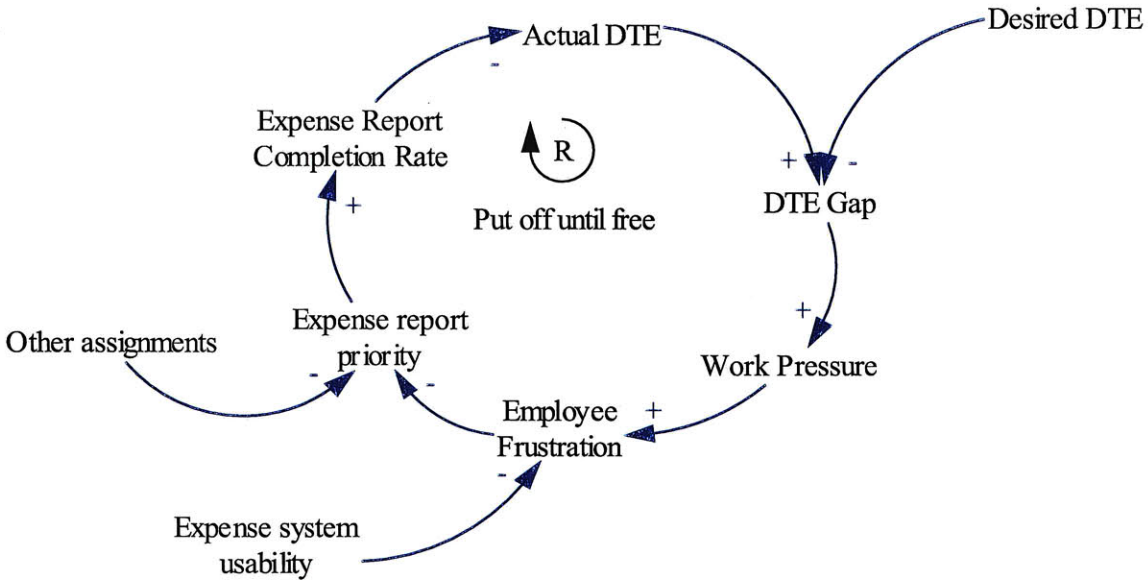

Figure 14 Causal Loop Diagram for DTE increase

The key insight in the previous model is the impact of employee frustration and the role that the expense system usability plays in tempering this variable. One can hypothesize that with a simple, user-friendly system that is reliable and requires minimal user manual data entry (e.g. pre-loaded expense data, embedded policy checks, electronic receipt submission, etc.), frustration is mitigated by a tool that facilitates faster processing of expense reports. This frustration does not stay contained only in the end-user experience. The growth in the DTE gap also results in another reinforcing loop originating from the frustration accounting employees who process the report. As the DTE gap grows, accounting performance metrics (in terms of credit-card transactions reconciled, expense reports processed within policy, etc.) worsen, leading to frustration within the employee group for its measures of compliance to policy. This frustration from accounting group

only creates mental models that travelers are to blame for the under-performance of the overall system. Whereas the accounting employees may want more pressure on travelers, such pressure only increases the gap, and this reinforcing loop, labeled the "Tighter Rules" loop, is observed in the following figure.

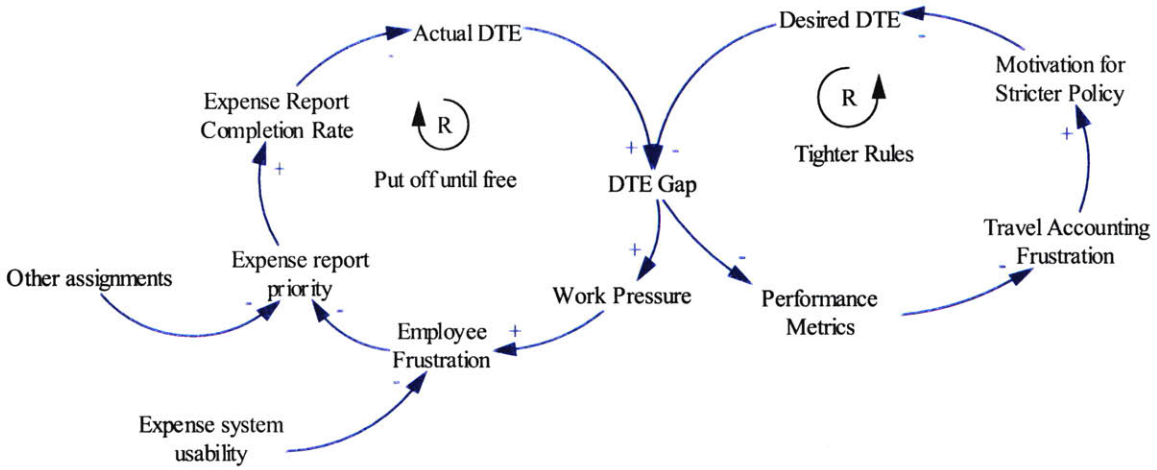

Figure 15 Expanded CLD for Tighter Rules

Amplifying the problem, the frustration from the accounting group also can lead to a reduction in customer service quality, labeled in the following figure as the "Service Deterioration" loop.

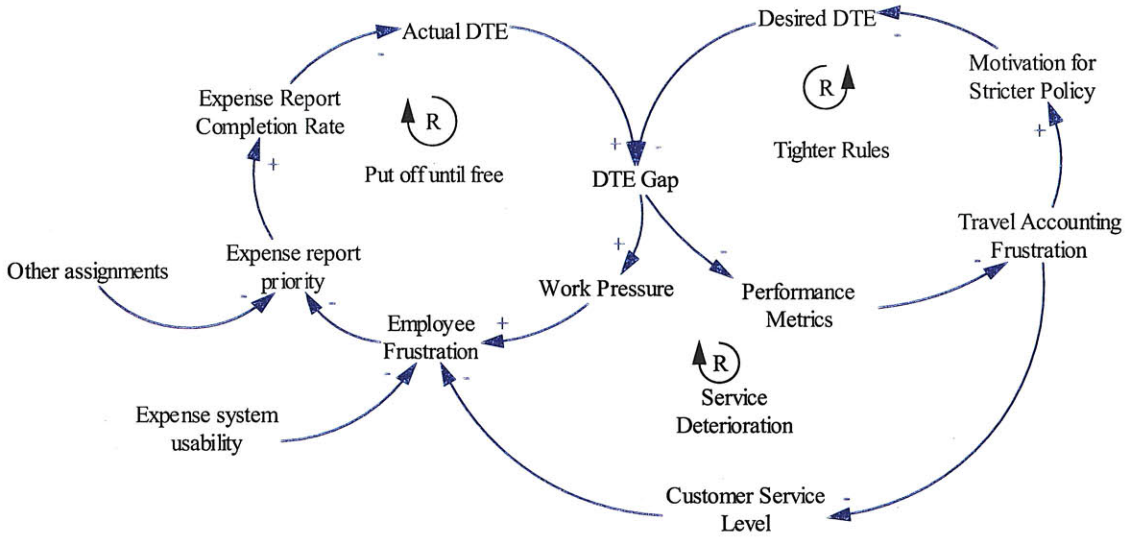

Figure 16 CLD for Customer Service Changes

Incrementally, one can begin to appreciate the interplay between the feedback loops that drive behaviors in the system that would are not uncovered with a simple linear model. Up until now the loops have been reinforcing loops, but there are balancing loops present that do counteract these reinforcing properties and keep the system from completely sliding out of control. For example, borrowing from Sterman's model in *Business Dynamic*[13]*s* on managing workload, a balancing loop emerges from the shortcuts people may take in order to get their work submitted on time. If we assume that the increase in work pressure not only increases frustration but also decreases the amount of effort employees are willing to put into completing an expense report, we can observe that this decrease in effort actually *improves* the rate at which reports are submitted, and more importantly submitted in a timely fashion. This balancing loop is referred to as the "Corner Cutting" loop. However in the spirit of system dynamics one must remember that any action in an environment can trigger other actions that may not have been anticipated, and this holds true of the Corner Cutting loop as well. By decreasing attention to details of the expense report (e.g. forgetting to submit some required receipts, or charging an expense to an incorrect charge code), the error rate for expense reports increases, leading to more rejections by the accounting group and ultimately more re-work for the traveler to complete. Ultimately the gap widens yet again, in a loop referred

to as the "Quality Deterioration" loop. These two new loops are seen in the following figure and for the sake of clarity are removed from the larger model.

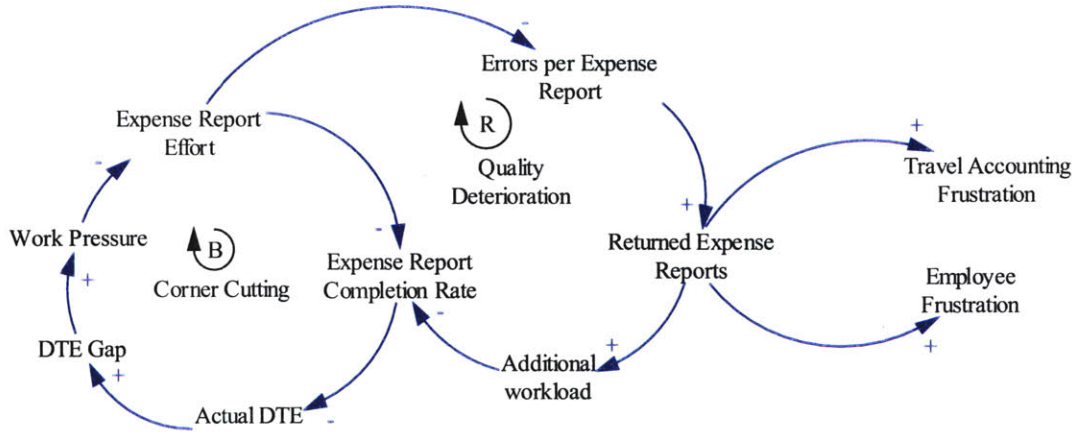

Figure 17 CLD for Corner Cutting and Quality Changes

One other effect not mentioned from these two new loops is the impact that returned expense reports then have on the frustration of the accounting group as well as traveling employees (see figure above). All stakeholders are displeased with the lack of first-time quality in the system. Over time this impairs the reputation of the expense system.

Ultimately, introducing systems thinking into the current state analysis of the travel and expense system reveals areas for improvements and mechanisms to address current system limitations. Most importantly, Systems Dynamics helps emphasize the importance of capturing and resolving problems up-front instead of in later stages of processes, and this insight spans into a variety of recommendations from policy improvements to IT system requirements. Additionally, the recognition of feedback loops and their relevance to complex systems such as travel and expense emphasizes the importance of consistency between the IT tools, policy, and business processes to achieve desired results.

4.4 Enterprise Architecture Views

In order to further enrich our understanding of the current state of the system, the eight enterprise architecture views provide a framework for analyzing other aspects of the travel system that may not have been fully captured during the benchmarking, current

state value stream mapping, or business case activities of the research project. The following sections summarize the findings from using these different views, with a more detailed analysis found in Appendix A.

4.4.1 Policy/External Factors View

At the highest level Boeing has two regulatory frameworks it must adhere to: the first is the internal accounting-based company policies originating from financial reporting standards, and the second is external government travel regulations required by virtue of Boeing's participation in U.S. Department of Defense contracted programs. Although these government regulations only apply to travel completed on behalf of government-funded projects, Boeing extends some of these requirements to all organizations, in an effort to reduce complexity (by eliminating separate standards) and promote standardization of company policy. While some of the regulatory standards that Boeing must adhere to are non-negotiable (e.g. the IRS requirement to keep receipts for all single expenses over $75), others are at the discretion of the audit team and the interpretation of Boeing. Boeing has made much effort in the past few years to regularly review its travel and expense policies and ensure pro-active compliance.

4.4.2 Strategy View

T&ES has developed a vision and mission statement, and each serve as the foundation for the strategy of the organization. These were derived from the parent SSG organization, and are stated below:

- **Vision:** Providing exceptional end-to-end service for all your travel needs
- **Mission:** Enable Boeing competitiveness by providing effective travel services at an affordable cost

Although each year specific goals and objectives are developed based on current business challenges, the ultimate strategic goal of T&ES is to deliver the services Boeing employees need for travel essential to their work functions; this is balanced however by the requirement to contain costs that affect the profitability of the company as a whole. As almost all functions of the company participate in some sort of work-related travel,

keeping T&ES as a shared service across the enterprise is consistent with the strategic goals of delivering affordable services, but meeting the requirements of a wide variety of business units has led to difficulties in providing quality services. Ultimately the Boeing travel system strategy is centered on the end user (the Boeing traveler) and management emphasizes this focus via their integrated work plan.

4.4.3 Products/Services View

The Boeing travel system provides all the needs for a Boeing traveler, from airline, hotel, and car rental reservations to credit card and expense report management. These services are mainly centrally administered from a Shared Service site in St. Louis, with a few employees (mainly management and some travel booking staff) based in Seattle or remotely. Historically, the services of the travel management function have been more customer value focused, whereas the travel accounting function has focused more on compliance, delinquency, and discrepancy issues. This is worth noting because it is this set of services that is typically the cause of frustration for travelers and generally receives a lower customer satisfaction score than travel booking. As one employee explained, "Booking a trip is the fun part. You get to pick your flight, where you want to stay, etc. It's when you come back from a trip and have to submit receipts and log expenses that things become annoying."

As revealed in the benchmarking activity, Boeing also provides a wider array of services for their travelers than other companies, most notably credit card reconciliation. Although there are plans to eliminate this service from their offerings, many employees have come to expect this as a routine feature. A constant challenge in the travel system is determining which products and services can be self-procured by the traveler, and which require intervention from the T&ES staff.

4.4.4 Information Technology View

Over the past decade Boeing has implemented a patchwork of various systems and platforms to accomplish the goal of providing efficient travel services while keeping up-to-date with technology improvements, only to end up with an unwieldy amalgamation of

tools that are integrated to a very limited degree. As a result, data is stored in a variety of different systems both formally and informally, and a proliferation of home-grown Microsoft Access and Excel databases and spreadsheets are used to track critical financial and operational information. Another negative consequence of the large number of systems is the amount of effort that is involved in gathering and synthesizing data for management or other customers to review. Furthermore, with such a variety of source record systems the ability to get one definitive answer to a query is reduced; when asking how much Boeing spends on travel in a fiscal year there could be as many as four or five different answers depending on the system used to obtain the records.

The overall result of such a broad set of data is that the organization for too long has emphasized quantity of data over quality. Meetings include time to review a variety of compiled metrics but it is difficult to determine which indicators truly capture the state of operations. Although steps are being taken to mitigate such problems, including introducing new streamlined reporting tools in the current system, many improvements are necessary to ensure data integrity is not compromised.

4.4.5 Process View

Business process management has improved significantly in recent years due to management attention and focus. Boeing travel management has taken steps to streamline and document standard processes, but has had more difficulty with exception handling and fully capturing the different scenarios that arise from the many different combinations of travel types. Additionally, although processes can easily span across a variety of work-groups, most efforts to standardize work are kept within self-contained functional groups, usually either to identify a responsible party or simplify an otherwise tediously complicated task, but this usually results in "silo" effects where handoffs between activities are mishandled.

Another difficulty Boeing has encountered is the concentration on process improvement has sometimes led to a loss of focus on the customer. With emphasis placed on reducing backlogs of work by either shortening cycle times or eliminating down-

stream non-value added activities, less attention is available to discover root causes and eliminate upstream problems the customer encounters. From a systems dynamics point of view, too much time is spent on draining a stock without as much regard for realizing the original flow that is increasing the stock in the first place.

4.4.6 Organization View

As previously stated, the Boeing T&ES organization is comprised of roughly over 200 employees, mainly based out of St. Louis, which centrally process the majority of travel services for The Boeing Company. Functional teams are organized around specific processes, and alignment between these teams has increased but is still limited. Additionally, the insular nature of the organization results in many employees perceiving the customer as the root cause of service problems (e.g. "if only travelers followed policy" or "it's not our fault, those travelers aren't keeping their receipts) instead of finding ways to resolve service issues.

Recent management changes have resulted in various re-organizations, sometimes to the frustration of employees who would prefer a more "stable" organizational structure. Additionally, remnants of old allegiances remain between historical travel management and travel accounting groups. These organizational issues are discussed in more detail in a three lens analysis included in Chapter 8. Overall, organizational alignment has improved but T&ES is still shy of being one unified group.

4.4.7 Knowledge View

Like many organizations, knowledge management is lacking within the T&ES organization to the detriment of employees and customers. In a variety of groups, knowledge is contained within a few key individuals (one example of this arose during a process mapping exercise, where individual names were used to title a standard process, e.g. the weekly Mike file or Bob's database[i]) with either many years of experience or subject-matter expertise. Although employees are given opportunities for formal training

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[i] Names changed from real employees

and advancement in generic skills, minimal training or learning opportunities seem to be available for task-specific functions.

5 Evaluation Criteria – Key "-Ilities"

In order to objectively evaluate candidate future state architectures, we must first define the dimensions along which we expect the enterprise system to improve. Nightingale and Rhodes refer to the "-ilities" as overarching considerations that take a longer-term look (as opposed to shorter term quick fixes) at the enterprise and help define the preferred function of the system. The "-ilities" generally describe desired system behaviors or characteristics; examples include flexibility, scalability, modularity, quality, sustainability, agility, etc. Before evaluating candidate architectures the key "-ilities" should be determined to avoid bias in the selection process.

In the case of Boeing T&ES, the criteria for evaluation of the future state architectures consist of three key "-ilities": quality, affordability, and usability. These three "-ilities" are most consistent with the goals of the T&ES organization and the larger Boeing enterprise, and directly address current shortcomings of the as-is system. This section will help explain why each ility is important and the sub-criteria created from each ility which will be used to judge the candidate future state architectures.

5.1 Quality

Quality is of the utmost importance to a company like Boeing, and improving the quality of the travel system is perhaps the most important goal for the T&ES organization. In this case quality refers to reliability and consistency of service as opposed to variety of features. As highlighted in previous examples and data, Boeing has struggled recently with quality in delivering travel and expense services: process error rates, re-work levels, and customer service complaints were too high and have negatively impacted overall performance of the organization. Key questions used to evaluate the quality of the system include:

- Does the proposed architecture facilitate lower defects?
- Does the proposed architecture improve data integrity across systems?

5.2 Affordability

In addition to ensuring that a future-state system reduces the rate of defects and improves the service quality of the organization, the preferred architecture must also deliver these results in a cost-effective and affordable method that the enterprise is willing to financially support. We deliberately use the term affordability because it addresses the assumed trade-off between cost and quality. Boeing does not necessarily aim to find the lowest cost travel and expense systems software package; instead it seeks to balance the total cost of ownership of the travel and expense system with the objectives of quality and usability to determine the optimal system expense. Much like Boeing should not impose draconian travel restrictions (e.g. shared hotel rooms, low meal allowances) to save on costs, it should not assume to automatically take the least expensive system to do the same. Key questions used to evaluate the affordability of the system include:

- Does the proposed architecture enhance end-user productivity?
- Does the proposed architecture minimize implementation & operational cost?
- Does the proposed architecture lower total cost per transaction?

5.3 Usability

Finally, as a service organization Boeing T&ES must provide its customers with a simple and intuitive system that provides travelers the key tools needed to satisfy their objectives. Historically the Boeing expense system has been perceived by employees as cumbersome, unfriendly to the user, and complicated to navigate. To address these issues Boeing must ensure that any new software tools eliminate non-value added activities and steps in the travel process. Key questions used to evaluate the usability of the system include:

- Does the proposed architecture reduce manual intervention by user?
- Does the proposed architecture provide a simple and intuitive user interface?
- Does the proposed architecture reduce the amount of time required for a user?

Ultimately, the "-ilities" are used to develop a weighted scoring mechanism based on the relative importance of each of the sub-criteria and main criteria. The weights and scoring matrix can be found in detail in Appendix B. A detailed discussion of the results of the scoring matrix is found in the following chapter.

6 Candidate Architectures for the Next Generation Travel System

In developing the potential future state architectures for the Next Generation Travel System, two points stood out:

1) Independent of the software system used to manage travel, the policies, people, and processes would all undergo the same change
2) As a result of point 1, the only differentiation between future state architectures would be the software system; as a result this is the focus of the candidate architecture evaluation

Because such a large portion of the travel and expense system is defined by the IT tools used to manage this system, the majority of this section is dedicated to explaining the candidate tools and selecting a preferred option. More information on the preferred architecture for the people, policy, and process architecture will be discussed in the next chapter, Transitioning to the Future State.

In determining the preferred combination of IT tools and platforms to manage the Next Gen system, Boeing must decide where it chooses to place itself in a spectrum of supplier combinations. A visual representation of the options available to Boeing is seen in the following figure.

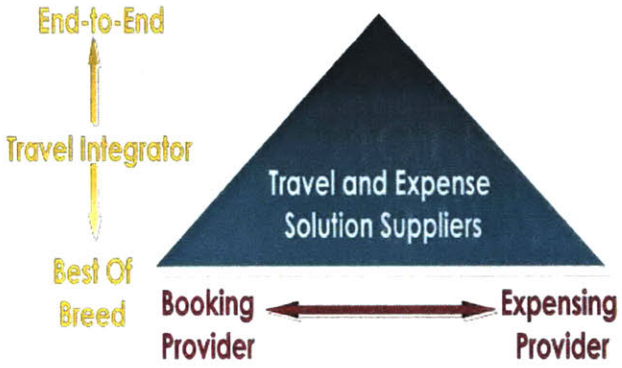

Figure 18 Travel System Supplier Spectrum

Along the vertical axis, Boeing has the option to select either a multitude of best-of-breed suppliers or a smaller set of integrator companies that provide a more comprehensive set of services. The horizontal axis represents the variety of different types of suppliers, from the beginning of the process value chain of travel bookings all the way to the post-travel expense management providers. The triangle representation in this figure is also deliberate; the higher Boeing runs up the integration axis the lower the number of available suppliers and the more the classification blurs between booking and expense provider (i.e. the few suppliers in this group identify themselves as overall travel system providers). With this model in mind we propose three different future state candidates, and the following sections describe these options in more detail.

6.1 Best-of-Breed Model

The Best-of-Breed architecture assumes a modular approach to architecting the to-be system. In this case, Boeing would develop deals with multiple suppliers instead of bundling with one single provider. Each supplier would supply their best-in-class module, from online booking tool to expense management, and Boeing could choose to either integrate these modules internally or externally seek another partner to manage integration.

The advantages to such a model include the flexibility to swap components in or out of the system as requirements change or updates are needed, as well as the ability to obtain the best possible solution for each set of business processes. By procuring best-in-class tools, Boeing can increase end-user productivity by selecting the systems most likely to provide a simple and intuitive interface for a traveler. Best-of-breed suppliers have this capability due to their domain expertise and experience developing systems that better fit the workflow of a specific business process. Additionally, by establishing contracts with various suppliers, Boeing can create a healthy competition for these suppliers to provide the best value in the travel and expense system, and can establish service-level agreements that incentivize suppliers through financial rewards.

The disadvantages to a modular architecture lie in the ability to successfully integrate a variety of systems that do not have common or standard interfaces; although this can be

mitigated by partnering with an external party to manage the integration, few examples of successful integration exist in the corporate travel industry. Beyond integration issues, other concerns include the need for increased supplier management capabilities to handle the variety of suppliers as well as the need for active monitoring of system upgrades and changes and their potential effects on other components and modules.

6.2 Fully integrated Model

In the Fully integrated architecture model, Boeing would seek a supplier to bundle the entire travel and expense system, engaging a single supplier to manage. In this model the travel and expense system graduates to a level more analogous with Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), or Supply Chain Management (SCM) software systems, where one large integrated solution integrates several process modules.

The advantages to a fully integrated model are mainly the improvements in data integration and the assumed corresponding decrease in manual user intervention. With an integrated system, data in theory passes from one module to the next without the need for staging or preparation for the next step, decreasing the amount of user involvement in operations. Additionally, an integrated model might allow Boeing to monitor rather than heavily manage system upgrades and modifications, because these are handled by the supplier and are orchestrated activities that take into account the impact to all system components. By transitioning most of the maintenance and some of the operating activities to the supplier, Boeing T&ES can concentrate more on delivering value-added services to the traveler, such as data reporting to management and customer service inquiries.

The main disadvantage to a fully integrated model is the reliance on one supplier to provide the entire system and ensure the interoperability of many complex pieces. By depending on only one supplier Boeing runs the risk of being locked-in to a system that may not adapt as quickly as a more nimble collection of smaller sub-components. Additionally, once committed to a single supplier the costs for Boeing to switch in the case that benefits do not materialize becomes higher; this presents dual problems as the

system may not achieve the desired objectives and the supplier may raise prices knowing that Boeing is faced with few viable alternatives to exit the agreement.

6.3 Hybrid Model

In between the best-of-breed model and the fully integrated approach resides the hybrid model; this architecture is characterized by breaking down the travel and expense system into more "natural" pieces in order to integrate a few key components. Unlike the best-of-breed approach this model does not break the system down into the largest number of possible IT tools, rather it groups certain sections together in logical pieces. To use a clarifying analogy, if the travel and expense system is viewed as an airframe, the best-of-breed approach seeks to find the best ailerons, flaps, frames, and fasteners; the hybrid model looks for the best wings and fuselage. In the case of the Boeing travel system, the travel management and online booking tool system is paired into one group, whereas the credit card management and expense management system comprises the second group.

The advantages and disadvantages of the hybrid model are not surprisingly an amalgamation of those found in the other two candidate architectures. The critical dependency for the success of such a model is the ability to integrate these larger components into one unified system. If this can be accomplished Boeing can realize lower lifecycle costs by spurring supplier competition as well as increasing quality by decreasing system defects and re-work requiring manual intervention.

6.4 Candidate Scorecards

After reviewing the potential architectures and comparing them to the preferred future state vision of the Boeing travel and expense system, the following three basic scorecards are developed to assist in the selection of a preferred architecture.

Candidate 1: Best of Breed Model	
Description Boeing could source the best-in-class provider of each service (travel management/OBT, credit card, expense reporting software) and integrate these systems either externally or internally	**Assessment** Quality 3.0 Affordability 2.45 Usability 3.2 WEIGHTED TOTAL 2.80
Architecture Strength Provides leading tools to accomplish tasks; domain expertise and implementation experience; supplier competition	**Architecture Weakness** Integration can prove difficult and costly; requires active monitoring for changes/updates; many suppliers to manage

Candidate 2: Fully integrated Model	
Description Boeing could source one integrated total travel package, either from one core supplier or from a partnership of suppliers	**Assessment** Quality 4.25 Affordability 3.25 Usability 3.9 WEIGHTED TOTAL 3.71
Architecture Strength Out-of-the box integration allows Boeing to concentrate on customer; single source for data; minimizes manual user intervention	**Architecture Weakness** Dominant supplier complacency; switching costs increase; few capable suppliers for this type of service

Candidate EA 3: Hybrid Model	
Description Boeing could source a few key components from "Tier 1" style suppliers and then integrate large sections into one system; these suppliers would manage integration of sub-systems	Assessment Quality 4.0 Affordability 4.15 Usability 3.3 WEIGHTED TOTAL 3.89
Architecture Strength Reduces complexity from integrating large number of systems; allows for supplier competition; maintains flexibility to switch	**Architecture Weakness** Relies on suppliers to integrate sub-components; upfront investment in syncing bigger pieces

Figure 19 Candidate Architecture Scorecards

6.5 Preferred Architecture

Through the use of weighted scoring to evaluate the different alternatives, the hybrid model emerges as the preferred architecture for the travel and expense system. This result emerges from the hybrid model emphasizing lower overall lifecycle costs which increases affordability while also providing comparable quality to the fully integrated solution. We should note that the fully integrated model does come in a close second, whereas the best-of-breed approach is a distant third.

7 Transitioning to the Future State

To successfully transform the Boeing travel and expense system to the desired future state, the organizational, process, and policy considerations must be aligned with the proposed IT system architecture to maximize the value of the entire system. Before describing the recommendations for this transition, a review of the enablers and barriers to change is a useful exercise to understand the likelihood these recommendations are successful. The following chapter provides this analysis using the Three Lens framework, and concludes with an overview of the Boeing T&ES transformation plan and the current strengths to achieve these goals.

7.1 Three Lens Analysis of the Boeing Next Generation Travel Project

In order to assess the viability of lasting change in an enterprise, a framework is needed to synthesize the complexity of the organization into key dimensions that can be easily understood. A useful model for analyzing the Boeing travel and expense system is Carroll's Three Lens framework[14] for diagnosing organizational design, focusing on the strategic, political, and cultural dimensions of the issues an organization faces. The following sections summarize the results from the three lens analysis used to accomplish three key objectives:

1) Understand the enablers and barriers to project success
2) Evaluate how each perspective influences the interpretation of how the system operates
3) Reflect on the key interdependencies between these dimensions

Before describing the organizational design through each particular lens, it is important to establish the context of the project by answering some basic questions on the goals, rationale, and requirements of the project, and also disclosing the role of the researcher in the advancement of these objectives.

For the Boeing Next Generation travel program, the ultimate goal of the project is to completely overhaul the policies, processes, IT tools, and organization used to deliver and support all of Boeing's travel services. Not to be confused with a simple IT

implementation to replace a legacy system, the Next Generation travel project was commenced to address not just the technical limitations of the current system but also the business process and enterprise-wide issues that have adversely affected Boeing as a whole. Examples of the types of problems the project aims to address include reducing the long cycle time for employee reimbursement, increasing the low levels of customer (e.g. Boeing traveler) satisfaction scores, decreasing the financial burden from running an inefficient organization, and eliminating the lack of visibility into corporate travel spending throughout the company. However, similar to most IT implementation projects the Next Generation program uses project management best practices at Boeing to identify key deliverables, including requirements documentation, system design specifications, and an overall project implementation plan.

Because this is a relatively new program that is intended to last several years, the role of the researcher in this project is to provide consulting support as a team member for most activities, with an emphasis on strategy and high-level problem identification and resolution; however as a new program with limited staff, the researcher will also contribute as a team leader for various activities where applicable. This dual insider/outsider role can provide the opportunity to enrich the research however: by offering insider familiarity coupled with outsider ability to propose new ideas and paradigms for the future, a more enriched view of the organization can emerge.

Equipped with a high-level understanding of the project context, the following three sections are devoted to each specific lens (strategic, political, and cultural) and document their impact on the ability to implement and deliver sustainable change with the Next Generation Travel project recommendations.

7.1.1 Strategic Lens

For a corporation the size of Boeing, the strategic design lens is typically the most common framework used to analyze organizational problems. This lens views organizations as "machines" that are designed and constructed to accomplish specific tasks. For Boeing travel, its goal as an organization within the Shared Services business

unit is to provide travel services and support to the entire Boeing organization. Over the past few years, the Boeing travel organization has undergone a variety of organizational structure changes, the most notable being the merger between two traditionally distinct and separate entities: Boeing Travel and Boeing Travel Accounting (TA). Although this distinction was mainly a holdover from historical events (more on this subject in the cultural lens section), it is worth noting that the two groups do provide unique services, albeit to the same end-consumer. Whereas Boeing Travel is responsible for pre-travel activities such as air, hotel, and car bookings and reservations, TA is tasked to process all post-travel activities such as expense reporting and corporate credit card reconciliation. As previously stated, both groups ultimately serve the traveling Boeing employee, and as a result the groups were brought together under one group in the spirit of Lean to propagate the notion of an integrated end-to-end value chain dedicated organization.

To date, the integration of these two units has been turbulent at times and has yet to yield the synergies originally desired from the unification. Through informal discussions, observation of meeting dynamics, and a review of the current metrics used to assess organizational performance, most data show that these two groups still consider themselves separate entities that are forced to work together and some within the organization doubt the benefits of the combination. The following figure highlights how to many employees the integration has been in name only, as the current organizational structure is based on a functionally-oriented design that still keeps these two groups apart.

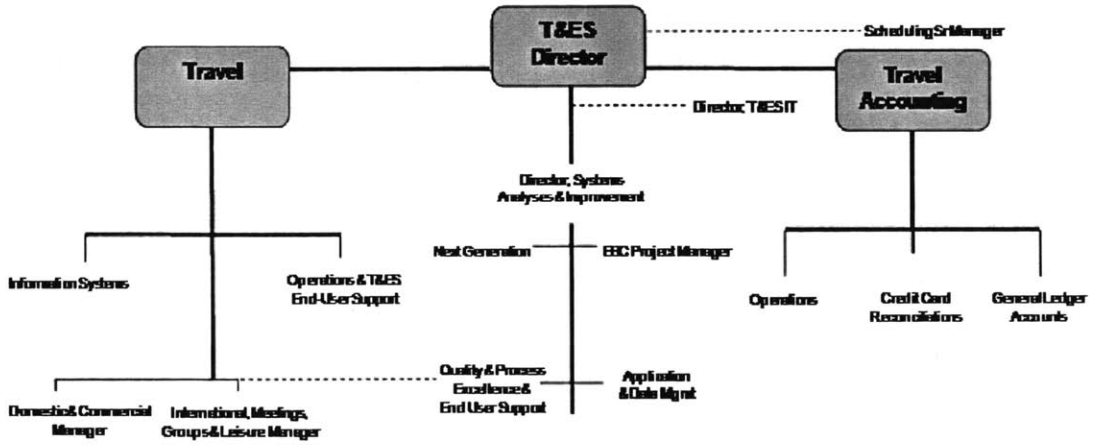

Figure 20 Boeing travel organizational structure

In contrast to the larger travel organization structure, the Next Generation travel program is designed as a matrix organization with representatives from various parts of the larger travel group as well as other broad company-wide functionally specific "support" groups, such as finance, IT, supplier management, etc. The following figure is an example organizational chart for the Next Gen program:

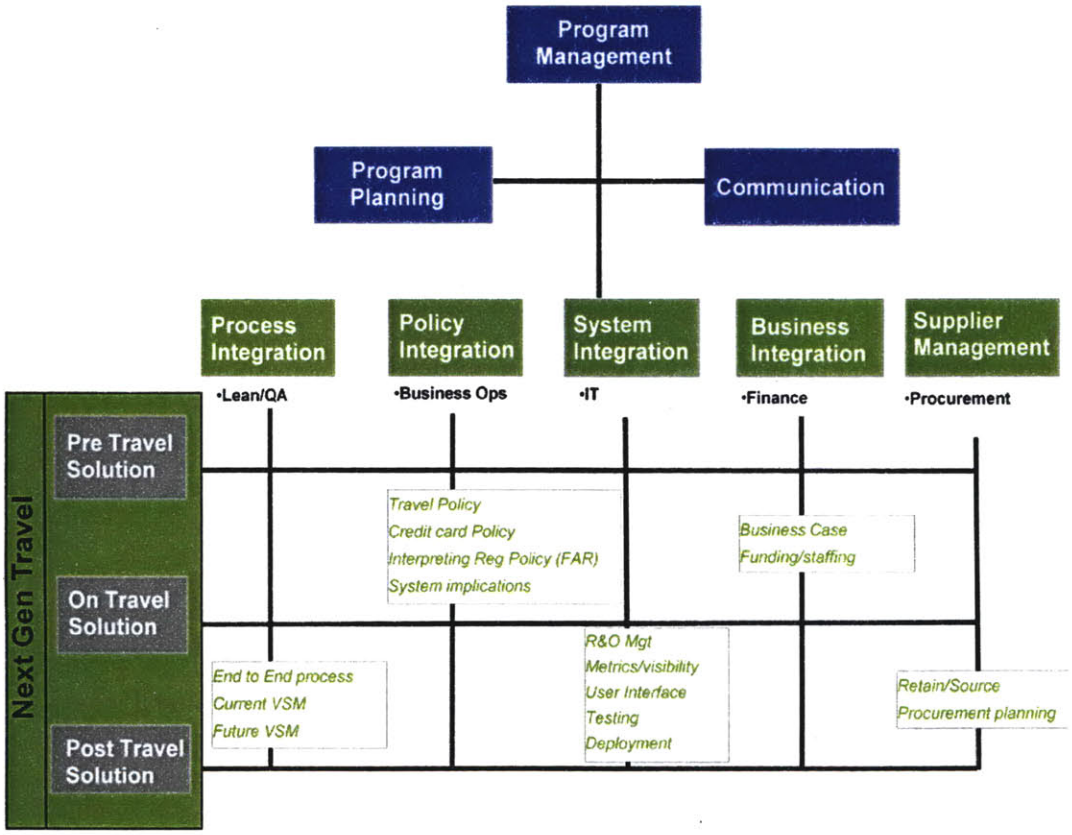

Figure 21 Next Generation organizational structure

It is worth noting however that in its current manifestation the Next Generation org structure is a "virtual" team, as only two dedicated resources (including the researcher) are assigned to the task. The remaining team members are borrowed from other parts of the organization to participate part-time on the project, which not surprisingly has led to difficulties in terms of the volume of work that can be accomplished (i.e. borrowed resources typically prioritize their "core" jobs before delivering time and attention to

Next Gen) as well as the depth of knowledge available to evaluate more technically rigorous issues (e.g. one general IT employee is tasked to develop detailed level requirements that occasionally require more subject-matter expertise). Despite these challenges however, the team has been able to leverage the novelty and openness of the project to entice other travel employees to consider joining "the next big thing" as their responsibilities for other tasks (such as the current minor software upgrade project) begin to conclude. Additionally, the small size has allowed the team to think in terms of simpler, higher-level metrics that can assess the health of the entire organization, instead of task-specific measures that may not be aligned to overall goals.

Finally, it is worth considering that although the strategic design of the project is not consistent within the larger organization, in a certain sense it is consistent with what management perceives as the end-goal of the current organizational evolution (i.e. over time the larger travel organization will morph from the traditional functionally oriented design of booking/expensing travel to one face of travel). This evolution in fact has begun as some travel groups are undergoing further re-organization; it is the author's opinion that testing the design in the smaller project first not only establishes viability but also allows for evaluation of strengths and weaknesses for a larger, long-term rollout.

7.1.2 Political Lens

Whereas the strategic lens views organizations as machines, the political lens perceives an organization as a contest for power between various stakeholders. In a broader sense, this lens is particular useful for analyzing the dynamics between the travel organization and Boeing at large. We shall return to the subject of the political view within the travel group, but first a review of networks of power and influence within Boeing is valuable for understanding the constraints and limits under which the Next Generation project can operate.

Boeing not only has a diverse set of business units comprised of commercial and defense-oriented business activities, but within these groups it also has a diverse set of employee types (union, non-union, contractor, blue-collar, white-collar, executive

management, etc.) and geographic locations (domestic, international, telecommuters, etc.) that significantly affect the different types of travel requirements and support mechanisms needed to service such a large organization. Each of these classifications essentially creates a new stakeholder group with their own sets of demands, interests, networks, and influence that makes it difficult at times for Boeing to ensure consistent compliance with policies and procedures.

A few examples shed some light on these challenges. On the subject of timely expense reporting and reconciliation, many employees consider such tasks as unworthy of their time and attention, and ultimately this negligence can result in Boeing paying large amounts of money on late fees to the corporate credit-card provider. While a corporate policy with enforceable penalties should mitigate such risks, cases exist of employees working up their management chain to request exceptions.

As part of the objective of the Next Generation project is to implement new policies and procedures for travel services, an understanding of the political lens is critical for knowing the constraints or boundaries to change. On a more positive note however, understanding the political landscape has also helped drive change; as the travel organization has improved their ability to deliver more consistent and accurate data reporting, identifying the holders of power and influence has helped the travel group target their solicitation for allies in support of both enforcement and incentive efforts for change.

Finally, within the travel organization, power and influence largely resides with those that have subject-matter expertise; with a high turnover rate for task-level employees, those that quickly grasp the system are revered and have the capability to build coalitions and develop consensus. Again, viewing through the political lens is beneficial as it allows the Next Gen team to identify and develop key leaders of change over the lifetime of the project by finding opportunities for their training and development.

7.1.3 Cultural Lens

Lastly, the cultural lens views organizations as an environment where shared identities, assumptions, and traditions are passed on over time within groups. In a way the cultural lens attempts to see what can't be necessarily be seen easily, that is the norms, customs, and values of an organization. In the case of the Boeing travel organization, two distinct cultures exist within one organization, and one of the goals of the Next Generation travel project is to reduce the amount of "us" vs. "them" sentiment that pervades the group.

As mentioned earlier, the merger of Boeing Travel and TA has yet to reach its full potential, and much of this is due to the cultural differences between these groups. Of historical note, the Boeing Travel group is comprised mainly of ex-McDonnell Douglas employees who joined Boeing via the merger back in 1997. Although it has been more than a decade, some employees continue to perceive a difference after all these years. On the other hand, many TA employees are relatively new (and also mainly contracted labor), and only know the norms and customs of The Boeing Company.

Another significant difference between these two groups originates from the types of work they are assigned and the nature of their challenges. Although both groups are well versed in problem solving and quantitative abilities, they fundamentally seem to approach problems from opposite ends of the innovation/standardization spectrum. Whereas Boeing Travel employees are typically travel agents trying to hunt for the best possible combination of travel arrangements (e.g. looking for best rates or best hotel locations), TA employees are generally accountants, auditors, or other technical staff that seek to eliminate variability or differentiation in their work. To a travel expense auditor, the worst possible scenario is dealing with a travel expense report that does not fit within their examination methodology, even if it ultimately saved the company hundreds of dollars. Similarly, travel agents experience frustration when booking a rate they know is not the best possible option for the company.

To address these fundamental differences, management within the travel organization has developed a unifying mission and vision statement to begin the process of creating a core set of values for all employees in the newly merged entity. In an effort to demonstrate consistency and align the values of the travel organization with their parent Shared Services (SSG) business unit, the mission and vision are only slightly amended versions of the SSG mission (see example below).

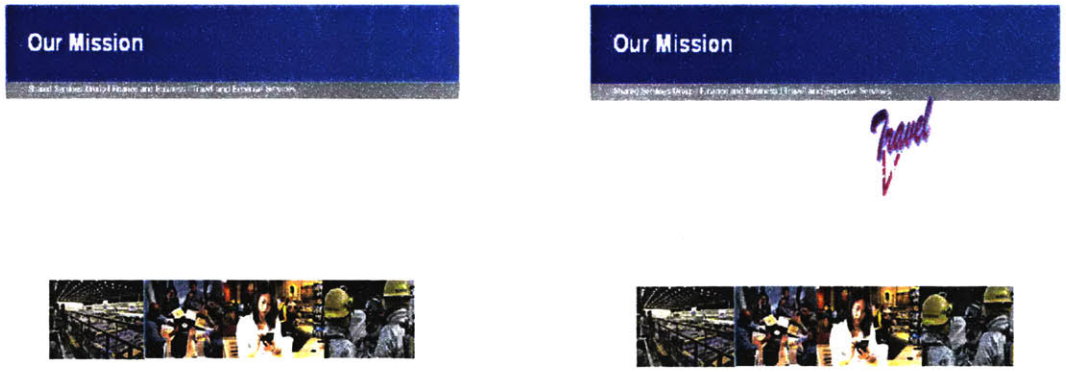

Figure 22 Sample SSG and T&ES Mission statements

Furthermore, the Next Generation travel project has emphasized the importance of fit between this new culture that management aims to develop along with the strategic goals and political opportunities for change in the organization. One such case of recognizing this alignment comes from a benchmarking activity completed by the Next Generation travel team. This activity focused on extracting industry best practices that were aligned with organizational performance objectives as well as the culture within the Boeing organization. For example, although other companies found interesting methods to reduce travel spend such as sharing hotel rooms or having employees personally charge certain expenses, the team quickly recognized such ideas would be inconsistent with the broader Boeing values and as such would fail from fierce resistance.

7.2 Transformation Planning

As stated earlier, in order to achieve their desired future state vision Boeing must align their policies, processes, and people to the IT tools used to manage the entire system. The three lens analysis combined with the enterprise architecture views framework provides the basis for developing the future state vision of these dimensions as well as suggestions for conducting this transformation. To develop this vision a framework is recommended that links these dimensions with the key "-ilities" of cost, affordability, and usability with the preferred systems architecture of a hybrid model. An example for the policy framework appears in the following figure.

Policy	Quality	Cost	Usability
Booking	▪ Monitor & provide booking compliance feedback (missed savings) ▪ Minimize unnecessary travel/travelers/car rentals/	▪ Lowest/Advance airfare ▪ Use preferred hotel ▪ Use preferred ground/parking ▪ Use preferred groups/meetings	▪ TA approval not required except on exception basis ▪ Utilize unused ticket visibility ▪ Base policies that can be customized to groups
Credit Card	▪ Monitor & provide Credit -Card compliance feedback ▪ Clear escalating delinquent balance policy before charged off	▪ Must use corporate card ▪ Per diem cap hotel, Meals and Incidentals (M&I) ▪ Central Meetings/conf coordinate & ghost card ▪ Central Contractor/Intern card ▪ Minimize cash advance	▪ Minimize declines ▪ Paperless ▪ Minimize receipt faxing via level 3 data (Airline)
Expensing	▪ Monitor & provide Expensing compliance feedback (Unapplied) ▪ Ensure expenses on monthly statement fully expensed with clear escalating unapplied policy (vs. expensing post trip)	▪ Audit 90% of dollars & 10% doc ▪ Itemize/track cash advances ▪ Identify/track credits/disputes	▪ Standardized exception approval process, otherwise no approval required (mgt cc) ▪ Payment ready within 2 days from expense submittal (paycheck) ▪ Provide quarterly individual (worst offender)/group travel benchmarking report

Figure 23 Future state framework

Similar tables are completed for Processes and Organizations, and in tandem these comprise the overall future state vision. In terms of the path to achieve this vision, these charts roll up to a transition timeline that takes into account some simple road-mapping of the proposed timeline for the travel and expense systems implementation schedule as well as technology and business model changes over time. Before implementing the new travel and expense system, Boeing must continue to leverage their Tailored Business Stream (TBS) framework and their Lean+ initiatives to drive improvements and eliminate inefficiencies currently consuming resources. As the new system is later implemented

Boeing must stay aware of technology changes that may affect system requirements (e.g. expensing via a mobile phone or using videoconferencing as an alternative to travel). Finally, the new system must consider industry dynamics and the new role of travel.

Ultimately, the recommendation finds that over time the Boeing travel and expense system evolves from less of a process-oriented system (in essence a processing shop) to more of a knowledge-focused value added service (more of a data provider) to the rest of the enterprise. The following figure demonstrates how the travel and expense system implementation sits in between two eras of change.

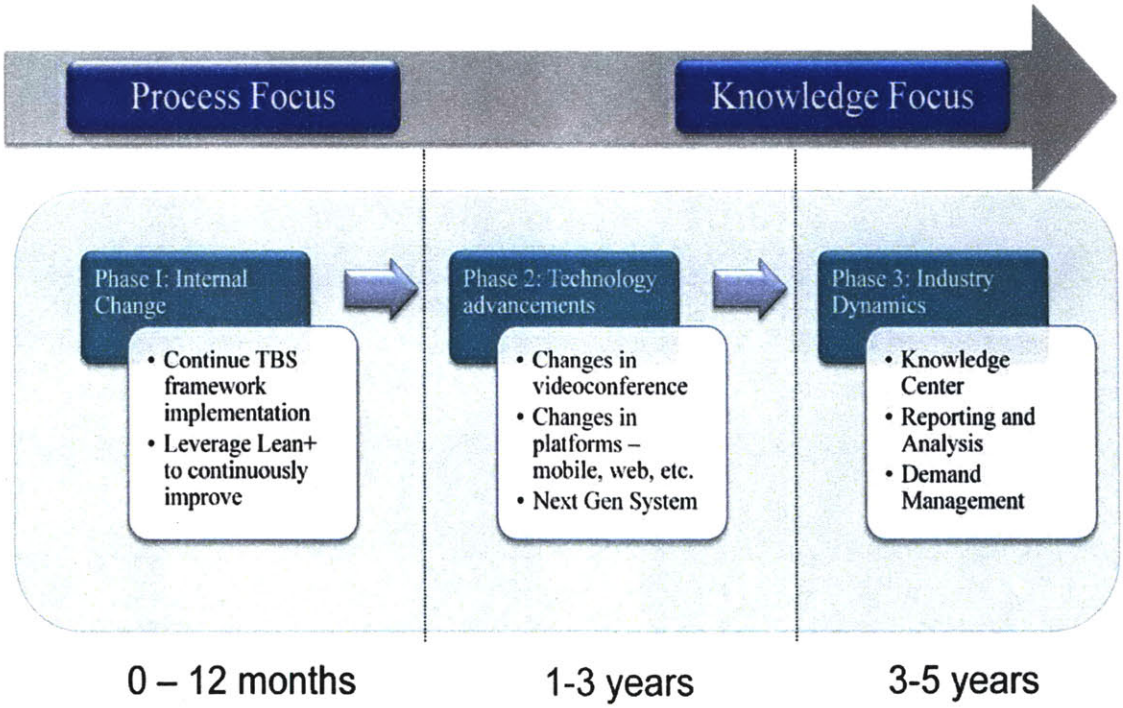

Figure 24 Transformation timing

Finally, it is worth noting that T&ES does have certain qualities that facilitate the transformation of their organization. The following list highlights some of the features that the Next Generation travel team identifies as enablers for change:

- **Integration focus**
    - T&ES leads in linking organization and processes
    - Travel as an end-to-end value chain is customer-oriented

- **Management Support**
    - Awareness that improvements are necessary
    - Appreciation to do the right thing
- **Motivation for Change/Improvements**
    - Employees embrace change for the better
    - Staff generate many ideas for improvements

8 Conclusion

As the Boeing travel and expense system has evolved over time to meet the needs of the company, insufficient emphasis has been placed on taking a systems level view of the travel enterprise. This has resulted in poor operational performance, frustrated travelers, and increasing lifecycle costs. In order to create a new travel and expense system, Boeing has decided to employ a more systems-based approach, taking into account the affect that components have on each other and the enterprise as a whole. This research used two complementary strategies, Enterprise Architecture and System Dynamics, to discover the underlying causes of inefficiencies and unintended consequences in the current system, and ultimately propose a new architecture for the new travel and expense system. Moreover, this new design emphasizes the role of the Boeing T&ES organization as primarily a service organization that must balance quality, affordability, and usability (or in other terms customer satisfaction) when delivering to the customer.

Using Enterprise Architecture and System Dynamics frameworks the research conducted during this project has provided Boeing with insights that will lead to an improved implementation of the new travel and expense system. Through causal loop diagrams and the observations of stocks and flows within this system, we discover the impact the expense software system has in the performance of policy compliance and operational efficiency. These observations stress the importance of a user-friendly system with improved capabilities for data entry and retrieval (e.g. auto-loaded transactions, electronic receipts, etc.), as well as changes in policy and process (e.g. streamlined manager approval, policy embedded into software) to achieve goals of operational improvements, service-level and quality upgrades, and cost reductions. The EA views analysis complements these findings by examining the expense system within the larger context of strategy and organizational aspects that influence the ability of the system to function without creating friction with other components. Ultimately, this comprehensive as-is analysis of the current Boeing travel and expense system revealed various areas for improvements that led to the development of the future state vision for the system, which serves as the foundation for the proposed recommendations.

8.1 Recommendation

An analysis of various candidate architectures finds that a hybrid model in between best-of-breed and fully integrated sourcing works best for the Boeing travel and expense system. When comparing this recommendation against industry suppliers, we note that the best option for Boeing is to integrate a small number of key commercial off-the-shelf suppliers into one comprehensive travel and expense system, with these suppliers sub-integrating the "natural" components of their sub-systems. Furthermore, the rise in software-as-a-service licensing models among suppliers is seen as a benefit as Boeing selects suppliers. By organizing key metrics around the costs per transaction (e.g. the cost per online booking or the cost per expense report completed), Boeing can align the entire system around increasing first time pass through quality, reducing rework, and improving the usability and experience for the Boeing traveler. Not only will these efforts address the shortcomings of the current system, but they also lead to a reduction in overall system costs, as the inefficiencies that plague the current system and contribute so much to its cost are eliminated.

8.2 Implementation Next Steps

Research has shown that most organizations do not generate the value from IT investments that they potentially could extract from these projects.[15] As a result, this section is dedicated to recommendations for the next steps of the travel and expense system implementation. As stated earlier, this project is currently in the beginning stages of what is a three- to five-year initiative, and although the recommendations herein address the larger-scale issue of which architecture to deploy, some tactical recommendations for next steps are also useful to list here.

The following is a brief listing of some of the key next steps along with recommendations for their successful completion for the travel and expense system implementation:

- **Develop system requirements**: Using the framework described in the Transformation Planning section of this document, Boeing can drill-down one level lower to develop detailed system requirements for the new travel and

expense system. By linking the requirements to this framework Boeing can maintain consistency between the detailed level requirements and their higher level goals.

- **Evaluate suppliers**: Prepared with an understanding of the system requirements, Boeing should determine which suppliers can most capably meet their needs at a fair price. Additionally, for such a large-scale implementation, aligning the interests of Boeing with the supplier can increase the likelihood of an on-time and on-budget implementation.
- **Design organization**: Boeing must begin to evaluate the composition of the implementation team, and position leaders with the appropriate project management skills to handle the challenges of a complex implementation.
- **Test:** Although many IT projects wait until later stages closer to delivery or go-live, Boeing must begin to test and experiment as soon as possible to develop knowledge of the system and gain a comprehensive gap analysis. Starting this testing earlier also allows for more time to load and stress test the system as the final completion date nears.

APPENDIX A- Enterprise Architecture Views

	STRATEGY VIEW: This view represents goals, vision and direction of the enterprise and includes the business model and competitive environment
Structure	The configuration characteristics of the strategy ▪ Focused on customer: Boeing traveler
Behavior	The operational characteristics of the strategy ▪ Defined by management ▪ Senior management engages first line staff to provide input to strategic framework ▪ Mission and vision can sometimes be confusing to some people; although simple statements some find them slightly ambiguous
Artifacts	The items produced to document the strategy ▪ Vision and mission statements drive strategic focus and serve as framework for tactical issues ▪ Integrated work plan
Measures	The quantification of strategy performance ▪ Cost containment ▪ Quality measurements (e.g., complaints, defects) ▪ Customer satisfaction
Periodicity	The temporal aspects of strategy definition and deployment ▪ Not observed, but likely driven by executive staff

	ORGANIZATION VIEW: **This view represents organizational structure as well as relationships, culture, behaviors, and boundaries between individuals, teams and organizations**
Structure	The configuration characteristics of the organization ▪ Boeing Travel as a former subsidiary of the company ▪ Functional groups aligned around key processes ▪ Centralized structure with most employees based out of St. Louis
Behavior	The response of the enterprise to configuration in context of a dynamic environment ▪ Some silo behavior defined by functional areas ▪ Cross-functional collaboration through regular periodic meetings and group report outs ▪ Current behaviors: improved collaboration between teams, pockets of "us vs. them" still exist (between groups and between travel and Boeing employees)
Artifacts	The items produced to document organization and its performance ▪ Organization chart ▪ Roles and responsibilities documentation
Measures	The quantification of organizational performance ▪ Based primarily on financial performance measures ▪ Customer feedback is sought through company surveys ▪ Integrated annual plan and functional maturity model for organization
Periodicity	The temporal aspects of organizational definition and its evolution ▪ Employee turnover ▪ Recent management change triggered significant reorganization

	PROCESS VIEW: The core, enabling, and leadership processes by which the enterprise creates value for its stakeholders.
Structure	The configuration characteristics of the processes ▪ Processes defined within each functional area ▪ Processes are designed to be standard, but much deviation exists
Behavior	The operational characteristics of the processes ▪ Varying cycle times, backlogs build up in some areas but not others ▪ Lean+ mechanisms used to improve processes wherever possible ▪ Fire-fighting has reduced as processes become more standard and knowledge is diffused
Artifacts	The items produced to document the process architecture ▪ Process mappings ▪ Travel Handbook
Measures	The quantification of process performance ▪ Many metrics captured, but processes do not always exist to act on the information ▪ Emphasis is placed on cycle times and "inventory" measures, but less on costs and customer satisfaction ▪ Costly and time-consuming to produce metrics in terms of person-hours of effort
Periodicity	The temporal aspects of process definition and deployment ▪ No formal structure noted for process review/updating

	KNOWLEDGE VIEW: This view represents the implicit and tacit knowledge, capabilities, and intellectual property resident in the enterprise.
Structure	The form the knowledge/knowledge community takes in the enterprise ▪ Mainly informal knowledge sharing/documentation; some formal sharing practiced periodically ▪ Knowledge mostly learned on the job and shared as needed
Behavior	The response of the enterprise to the knowledge structure ▪ Knowledge passed down through practice ▪ Knowledge holders can be bottlenecks to processes
Artifacts	The items produced to document the knowledge its use ▪ Increased usage of documentation for knowledge capture and sharing ▪ Documentation resides in various locations with organization only tailored for those that use it consistently; can be difficult for organization to easily access data
Measures	The quantification of knowledge ▪ None noted
Periodicity	The temporal aspects of knowledge creation and transfer ▪ Knowledge transfer paced by attrition rate

	INFORMATION VIEW: The information needs of the enterprise, including flows of information as well as the systems and technologies needed to ensure information availability
Structure	The structure of information ▪ Data stored in various different types of IT systems ▪ Many formal as well as informal (e.g. personal MS Access databases and Excel spreadsheets) methods for archiving data ▪ Limited reporting tools available to query information
Behavior	The response of the enterprise to information ▪ Difficulty in getting accurate information due to the variety of source systems for data (e.g. overall travel spend can be three different amounts depending on system queried) ▪ Data available, but efforts to compile data can be arduous and non-consistent
Artifacts	The items produced to document the information/its use ▪ Not observed
Measures	The quantification of information ▪ With so much data, to date quantity of data has been emphasized over quality of data
Periodicity	The temporal aspects of information ▪ Metrics gathered and reported periodically, depending on the type of information

	POLICY/EXTERNAL FACTORS VIEW: **This view represents the external regulatory, political and societal environments in which the enterprise operates**
Structure	The structure of the policies and external drivers, etc. ▪ Company-wide internal policies and procedures for travel, credit card use, and reimbursements ▪ External regulations from defense-related activities as well as IRS regulations for financial controls ▪ Travel policy board to manage policies
Behavior	The response of the enterprise to policy/external factors. ▪ Policy compliance to external regulations is strict ▪ Internal policy compliance is lower
Artifacts	The items produced to document the information and its use ▪ PROs and Travel Policy handbook ▪ Federal Government regulations – FAR, DCAA, IRS
Measures	The quantification of policies/external factors ▪ Internal compliance measures such as out of balance credit cards, late expenses (most measures are post-travel oriented) ▪ Audit results
Periodicity	The temporal aspects ▪ External regulations follow pace of rule changes in government ▪ Internal policies have been changing more quickly in order to meet compliance goals

	PRODUCT/SERVICES VIEW: This view represents the products produced and services developed and delivered by the enterprise
Structure	The form of the products and services ▪ Three major services: travel booking, credit card management, and expense reporting/reimbursement ▪ Majority of services administered to two key business units: Commercial Airplanes and Integrated Defense Systems ▪ Centralized service from St. Louis, with some service completed at site with assistance of administrative staff network
Behavior	The response of the enterprise product/services to the dynamic environment ▪ Emphasis is placed on working down back-log of service requests ▪ Efforts are mainly expended on compliance, delinquency, discrepancy issues, leading to a less than desired "customer-centric" mentality ▪ Timeliness of services can be erratic due to lag times in collecting data
Artifacts	The items produced to document the products/services ▪ Internal travel website and travel policy handbook ▪ Travel communications to employees via on-line software tools (i.e. travel updates posted to online booking tool or to expense management software)
Measures	The quantification of product /service performance ▪ Customer satisfaction scores from surveys ▪ Formal and informal feedback from travelers (and typically also their managers)
Periodicity	The temporal aspects of products/services ▪ Changes to services (either expansion or contraction) occur roughly quarterly, difficult for customers to keep track

B – Candidate Evaluation Criteria and Scorecard

To Be Enterprise Architecture Evaluation Criteria			
Transformation of Key "-ilities" and Dominant Views into an Evaluation Approach			
Criterion	Weight	Sub-Criterion	Sub-Weight
Quality	30%	Does the proposed architecture facilitate lower defects?	50%
		Does the proposed architecture improve data integrity across systems?	50%
Affordability	45%	Does the proposed architecture enhance end-user productivity?	10%
		Does the proposed architecture minimize implementation & operational cost?	40%
		Does the proposed architecture lower total cost per transaction?	50%
Usability	25%	Does the proposed architecture reduce manual intervention by user?	60%
		Does the proposed architecture provide a simple and intuitive user interface?	30%
		Does the proposed architecture reduce the amount of time required for a user?	10%

For the evaluation criteria, weights for the three key "-ilities" as well as the sub-criterion were determined by the impact to the total system performance as measured by the business case analysis completed by the Boeing team in July 2010.

					Candidate Architectures		
					Best of Breed	Integrated	Hybrid Model
Key Criteria	Quality	30%	Does the proposed architecture facilitate lower defects?	50%	3	4	4
			Does the proposed architecture improve data integrity across systems?	50%	3	4.5	4
	Affordability	45%	Does the proposed architecture enhance end-user productivity?	10%	4	3	3
			Does the proposed architecture minimize implementation & operational cost?	40%	2	3	4
			Does the proposed architecture lower total cost per transaction?	50%	2.5	3.5	4.5
	Usability	25%	Does the proposed architecture reduce manual intervention by user?	60%	3	4.5	3.5
			Does the proposed architecture provide a simple and intuitive user interface?	30%	4	3	3
			Does the proposed architecture reduce the amount of time required for a user?	10%	2	3	3
			TOTAL SCORE		**2.80**	**3.71**	**3.89**

Candidate architecture scoring was developed through supplier research and internal rankings with team members.

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