DEPOT MAINTENANCE TRANSFORMATION: SUCCESSFUL STRATEGIES IN CAPITAL INVESTING

GRADUATE RESEARCH PROJECT

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Abstract

In 2000, it was determined that the three Air Logistics Centers were underfunded compared to commercial industry. Specifically, the depots were not funded enough to allow reinvestment into capital assets. This determination was based on the fact that commercial industry reinvests 6% of its profits into capital programs while the Air Force depots reinvest only 3%. To keep the three Air Logistics Centers competitive, Congress injected $900M into the depots over a six year period, beginning in 2003. This Depot Maintenance Transformation (DMT) strategy was implemented so that the depots would increase profits over each of the six years to a point that would allow them to reinvest a sustained 6% (organically) at the end of year 6 in order to stay on par with the private sector. As the DMT program nears completion, the urgency to identify the aggregate benefits of the DMT program is increasing. However, this is not an easy task because many of the projects have intangible benefits that are hard to capture by quantifiable means. Additionally, of the tangible benefits associated with the DMT projects, 21% are reported to have negative projected savings in the out-years beyond initial investment. This makes the task of identifying the aggregate benefits that much more difficult to do. Six years later, the question still remains: *how well is the $900M DMT program performing* ... but more strategically, *what are the important considerations when making capital investment decisions?* This Graduate Research Project addresses these important questions.

I would like to dedicate this project to the hard working and extremely talented men and women of the three USAF Air Logistics Centers.

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Scott M. Ritzel

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DEPOT MAINTENANCE TRANSFORMATION:
SUCCESSFUL STRATEGIES IN CAPITAL INVESTING

I. Introduction

Background

In 2000, it was determined that the three Air Logistics Centers (ALC) were underfunded compared to commercial industry. Specifically, the depots were not funded enough to adequately provide for reinvesting into capital assets. This determination was based on the fact that commercial industry reinvests 6% of its profits into capital programs vs. the Air Force depots reinvesting only 3%. To keep the three Air Force depots competitive, the United States Congress injected $900M into the depots over a six year period ($150M per year for all 3 ALCs for 6 years). The intent of this strategy was that the depots would increase profits over each of the six years to a point that would allow them to reinvest a sustained 6% (organically) at the end of year 6 in order to remain competitive with the private sector. With this additional funding, the Air Force Materiel Command (AFMC) developed the Depot Maintenance Transformation (DMT) Program which is rooted in moving the command towards a world-class enterprise culture in an era of shrinking budgets. The DMT program aims to transform the way AFMC does business by finding more efficient process improvements through investing in a skilled workforce, state-of-the-art equipment and facilities in order to ensure the command has the capability, capacity and competitiveness to meet its peace and war-time missions (AFMC/LG, 2004). There have been 66 DMT projects initiated throughout the 3 ALCs.

Problem Motivation

Frequent personnel turnover and overriding mission priorities have made the DMT reporting process a challenging task and as the program nears completion, the urgency to identify the benefits of the DMT projects is increasing. However, six years after initiation, an aggregate view of DMT funding allocation and benefits is unknown. Furthermore, there is no indication of which capital investment decision-factors led to implementation of successful projects. While financial details exist for the DMT projects, the challenging task is identifying the non-financial benefits realized by projects, or the "intangible benefits" of the DMT projects.

Problem Statement

This leads to the sponsored research problem: *where were DMT funds invested and how well did the program perform,* but more strategically, *what are the important considerations when making capital investment decisions?* This is a relevant issue since AFMC has a vested interest in identifying the DMT program benefits for purposes of hierarchical reporting to the Air Staff. But perhaps the more relevant idea lies within identifying what determines the success of capital investments so that these determinants of success can be repeated with future investment decisions.

Research Objective

The research for this study was conducted in three major areas. The objective of the first area was to identify key tenets of the capital investment planning process in order

to identify what capital investment plans within different organizations have in common (*capital investment planning*). The second area focused on the different types of performance-based metrics associated with capital investments (*investment metrics*). The objective of this area of research was to identify the types of metrics commonly used and the alternatives to financial-based measures. Efforts also focused on identifying why investment metrics are important to an organization and what leaders do with metric information. The objective of the third area was to identify the different types of intangible benefits and the potential impact that those benefits have on overall investment decisions (*intangible benefits*). Additionally, this part of the research effort attempted to identify existing models that integrate intangible benefits into the capital investment decision-making process. These three objectives consolidate to the following hypothesis:

> **H_o: All successful USAF DMT capital investments have a positive financial return**
>
> **H_a: Not all successful USAF DMT capital investments have a positive financial return**

The hypothesis is that capital investments which don't yield a positive financial benefit potentially will have intangible benefits: *but what are they and do they equate to a positive benefit that impacts the owning ALC in some way?*

Theoretical Lens

There are many theories that apply to this study, most of which are business and monetary-related such as the overarching Theory of Monetary Economics. Capital

market theory is also relevant to this study. According to David Nawrocki, PhD, Capital Market Theory is an important input to financial decision making. (Nawrocki, 1997) This specific theory puts to use concepts that attempt to predict the progression of capital markets over time on the basis of mathematical models. (Nawrocki, 1997) Some of the basic mathematical models that will be addressed in this study take the form of the individual investment metrics researched in Chapter II, as they are a means to analyze or predict the performance of investments. Therefore, the Theory of Monetary Economics and Capital Market Theory will be used as the overarching theories that encompass the specific monetary concepts and subsets that will be referred to and used throughout this research project such as, Return on Investment (ROI), Net Present Value (NPV), Capital Asset Budgeting, etc.

Methodology

The type of research used in this study was content analysis. This style of research is defined as "a *detailed and systematic examination of the contents of a particular body of material for purpose of identifying patterns, themes, or biases*." (Leedy, Ormrod, 2010) Throughout the study, research questions, hypotheses, and analysis focused on identifying patterns of success amongst different DMT projects and the common themes of successful capital investment decisions. The general approach to the research problem took a sample of DMT projects that were likely to yield intangible benefits in order to identify the non-financial benefits of those investments in the absence of a mathematically calculated ROI (or in addition to a negative one). Financial details were also gathered for the DMT projects to identify the allocation of the entire $900M.

This strategy required different types of data from multiple sources. To identify funding allocation and initial purchasing information for each of the 66 DMT projects along with performance details, assessment of the initial project planning documents combined with a screening of status reports was required. For the intangible benefits analysis, qualitative information from project representatives was needed. Information that revealed the non-financial benefits of projects was critical in order to capture the overall projected benefits. Data required to measure the performance of those projects in order to validate realized benefits against projections was difficult to obtain and required a combination of survey and interview protocols conducted by AFMC/A4D. It is important to note that the Air Force Institute of Technology did not survey or interview personnel associated with this study. Tools and techniques were developed by the researcher but AFMC/A4D executed all data calls.

Assumptions and Limitations

There are two primary assumptions associated with this study. The first assumption is that the existing data for the 66 projects gathered by AFMC, over a 6-year period, is accurate. The second assumption is that the expected or future savings of individual projects will eventually be realized. This is significant because some projects forecast savings into the year 2025 and in some cases 2035. The major limitation of this study is that only 1/3 of the DMT projects were assessed. The feasibility of assessing all 66 projects was unrealistic and therefore conclusions have been drawn about the entire population based on a sample population. Another limitation of this study is the qualitative nature of the intangible benefits assessment. Intangible benefits are highly

subjective and that subjectivity is likely to be reflected in the data collected since it is based on the scrutiny of the individual respondent.

Implications

This research project has the potential to impact both the Air Force and the Supply Chain Management body of knowledge in general. First, the ability to report the benefits of a $900M appropriated program to Air Staff is important to AFMC. The command must be able to articulate the benefits of appropriated funds intended for capital investments. Secondly, this research project identifies some of the important factors to consider when making capital investment decisions. These factors are intended to ensure that the right capital investment decisions are made when presented with multiple investment opportunities.

II. Literature Review

Chapter Overview

This chapter presents the relevant literature surrounding capital investments. It begins by describing the strategies involved with capital investment planning and the metrics used to measure performance. It also addresses tangible vs. intangible benefits by describing the differences between them and identifying some of the different types of intangible benefits that are recognized in commercial industry.

Research Approach

In order to identify how well the investment dollars performed, a solid understanding of capital investment strategies in terms of planning for investments and measuring them was required. Classifying intangible benefits realized by the DMT projects can be accomplished through application of theory and benchmarking commercial industry efforts. This research approach combined with the analysis of existing data allowed for the problem statement to be addressed in its entirety.

Capital Investment Planning

Business owner, famed author and former editor of Time, Inc., Wilbur Cross, describes capital as one of the three major factors of production in terms of economic theory, along with labor and property. (Cross, 1995) He also distinguishes between circulating-capital (raw materials and wages) and fixed-capital (factories and machinery) which quickly identifies the DMT projects as fixed-capital investments since all 66 of the

projects involve either a factory, technology, or machinery upgrade or improvement. According to Cross, capital budgeting refers to the systematic planning of cash outlays for capital investments. There are many examples of organizations that have learned to do this quite well. The overriding theme that they share is linking future capital investment strategies to the strategic goals of the organization. The following paragraphs describe some of these examples.

The Federal Aviation Administration (FAA) provides Air Traffic Control, Aviation Safety/Security Services and establishes the necessary international coordination to provide a seamless global aviation system. (FAA, 2010) According to its 2003-2007 Capital Investment Plan (CIP), the FAA uses its Acquisitions Management System (AMS) as a formal approach to investment planning in an attempt to define how investments are made and to provide analyses to support investment decisions. (FAA, 2003) But more importantly, the CIP specifically ties investment projects to the strategic goals of the FAA. There are 5 overarching categories of goals within the FAA CIP that guide capital budgeting and capital investment planning: (1) improve aviation safety, (2) improve efficiency of the Air Traffic Control System, (3) increase capacity of the National Airspace System (NAS), (4) improve reliability of the NAS, and (5) improve efficiency of mission support. Each category lists specific performance goals outlined in the FAA's Strategic Plan that are associated with capital investments. For example, improving aviation safety (category 1 above), is derived from the following performance goals contained within the FAA Strategic Plan:

Fatal Aircraft Accident Rate: By 2007, reduce the US commercial aviation fatal accident rate per aircraft departure, as measured by a three year moving average, by 80 percent from the three year average for 1994-1996.

Overall Aircraft Accident Rate: Reduce the rate per aircraft departure.

Fatalities and Losses by Type of Accident: Reduce the number of fatalities and losses from accidents that occur for each major type of accident.

Occupant Risk: Reduce the risk of mortality to a passenger or flight crewmember on a typical flight.

These performance goals are then used as objectives for capital investments within the FAA. For example, one of the FAA's capital investment programs seeks to reduce the fatal accident rate by investing in new technology that is better equipped to detect hazardous weather patterns through the next generation of weather radar technology. This system implements the medium intensity airport weather system at airports that have limited wind shear detection capabilities. (FAA, 2003) The FAA capital budgeting process subsequently plans for this targeted investment by allocating cash outlays to support the investment. Once the other investment decisions have been made based on performance goals, the capital budgeting process allocates all outlays and culminates with a pictorial representation similar to Figure 1 which shows the funding allocation supporting all capital investments that are targeted towards meeting the 4 performance goals within the overarching category of "improving aviation safety".

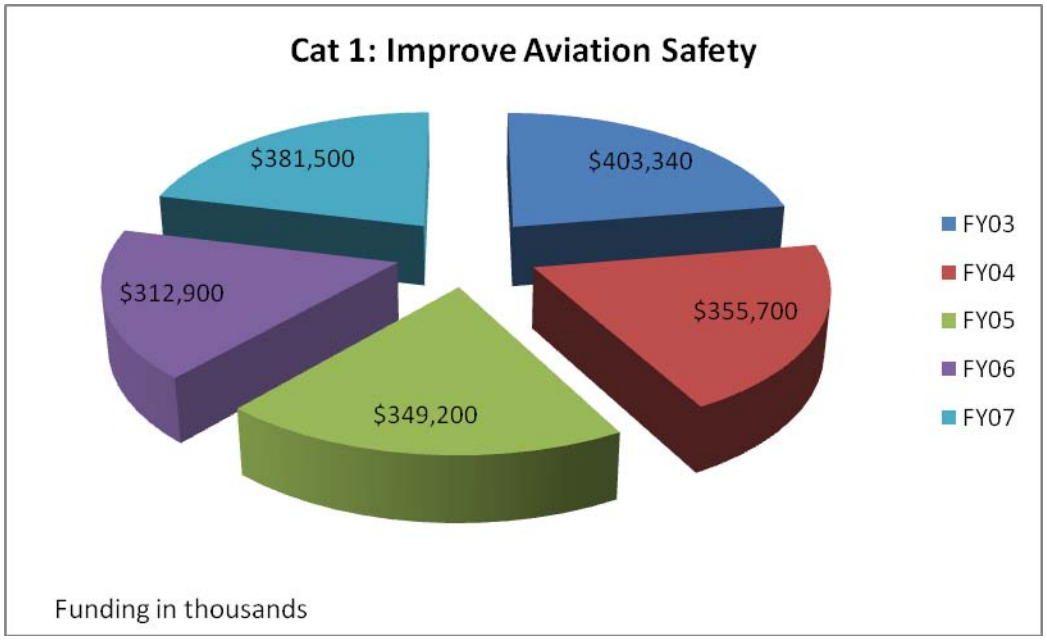


Figure 1. Funding Allocation For Improving Aviation Safety (FAA, 2003)

In summary, the FAA's "linked" approach to capital investing provides a great example of how capital investments can be tied to the strategic goals of an organization. This systematic approach ensures that the overarching goals of the FAA are met through the planned and allocated funding of capital investments that are based on strategic performance goals.

Another organization that plans for its capital investments by associating investment decisions with strategic goals is the New Jersey Transportation Planning Authority (NJTPA). The NJTPA captures its capital investment goals in a document titled, the Regional Capital Investment Strategy (RCIS), which is a key element of the state's long-range Regional Transportation Plan. The objective of the RCIS is to create a balanced and feasible approach to regional transportation spending. (NJTPA, 2010) The

RCIS states 8 broad capital investment principles that guide capital investment decisions which are listed immediately below.

Help The Region Grow Wisely: Transportation investments should encourage economic growth while protecting the environment and minimizing sprawl in accordance with the state's Smart Growth plan, Energy master plan, and Greenhouse Gas plan.

Make Travel Safer: Improving safety and security should be explicitly incorporated in the planning, design and implementation of all investments.

Fix it First: The existing transportation system requires large expenditures for maintenance, preservation and repair, and its stewardship should be the region's highest priority.

Expand Public Transit: Investment to improve the region's extensive transit network should be a high priority, including strategic expansions to serve new markets.

Improve Roads but Add Few: Road investments should focus on making the existing system work better, and road expansion should be very limited.

Move Freight More Efficiently: Investments should be made to improve the efficiency of goods movement because of its importance to the region's economy and quality of life.

Manage Incidents and Apply Transportation Technology: Investments should be made to improve information flow, operational coordination and other technological advances that can make the transportation system work smarter and more efficiently.

Support Walking and Bicycling: All transportation projects should promote walking and bicycling wherever possible. (NJTPA, 2010)

The most important feature of the RCIS is its assurance that allocated investment funding is spent according to clearly identified priorities. On average, $2B a year is made available for the NJTPA's capital investments. (NJTPA, 2010) These monies are allocated across the above 8 principles according to quantitative targets assigned to each principle. For example, the principle ... *move freight more efficiently* ... is paired with a quantitative target that states "modestly increase the current allocation or dedicated freight improvements (such as freight rail facilities and intermodal infrastructure) from 0.8 percent of spending to 1.0 percent". (NJTPA, 2010) Similarly, the quantitative target associated with the principle ... *support walking and bicycling* ... is "increase spending from approximately 1 percent of funding to 1.25 percent for walking and biking facilities". (NJTPA, 2010) These numerical targets serve as a guide for making capital investment decisions within the confines of the 8 guiding principles. The Transportation Improvement Program (TIP) is the NJTPA's three year agenda of capital investment projects and programs to be implemented. (NJTPA, 2010) Within the TIP are the actual investment descriptions (including investment principle categories) and funding levels. For example, the 2009 TIP presents project identification # 08445 as the "Lehigh Rail Line Separation" project. This particular investment is associated with the RCIS category "safety" (principle: make travel safer, noted above) and specifically outlines the "separation of the intersection of 13th street and the Lehigh Rail Line through a bridge or tunnel in Manville, Somerset County". (NJTPA, 2010) The TIP also identifies $0.77M as the state funding requirement for this project in addition to an $844M special Federal

appropriation that was allocated to this project. As mentioned, the state funding requirements are allocated to specific projects according to quantitative targets. Because they are "targets" vs. requirements, some investment years are over-shot and in others the targets are under-invested. To see this, Figure 2 shows the aggregated results for investment years 2008 through 2009.

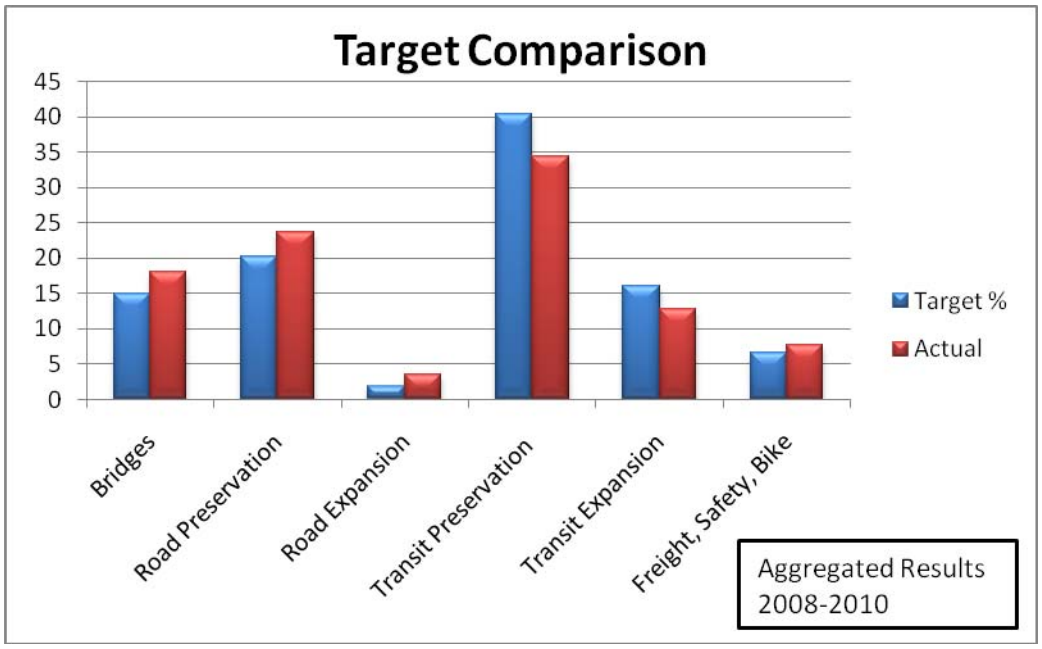


Figure 1. NJTPA Funding Allocation Targets (NJTPA, 2010)

As Figure 2 shows, the NJTPA allocates state funding closely to targeted investment areas. The RCIS process not only ensures that funding is allocated according to quantitative targets, but more importantly, it ensures that the right investments are made according to the NJTPA's guiding principles.

Investment Metrics

There are many calculations that exist to help decision-makers decide between potential capital investments. These calculations, or metrics, are primarily performance-based which means that the dollars invested are measured against the profits returned or dollars saved, as governed by the "theory of monetary economics". This section describes some of the common metrics used in assessing investment performance and begins with the most common one: ROI. This metric compares investment returns and costs by calculating a ratio, or percentage and is the most frequently used investment metric and also the most easily understood. (Solution Matrix, 2004) Specifically, ROI is calculated by dividing the net gains from an investment (gains less costs) by the investment costs. Typically, when comparing investment options, the option with the highest calculated ROI is labeled as the better performing investment, but ROI does have limitations. By itself, ROI says nothing about the risks involved or impact of potential intangible benefits associated with investments. (Solution Matrix, 2004) It simply shows the investment returns compared to investment costs assuming that expected returns and costs are accurate and reliable predictions. For that reason, a good business case analysis (BCA) will assess the risks involved and impact of potential intangible benefits associated with investment decisions. (Solution Matrix, 2004)

Return on Invested Capital (ROIC) is another investment metric that reveals whether or not invested capital was used effectively. In assessing ROIC, "the capital" can be either buildings, projects or machinery. ROIC is calculated as a percentage by dividing net income (less dividends) by the total capital. The resulting calculation gives a

sense of how well a company is using its money to generate returns. (Morningstar, 2010) A problem often associated to ROIC is that it does not identify where the return is coming from as it is expressed as an aggregate of returns. (Morningstar, 2010) For example, ROIC will not tell a decision-maker whether the returns are attributed to capital as it relates to continued-operations/firm-performance or a one-time profitable event.

A metric used to gauge the efficiency and profitability of a firm's capital investments is the Return on Capital Employed (ROCE). The ratio resulting from the ROCE calculation is an indicator of how well a company is utilizing capital to generate revenue and should normally be higher than the rate that the company borrows. (VBN, 2010) ROCE is calculated by dividing profits, before interest and tax, by the difference between total assets and current liabilities.

The Savings to Investment Ratio (SIR) is a useful metric to use when evaluating between two or more capital investment projects. Mathematically, it is the NPV of savings divided by the NPV of the investment and represents the amount of savings generated by each dollar invested. The SIR should be greater than 1 in order for the proposed project to be considered cost effective. (NAVFAC, 1983) In other words, the proposed project should generate more savings than it costs to implement.

Whereas most of the metrics mentioned thus far primarily apply to profit-seeking firms, many public and government organizations must decide between capital investments by comparing the costs of capital projects against the overall benefits to society. (Bardi, Coyle, Novack, 2006) One of the analytical tools used to do this is the Benefit/Cost Ratio (BCR) which is a measure of the total benefits to society divided by the initial capital investment cost. A BCR greater than 1 indicates that a given

investment project will produce a profit to society whereas a BCR less than 1 means that more will be spent on the project than society will ever gain in long term benefits. (Bardi, et al, 2006) Non-profit-seeking organizations use this alternative approach to assess potential investments when the face-value costs are greater than the expected benefits but yet the overall potential benefits to society are significant enough to warrant consideration of the investment project regardless of this fact. Using the example of a potential investment project that considers implementation of a public subway system, Bardi, et, al (2006), point out that although the extraordinary costs associated with such an investment are massive (cost of design, development, land, operations, interest, and public disruption during construction phase) the potential benefits to society are much greater, such as:

> **Organizational/City Benefits**: Reduced costs of city buses, less congested city roads, reduced need to expand city roads and parking areas, increased property, sales and wage taxes from higher economic activity downtown, etc.
>
> **Societal Benefits**: Reduced unemployment (construction phase and subway system employees), greater area-wide mobility, times savings, less pollutants, reduced commuting stress, increased retail activity, etc. (Bardi, et al, 2006)

Many of the proposed societal benefits are intangible or non-monetary benefits. Identifying and quantifying these benefits appear to be the most difficult task in using BCR as an investment decision tool. Nevertheless, when the potential exists for an investment to benefit society as a whole, BCR is a way to justify such a project when costs overshadow expected profits.

Intangible Benefits

Albert Einstein once said that "*not everything that can be counted counts, and not everything that counts can be counted*". (Einstein, date unknown) This quote embodies the idea of intangible benefits. Also known as "soft benefits", intangible benefits typically cannot be sufficiently quantified for purposes of financial reporting, but do contribute to increases in quality, performance and profit. (Survey Methods, 2006) According to author Jack Keen, more than 25 percent of the value of firms is based on heavy-hitting intangible benefits such as brand image and market share yet decision-makers resist this reality since intangible benefits don't add to the hard ROI. (Keen, 2003) And when investment decisions are based on ROI alone, critical strategic goals like improvement of market share or sharpening of competitive advantage can be under-assessed. (Keen, 2003) In fact, more often than not, soft benefits are not assessed as valid "returns" during the BCA process when considering capital investments. To counter this problem Keen offers three methods to bolster BCAs by maximizing the inherent power of intangible benefits. Method #1: transform the intangible into a tangible benefit. In his own study, Keen has found that as much as 75 percent of the intangibles cited in BCAs could have been converted into tangible benefits. This indeed requires some effort but if there's a way to quantify the benefit, Keen suggests doing so in order to strengthen BCAs. Method #2: Make intangible benefits that have a strategic impact on the firm central to the BCA. What's the monetary value of the Coca-Cola logo or "Intel Inside" stamp? It would be hard to quantify but they would likely have a strategic impact on a firm considering investments that would result in the use of either of these examples.

Method #3: Include intangible benefits in BCAs. Keen states that a core skill of senior managers is the ability to make the right decisions in the face of less than factual information. But when considering between investment decisions, the question is whether or not the associated intangible benefits will be included in the BCA for the decision-maker to consider.

Within the Information Technology (IT) industry, Alinean Inc., the leading provider of online sales tools, has developed an ROI model that factors in intangible benefits by measuring the potential performance of investments across three dimensions: Net Tangible Benefits, Intangible Benefits, and Risk. (Alinean, 2010) Figure 3 gives a pictorial representation of this model which is used to help quantify the overall value of individual projects by integrating time-honored and trusted standard financial measures with new modeling techniques and metrics that capture intangible benefits and risk so the return on technology investments can be more credibly quantified, analyzed and assessed. (Alinean, 2010)

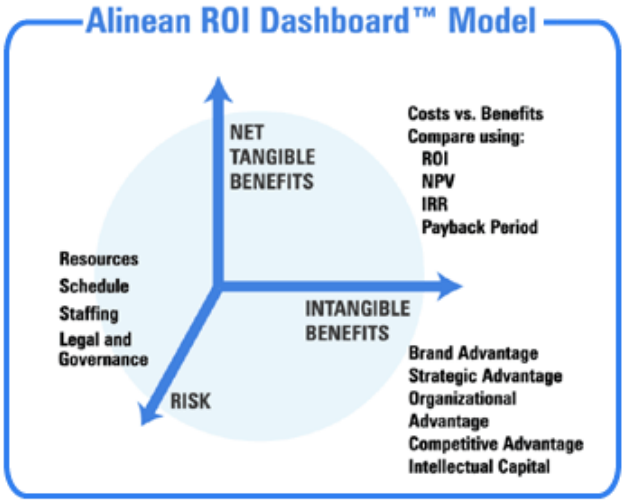


Figure 3. Alinean ROI Dashboard Model (Alinean, 2010)

The development of the model stems from the company's belief that many potential investment projects yield benefits that are strategic, yet difficult to quantify in monetary terms. However, like Keen, Alinean Inc. believes that often times, many of these intangible benefits can be quantified into tangible benefits or key performance indicators such as percent of market share, customer satisfaction or industry position rankings. As Figure 3 suggests, in addition to traditional cost vs. benefit analysis, the model assesses high-level intangible benefits such as:

Brand Advantage: Reinforcing, advancing or changing a company's brand.

Strategic Advantage: Working towards or meeting overall corporate objectives.

Competitive Advantage: Releasing solutions faster, developing solutions less expensively, better addressing customer needs, meeting changing market demand, and gaining market share.

Intellectual Capital: Increase in relevant knowledge gained by the staff and the perceived market value from those gains.

Organizational Advantage: Enabling an organization to function more effectively or reinforcing or recreating a corporate culture. (Alinean, 2010)

The potential risk involved with investment projects is also assessed under the Alinean ROI Dashboard model. High risk projects can lead to increased costs or reduced tangible and intangible gains. (Alinean, 2010) Alinean Inc. believes that during the decision phase, when risk is measured and presented, sometimes the overall investment value is discounted significantly. Some of the model's potential risk factors are:

Market or Strategic: The market may shift, competitors may change strategy, the company may change strategic direction, changing the project requirements, or changing the business benefits equation.

Compatibility: The project may not be compatible with current or future operating systems, platforms or other applications.

Labor Resources: The risk that required resources may not be available or not have the proper skill set or training.

Dependencies: Risks that affect a family of dependent projects, such as delays, resources or budgets. (Alinean, 2010)

This three-dimensional approach to assessing potential investments addresses the key areas that decision-makers must consider when making investment decisions. The Alinean ROI Dashboard Model highlights the significance of assessing the overall benefits of potential investments from a financial and risk perspective, but clearly the strategic impact of intangible benefits lies at the heart of the model.

Throughout the review of the literature surrounding intangible benefits, many examples of such benefits were identified. The following is a consolidated listing from various sources identifying potential non-monetary benefits that can result from investment decisions:

Source 1: Improved employee morale, heightened customer satisfaction, better vendor relationships. (Survey Methods, 2006)

Source 2: Brand image, market share improvement or sharpening of competitive advantage. (Keen, 2003)

Source 3: Brand Advantage (reinforcing, advancing or changing a company's brand), Strategic Advantage (working towards or meeting overall corporate objectives), Competitive Advantage (releasing solutions faster, developing solutions less expensively, better addressing customer needs, meeting changing market demand, and gaining market share), Intellectual Capital (increase in relevant knowledge gained by the staff, and the perceived market value from those gains), Organizational Advantage (enabling an organization to function more effectively, or reinforcing or recreating a corporate culture). (Alinean, 2010)

Source 4: Increases in employee engagement and improvements in teamwork, less stress and anxiety. (Kruse, 2004)

Source 5: Adaptability, reduced employee complaints, awards, brand awareness, career mindedness, image, caring, innovation, collaboration, job satisfaction, better communication, improved leadership, conflict resolution, networking, cooperation, organizational climate, corporate social responsibility, organizational commitment, creativity, partnering, culture, reputation, reduced customer complaints, enhanced resilience, customer response time, customer satisfaction, and talent development. (Breining, Phillips, Pulliam, 2008)

Source 6: Worker productivity, confidence in management, faster delivery of product and improved quality. (Burleson, 1997)

These six sources illustrate the multitude of types of intangible benefits that companies use today in assessing benefits of investment decisions. It is important to point out that

although any one of the above benefits is likely to be justified as an important benefit, they indeed have varying levels of impact on a firm's position within a given industry ranging from "increased morale" to "competitive" and "strategic advantage".

Summary

This chapter presented some of the relevant literature surrounding this research project. It is clear that capital investment planning begins with linking capital investments to the goals of the organization and that there are many different metrics used to measure investment performance. It is also apparent that by including intangible benefit analysis in the capital investment decision process, organizations can more accurately see the potential strategic value of their investment decisions. The following chapters are based on the observations identified during the literature review.

III. Methodology

Chapter Overview

This chapter describes the methodology used in this study and identifies why the specific methods were chosen. It begins with a brief explanation of the existing data associated with this study and continues with the rationale for the specific data collection technique used. The data collection tool used is also presented and deconstructed in this chapter to reveal the specific assessment questions, project weights and sample size criterion used in developing the data collection tool. Again, it is important to note that the actual data collection execution was conducted by AFMC/A4D and that the Air Force Institute of Technology did not survey or interview personnel associated with this study. Tools and techniques were developed by the researcher but AFMC/A4D executed all data calls. After a thorough explanation of the methodology approach, this section concludes with a chapter summary.

Determination of Methodology

The three ALCs have been reporting the status of their DMT projects since 2003. Most of what already existed (data) included approved EAs and status reports reflecting "as-of-date" performance results for individual projects. A two-tier methodology approach was used with initial efforts geared towards assessment of what had already been provided by the ALCs. The second-tier focused on gathering data that was needed to address the problem statement but not found in the existing data.

Data Collection Methods

In the absence of a consolidated list of projects, initial efforts consisted of searching through DMT project files provided by AFMC's Depot Modernization and Investments Branch. In general, the files included project descriptions, investment figures and projected savings. EAs located on the AFMC Capital Purchasing Plan Community of Practice were also reviewed for pertinent information with regard to DMT project details. These two sources of information were used to capture all 66 projects on one document that reflected project title, owning ALC, description, and amounts invested/saved. This 12-page consolidated document is listed in Appendix A and was used as a working document throughout the study. This document revealed that 14 projects reflected negative projected savings. Information gleaned from the literature review provided three potential explanations for these negative numbers. First, there is a potential that significant intangible benefits exist which are not captured in the financially calculated metric. The second potential explanation was that the projects with negative savings were under-performing investments as indicated by the negative savings values. The third potential explanation was that the projects' benefits to society outweigh the cost of the investments (BCR concept). These 14 projects formed the basis of the sample size discussed in the following paragraph. In addition, 6 other projects reporting positive savings values were included in the sample for comparison against the 14 with negative values resulting in a total sample size of 20 projects. These six projects were selected based on their association with significantly high SIRs, *in other words,* they appeared to be successfully-performing projects based on their associated metrics.

In order to gain insight and depth of understanding of the salient factors accounting for these negative values, an assessment of personnel directly involved in DMT projects was in order. To identify the specific projects to be assessed, different weights were assigned to the three ALCs based on the number of DMT projects the individual ALCs submitted. Warner Robins submitted 35 projects, Ogden submitted 24 and Oklahoma City submitted 7. The weights ensured that a proportionate number of projects were assessed based on the number of projects owned by each ALC. There were three sample variables associated with the assessment: (1) ALC project submission rates, (2) Negative savings values, and (3) Positive savings values. Table 1 is a listing of the projects assessed under this study.

Table 1. DMT Projects Assessed

ALC	Project Title
WR	Modern Paint Facility
	Airborne Electronics (MATE 390)
	Airborne Electronics (ARC 164, etc)
	MAI Auto Test Equip/SW Upgrade
	Advanced Metal Finishing Facility
	Transforming Avionics Repair
	Transforming Cargo A/C MX
	Scanning Electron Microscope
	Sheet-Metal Equipment
	Transforming Metal-Bond Process
	Transforming Functional Test Process
OO	Air Turbine Starter Tester
	World Class MX Operations
	Westinghouse 1650 Replacement
	F-16 Avionics Digital Test Station
	High Velocity Oxygen Fuel Program
	Transforming Gun Range Overhaul
	Transforming Software Support Facility
OC	Building 3001 Revitalization
	Tanker Business Unit

Note: WR = Warner Robins, OO = Ogden, OC = Oklahoma City

The aggregate theory behind the assessment tool supports testing the hypothesis identified in Chapter I. Specifically, the theory behind the assessment directly supports the second part of the overall problem statement, also identified in Chapter I (*how well did the DMT investment dollars perform),* by linking assessment questions to the sample variables (primarily to the positive and negative savings values). The assessment also targeted responses that would identify *the important considerations when making capital investment decisions?* The questions included on the assessment tool were also designed to collect data relevant to information gleaned throughout the literature review. For example, questions 4 through 7 were designed to measure the level of planning involved with the projects since the literature review revealed that strategy-linking is a common factor in capital investment decision-making. The specific assessment tool format (questions included) is included in Appendix C. AFMC/A4D accepted the assessment tool as an official tasking to send out to the three ALCs.

Summary

This chapter established the framework for the analysis phase. The initial identification of all DMT projects along with their associated investment and savings figures was a critical step in identifying the 20 projects to be studied. The assessment tool described above was based on the problem statement and designed specifically to gather data that would allow for an in-depth analysis of the sample variables in support of hypothesis testing. However it is important to note that a key element of this methodology was AFMC/A4D's acceptance of the assessment tool as an official tasking with an assigned suspense date for the ALCs to complete by.

IV. Data Analysis

Chapter Overview

This chapter outlines the analysis of the data that was collected throughout this study. It is presented in three major areas: DMT savings figures, intangible benefits, and capital investment planning. Within these three areas, findings are presented in addition to an explanation of the analysis techniques used to identify them. After a thorough explanation of the data analysis associated with these key areas, this section concludes with a chapter summary.

Savings Figures

As identified in Chapter III, the assessment tool is categorized into 3 major areas: savings, intangible benefits, and planning. While assessing the first major area of the assessment (savings), of the 20 projects studied, 12 responded by stating that the previously reported amounts invested and saved were incorrect. Of the 14 that reported negative savings prior to the assessment, 7 of those responded by providing new values that turned their negative savings into positive ones. The remaining 7 projects confirmed that they expect to realize negative savings in the out-years. Two of these projects reported recurring costs over a 25-year period because they are MILCON projects and are required to assess over a 25-year period as opposed to non-MILCON DMT projects that are only required to assess over a 10-year period. Three of them simply responded by stating that there were no tangible savings resulting from the investments and two of the respondents stated that there were inaccuracies within the EA (realized costs that weren't

captured in the initial EA). It is also significant to mention that all 7 projects with confirmed negative savings have strategic-level intangible benefits associated with them which will be discussed at length in subsequent paragraphs.

Analysis of the reported savings values also revealed inconsistencies in ALC-specific reporting practices with regard to projected savings for DMT projects. These inconsistencies led to the questionable fidelity of the aggregated Life-Cycle Savings (LCS) metric disclosed in the $150M DMT Program Cost Benefit Reporting (CBR) document. This document shows the LCS for all DMT projects as reported by the ALCs. Figure 4 represents a slide taken from the Jun 09 CBR that shows a LCS projection of approximately $3.3B.

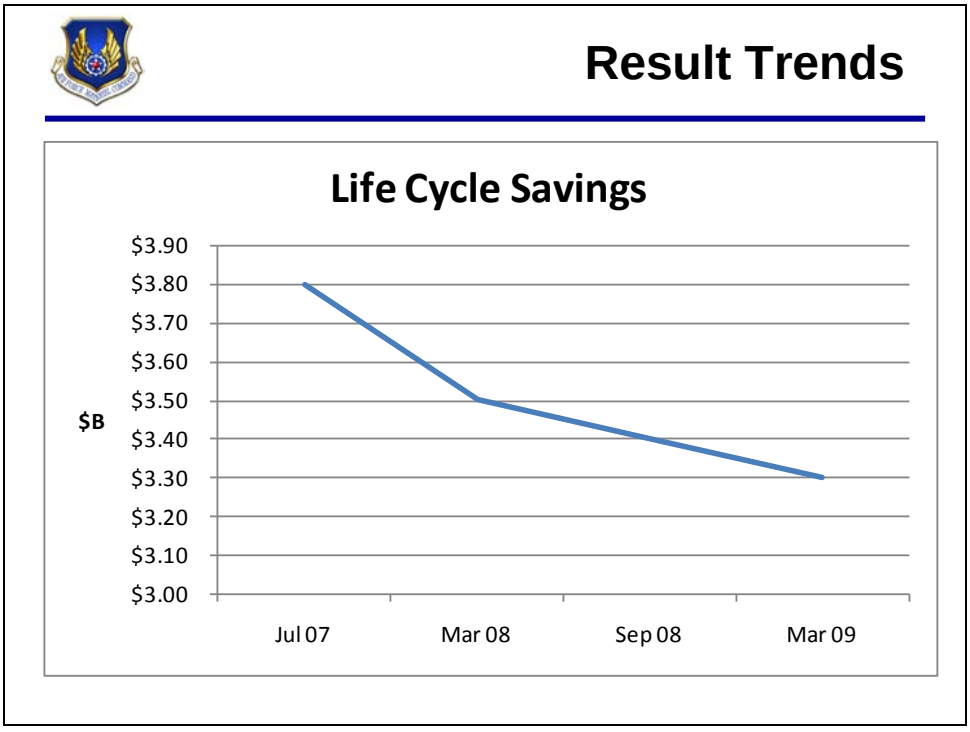


Figure 4. DMT Project Life Cycle Savings (AFMC/FMC, 2009)

This metric was calculated by adding the total AFMC savings projected for all 66 DMT projects between 2004 and 2035 (values represent future value savings). AFMC published "Business Rules" that describe three categories of savings: Hard Savings, Cost Avoidance Savings, and Opportunity Savings. Hard savings were identified as the strongest case for project justification and defined as, *savings that reduce or eliminate existing programmed dollars*. (AFMC/A4DM, 2004) According to the business rules, hard savings represent actual savings resulting from projects including reductions or elimination of existing expenses such as staff and operating costs (utilities, supplies, travel, repair, etc), or de-scoped contracts. Justification for projects that are expected to realize cost avoidance savings is scrutinized more closely compared to projects that realize hard savings. This is because cost avoidance savings are more speculative since they are associated with "potential" future cost reductions. The business rules provide the following example to explain cost avoidance savings more clearly: if funding is not programmed against an activity but funding is expected to come from year-end fallout money, the savings realized could potentially be a cost avoidance. Hard savings cannot be claimed because dollars were never programmed against the activity but avoidance dollars "might" be realized because fallout dollars won't be used. Opportunity savings are the most difficult type of savings to justify because, as the business rules state, opportunity savings are sometimes not even accepted as justifiable savings since they are qualitative in nature and represent savings that cannot be recouped. Opportunity savings allow for more efficient use of personnel and capital assets to achieve higher value with the same amount of resources including saving management and employee time or freeing up an asset for use in another initiative. (AFMC/A4DM, 2004) Upon completion

of in-depth analysis of the savings-related data collected, there appeared to be two primary inconsistencies with how the ALCs report their savings values. (1) Some projects' savings are reported as "actual" savings only. In other words, if a particular project has been activated, and "if" actual savings have been realized (to date), only those amounts are reported. In essence, the projected savings beyond the actual or realized savings are not captured in the aggregated LCS metric which leads to an underinflated LCS value. For example, Ogden's *World Class Maintenance Operation Transformation* project was initiated in FY05 and has realized an actual negative savings (opportunity savings) through FY09 of -$18,880,524 (cost of investment: $29,559,038 minus the "to-date" savings of $10,678,513). Not only does this affect the LCS metric, but it also flags the project as possibly being an under-performing project. Perhaps if the projected savings were extrapolated out, this particular project would not reflect negative savings in the out-years. In contrast, some projects' savings are not only being reported as projected savings (beyond actual), but some are reporting projected savings in extreme out-years well beyond the 10 year DMT reporting period. In fact, 21 projects have reported future savings beyond the year 2025 and some into 2035. This can lead to a significantly over-inflated LCS value. These inconsistencies, not only affect the aggregate LCS metric, but they also affect other important DMT metrics such as the SIR and NPV of DMT savings. Again, using the example of Ogden's *World Class Maintenance Operation Transformation* project, if Ogden were to report projected savings into the future beyond actual savings, there would be a positive impact on the aggregated LCS, SIR and NPV of savings for all DMT projects as well as a positive impact on Ogden's ALC-specific SIR. Conversely, the fact that they don't report projected savings, for this particular project,

under-inflates all of these metrics. Figure 5 shows all DMT metrics as reported by the ALCs (they reflect a combination of actual savings and projections).

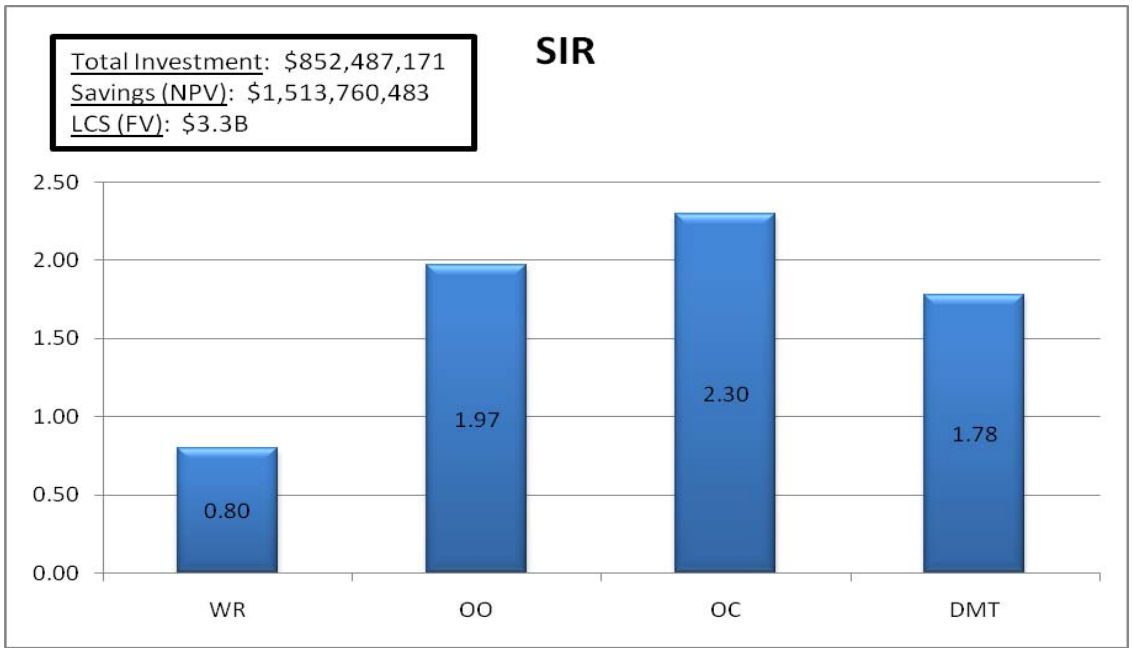


Figure 5. SIRs as Reported by ALCs (AFMC/FMC, 2009)

This figure illustrates DMT project performance as it is currently reported by the ALCs. It also highlights the overall Warner Robins SIR as potentially being sub-optimized since a calculated SIR of less than 1 is not considered cost beneficial. Furthermore, the inconsistent reporting practices identified during the analysis of the DMT savings values leads to an overall questionable LCS metric. Recommendations in Chapter V will outline potential measures to take to add fidelity to these metrics. In addition to the recommendations, actual savings are expected to be identified within two years after a project becomes fully operational. In October 2004, AFMC published an 18-page document titled *$150M Plus-up/Transformation Program Guidance* (PG). This document was designed to provide comprehensive DMT investment planning and

execution guidance to the 3 ALCs. (AFMC/LG, 2004) Within this document, AFMC requires the ALCs to conduct a Post Project Economic Analysis to identify actual savings realized. The specific requirements for this post-report are as follows:

Post Project Economic Analysis (EA): (accomplished NLT 2 years after project completion) EA will describe basis for determining savings, when savings will begin, how the project met the intended objective, and why actual savings or annual costs differ from estimates.

Completion Details: Year project was approved and completed.

Cost Details: Initial cost estimate vs. actual cost.

Savings Details: Initial savings estimate vs. actual savings realized.

Payback Period Details: Estimated vs. payback period. (AFMC/LG, 2004)

Intangible Benefits

The second major area covered by the assessment (intangible benefits), revealed that all 20 projects that were studied reported some level of intangible benefits. All respondents provided intangible benefits in aggregate form but after careful analysis, 48 different intangible benefits were identified. The intangible benefits reported by the ALCs had a wide range of mission impact. Some benefits positively affected worker morale while others had a direct impact on work center productivity and cost reductions. In order to test the hypothesis presented in Chapter I, (**H_o: All successful USAF DMT capital investments have a positive financial return,** *vs*. **H_a: Not all successful USAF DMT capital investments have a positive financial return)**, it was necessary to identify the significance of each reported intangible benefit by using information gleaned

throughout the literature review. Additionally, the concepts of perishable, enduring, and measurable intangible benefits were used to weight the significance of each intangible benefit according to respective ALC mission impact. For example, some intangible benefits can result from process improvements which lead to ease of task and increased morale (perishable benefits). However, some intangible benefits can have a direct impact on safety, the environment, standards compliance, automation and technological advancement (enduring benefits). The notional definition of an enduring intangible benefit is a intangible benefit that is sustained throughout the dimension of time. In contrast, perishable intangible benefits are not sustainable over time. For example: the intangible benefit of purchasing a new communication/navigation test set might be that "*the new test set is 10lbs lighter than the old one and less cumbersome to handle*." This would be considered a perishable benefit since it is not sustained over time. Once the new test set is introduced into the work center, the intangible benefit gained by the lighter unit is immediately realized by the technicians using the new test set. It is logical to believe that the first time a technician uses this new unit he or she will find it easier to work with compared to the old test set. It is also logical to believe that the same technician will prefer the lighter unit over the old test set the second, third, and fourth time (*etc, etc*) that he or she uses the new unit. But at some point in time, this perishable benefit begins to normalize. As time progresses, the technician's frame of reference associated with the lighter unit diminishes to the point where it is no longer relevant because the new lighter unit becomes "the norm." In short, the technician can no longer claim the lighter, less cumbersome unit as an intangible benefit because that benefit normalizes over time. Using the same example, if on the same day that the lighter test set

is introduced into the work center, a new employee is hired, the fact that the lighter unit is less cumbersome to handle has zero benefit to the new employee because he or she has no frame of reference to associate to the lighter unit so it is immediately normalized for the new employee. In contrast, enduring intangible benefits are sustained over time. For example: if the intangible benefit of purchasing an automated hydraulic line bending machine is that "*the new machine automates a manufacturing process that was previously done by a manual legacy system,*" this benefit is sustained over time because the work center has transformed, indefinitely, a manual process into one that is automated. The work center (in this example) is keeping pace with technology which is a sustainable benefit until that technology is surpassed by a new one. Non-financial environmental benefits can also be described as enduring intangible benefits. For example: if the intangible benefit of a new aircraft paint spray booth hood is "*reduces airborne pollutants by 11%*", that benefit is sustainable over time. Once the new spray booth hood is installed, the benefit on day 1 is also realized 5 and 10 years down the road (11% less pollutants). Another type of weight that can be used to differentiate between the varying levels of impact that intangible benefits can have on organizations is the idea of a "measurable" benefit. Measurable intangible benefits support Keen's idea that many intangible benefits are potentially quantifiable benefits. As previously noted, in many cases, 75% of intangible benefits can be transformed into quantifiable tangible benefits with a little effort and subsequently used to strengthen a BCA. When assessing intangible benefits, the concept of enduring, perishable, and measurable weights can help identify the level of impact the benefit has on an organization. Putting this concept to practice to identify the significance of each reported DMT intangible benefit, first the 20

overall benefits reported were separated into 48 individual benefits and subsequently categorized as either Strategic, Productivity, or Organizational related benefits. Then, each of the 48 reported benefits was assigned a benefit type: perishable, enduring, or measurable. Finally, a specific impact was assigned to each reported benefit using the consolidated listing of the potential non-monetary benefits also presented in chapter II. A summary of results is presented below in Table 2.

Table 2. Intangible Benefit Types, Categories, and Impact

		Reported Benefits by Type		
Category	**Impact**	**Enduring**	**Measurable**	**Perishable**
Strategic	Strategic Advantage		5	
	Brand image/advantage & Reputation	1		
	Improved performance/productivity		4	
	Customer responsive	1	2	
	Not Otherwise Specified (NOS)	1		
	Improved Quality	2	2	
Production	Improved Safety	3		
	Environmental	3		
	Improved performance/productivity	5	7	
	Improved Quality	1		
Organizational	Improved morale/job satisfaction	1		3
	Organizational Climate	2		2
	Not otherwise specified			1
	Culture	2		
	Totals	**22**	**20**	**6**

Of the 48 benefits reported, 22 were identified as enduring, 6 as perishable and 20 as potentially measurable benefits, which supports Keen's argument that often times intangible benefits can be transformed into tangibles. The analysis revealed that potentially 42% of the reported DMT intangible benefits can be quantified in some way and therefore transformed into tangible benefits to be used to bolster associated EAs. To

give a pictorial representation of the significance of each reported intangible benefit, three graphs were created to depict the benefit type and impact based on the overall benefit category (Strategic, Production, and Organizational). The first graph, Figure 6, represents the intangible benefits categorized as "strategic."

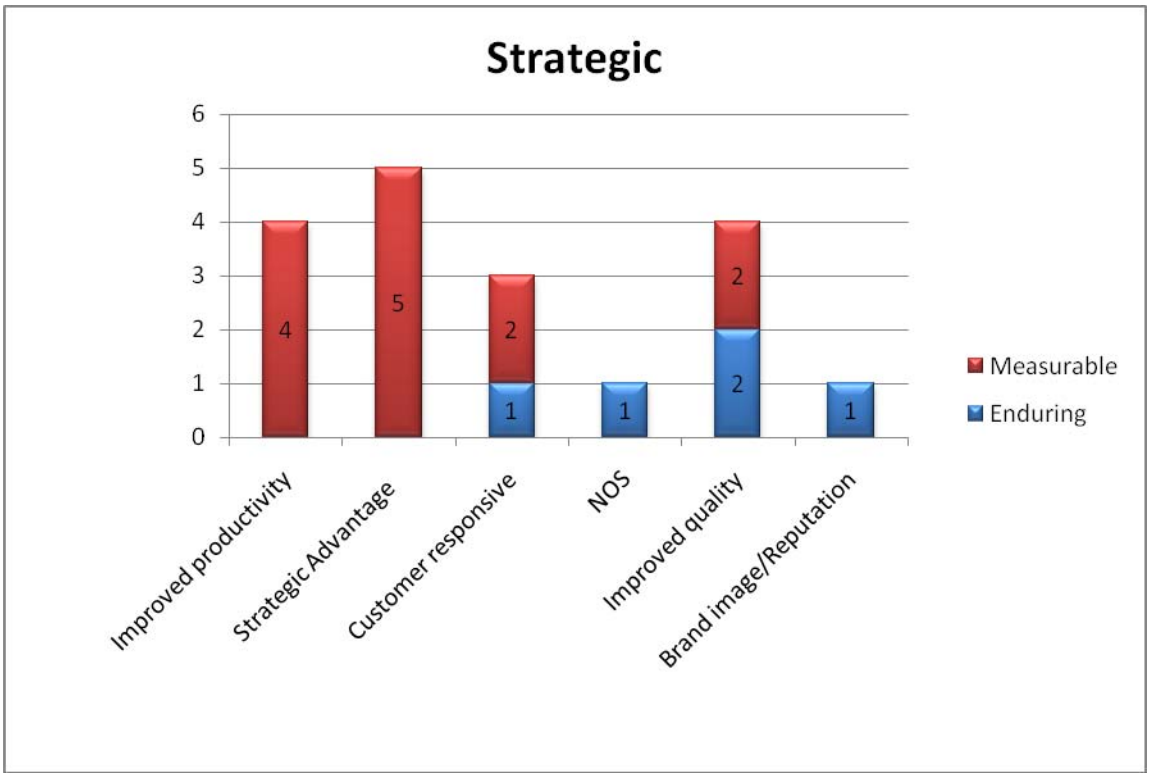


Figure 6. Strategic Category Intangible Benefits

Based on the assessment responses, and subsequent labeling, there are 18 strategic intangible benefits associated with the 20 DMT projects studied. Of those, 13 have the potential to be quantified in some way to potentially be used to strengthen corresponding EAs. The graph also shows that there are 5 enduring strategic intangible benefits associated with the projects in the sample population. For example, one of those 5 is associated with Ogden's *Gun Range & Overhaul Process Transformation* project. The

specific reported intangible benefit was "improved customer confidence". Chapter II describes the intangible benefit of "brand image/advantage and reputation" as *reinforcing, advancing or changing a company's brand*. Ogden's gun range project reinforces its "brand" by streamlining its process and shortening the time it takes to get the final product to the customer creating the strategic intangible benefit of improved customer confidence which is a benefit that is sustained over time (enduring). What is interesting to note in Figure 6 is that with the exception the "customer confidence" benefit just discussed, the remaining 17 strategic intangible benefits are linked to the corporate goals of the DMT program which is why these particular benefits are recorded as strategic benefits. For example, the lower-left corner of the graph indicates that there are 4 potentially measurable benefits that positively impact productivity. These are categorized as strategic benefits since Chapter II described the intangible benefit of "strategic advantage" as *working towards or meeting overall corporate objectives*. The corporate objectives in this case are the DMT program goals which are: (1) Achieve 100% On-Time Delivery (by reducing turnaround time by 30% and reducing Work-in-Progress), (2) Improve affordability (by cutting costs by 25% and providing reliable, predictable prices), (3) Improve data system efficiency (by utilizing commercial-off-the-shelf products and reducing/eliminating legacy and “home-grown” systems) and (4) Lower Customer Reported Defects. (AFMC, 2003)

The most significant finding of the intangible benefit analysis centers around the 5 intangible benefits that yield strategic advantage. These 5 projects report that they will reduce flow days to some degree. In general, flow days, or flow time, is the amount of time that a weapon system or subassembly remains at a work center before advancing to

the next one. (Chao, 1997) However, cycle time is the elapsed time a weapon system or subassembly remains in the production system. (Chao, 1997) In contrast to flow days or flow time, all work centers working within the production system must complete their tasks within the designated cycle time regardless of individual work center flow times. For example, if an aircraft enters the programmed depot maintenance (PDM) production system and must be ready to functional test flight and depart for home station 120 days after entering the production system, flow time and cycle time will differ. To see this, suppose that of the 11 different work centers that have required tasks to perform while the aircraft is in PDM, the structural repair shop has 20 days of required tasks on the aircraft and the fuel cell maintenance shop has 12 days of required work. In this example, the cycle time for the PDM is 120 days and the structural and fuel shops' flow days are 20 and 12 days respectively. The concept of flow days and cycle time is explained here to point out why the intangible benefit of "reduced flow days" is considered a strategic advantage and an extremely significant intangible benefit for DMT projects that realize a reduction in flow days. A reduction in flow days supports multiple DMT program goals. It reduces flow days (**goal**: *turnaround time reduction*), work-in-progress/process (**goal**: *work-in-progress reduction*) which subsequently reduces inventory carrying and labor costs (**goal**: *reduce costs*). In short, a reduction in flow days is a tremendous intangible benefit associated with DMT projects at the strategic level but perhaps even greater benefits could be realized if a reduction of one or more work centers ultimately reduces the overall production system's cycle time. When this happens the entire production cycle is likely to realize savings associated with these goals in addition

to an increased aircraft availability rate based on cycling aircraft (and subassemblies) through the production system faster.

Figure 7 below depicts the Production category of reported intangible benefits. It indicates that there are 19 intangible benefits (out of 48) associated with the 20 DMT projects studied that improve work center performance or productivity in some way. Of these, 7 have the potential to be quantified and subsequently used to bolster EAs. For example, Warner Robins reported that an intangible benefit associated with its *Cargo Aircraft Maintenance Transformation* project is that "additional floor space will improve the flexibility and productivity due to a more efficient layout." This particular benefit is categorized as a Production-category benefit because it is productivity-related and it is represented as a "measurable" intangible benefit because there are ways to quantify the additional production capacity based on a more efficient layout. What does the current facility layout look like? Are there any current constraints that will be eliminated by the cargo aircraft maintenance transformation project? How will the new layout affect any queuing processes within the work center and how will that improve productivity? Not an easy task, but with some effort and logical thought, the benefit of "improved productivity" mentioned above can be quantified, transformed into a tangible benefit and subsequently used in an EA. In contrast to the potentially-measurable intangible benefits, Figure 7 also shows that there are 12 enduring intangible benefits that are sustained over time. For example, 6 of the enduring benefits indicate that an improvement in the safety and environmental postures will result from their associated projects. These benefits are not likely to be quantified but are sustained over time since the improvement in the environmental posture is realized immediately after the project is implemented and that

same improvement is realized years down the road as well. The same can be said for the enhanced safety as a result of the projects.

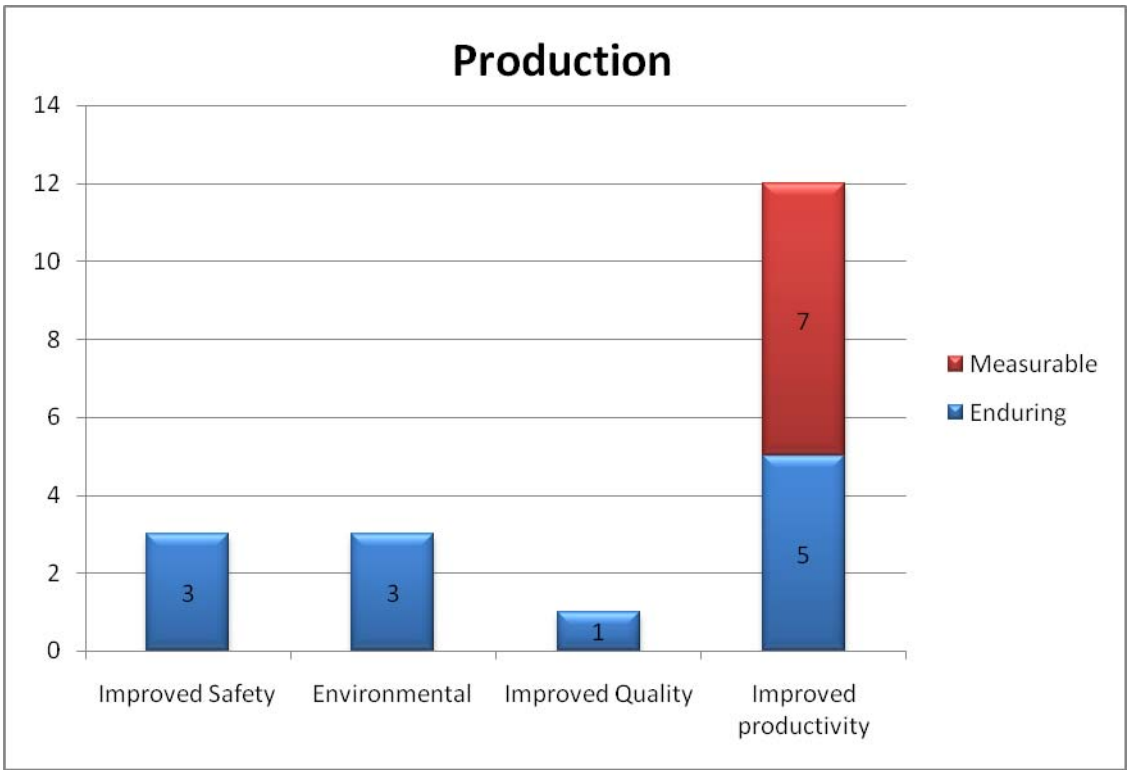


Figure 7. Production Category Intangible Benefits

The Organizational category of intangible benefits is represented in Figure 8. This graph shows that 11 intangible benefits are categorized as organizational benefits which impact either morale, work center climate, or culture. Of them, 6 are considered perishable because they are not sustainable over time and 5 are enduring intangible benefits. An example of a perishable benefit is Warner Robins' *Sheet-metal and Heat Treat Transformation* project. The survey respondent for this project reported that an intangible benefit was "improved morale" due to the ease of operation associated with the new heat treatment configuration. The improved morale resulting from the ease of

operation will certainly be realized immediately after implementation of the new system. The heightened morale is also likely to exist for days, weeks, and perhaps even months after implementation. But at some point in time, the ease of operation normalizes and becomes the status quo. At some point in time, the technicians using the new system lose the frame of reference of how much easier the new system is compared to the old one, therefore improved morale as a result of the new heat treatment system in not likely to be sustained over time. Also, in the case where a new employee enters the work center "after" implementation of the new system, the new employee's morale is not affected in any way by the new system since there is no frame of reference for the old way of doing business. Therefore, the heightened morale due to the ease of operation is not likely to be sustained over time thereby labeling this intangible benefit as perishable. In contrast to perishable intangible benefits, there are some enduring organizational benefits that are sustainable over time. For example, Ogden's *Software Support Facility Transformation* project reports one of its intangible benefits as being, "enhanced synergy between the various flights within the Software Group by shortening lines of communication and developing a team atmosphere." Enhanced synergy is sustained over time because it becomes part of the work center's culture. Because of the synergistic relationship between the work centers created by the software support facility project, the Software Group's culture becomes more rich and cohesive which is sustainable over time.

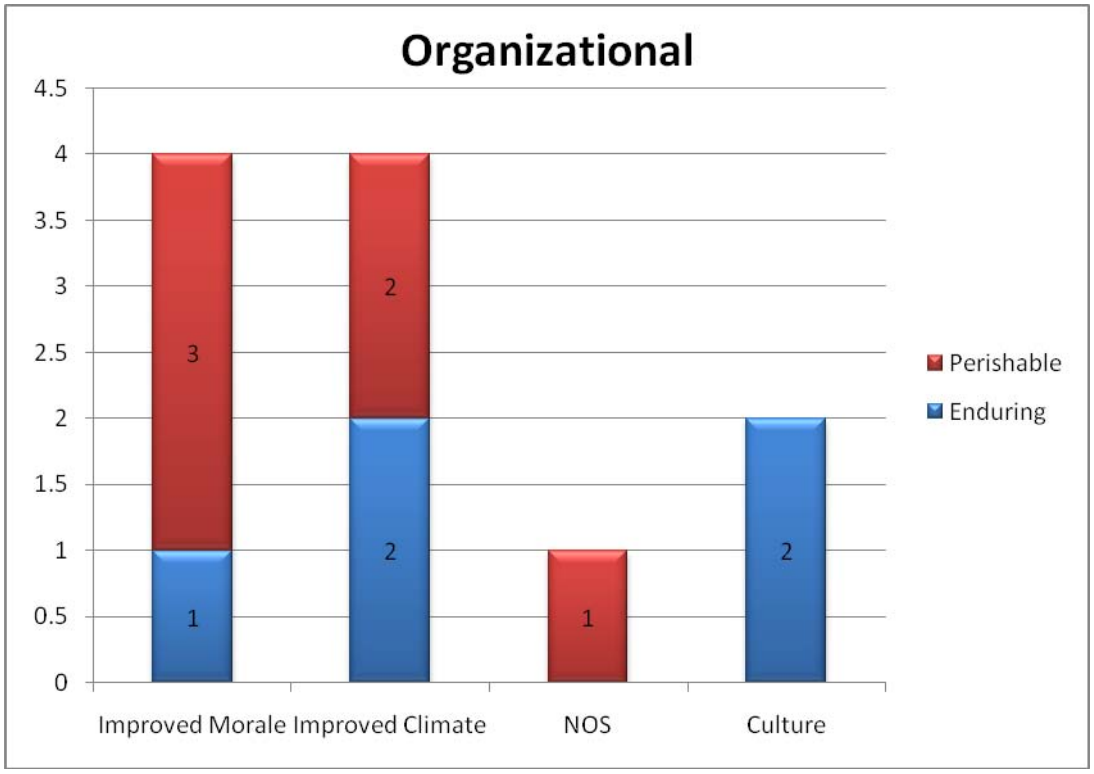


Figure 8. Organizational Category Intangible Benefits

Capital Investment Planning

The final major area of the assessment, *planning*, revealed that 13 of the 20 DMT projects studied conducted comprehensive, end-to-end planning and 7 did not (Figure 9 below). The fact that 7 projects responded that they did not conduct end-to-end planning was not a significant finding in this analysis because it is believed that the assessment question was simply miss-interpreted or that an insufficient response was given. All 7 "no" responses to the end-to-end question came from one particular ALC. In fact, this ALC responded "no" to end-to-end planning for every project in the sample, therefore this was an unsubstantiated finding.

The analysis also revealed that the majority of the projects studied were executed in accordance with their respective EAs and that the decisions to invest in those projects were based on existing needs. The most significant finding in this area was that 100% of the projects responded that they do not have an ALC-specific capital investment plan. This is significant due to the importance of capital investment strategy-linkage identified in Chapter II. The DMT PG requires each ALC to prioritize their submittals based on center needs and to ensure that each project is linked to the following five documents: Future Years Defense Program, Air Force Depot Maintenance Strategy, Air Force Depot Maintenance Master Plan, ALC Depot Maintenance Master Plans and the AFMC Sustainment Technology Process. (AFMC/LG, 2004) AFMC has provided significant guidance on requiring the ALCs to link capital investment decisions to strategy. For example, written into Ogden's Depot Maintenance Master Plan is the requirement for each capital investment project to go through a strategy linkage process prior to approval which rates how each project supports Wing strategic plans. (OO-ALC, 2009) Projects with the highest strategy linkages are considered for approval. However, in contrast to the FAA and NJTPA CIPs, none of the documents mentioned above specifically outlines the mechanics of linking investment initiatives to strategic documents nor do they address the targeted funding concept shared by the FAA and NJTPA. In fact, the DMT Program Guidance requires each ALC to specifically plan for capital investment initiatives in increments of $50M per Fiscal Year. Figure 9 summarizes the planning results of the DMT projects that were assessed.

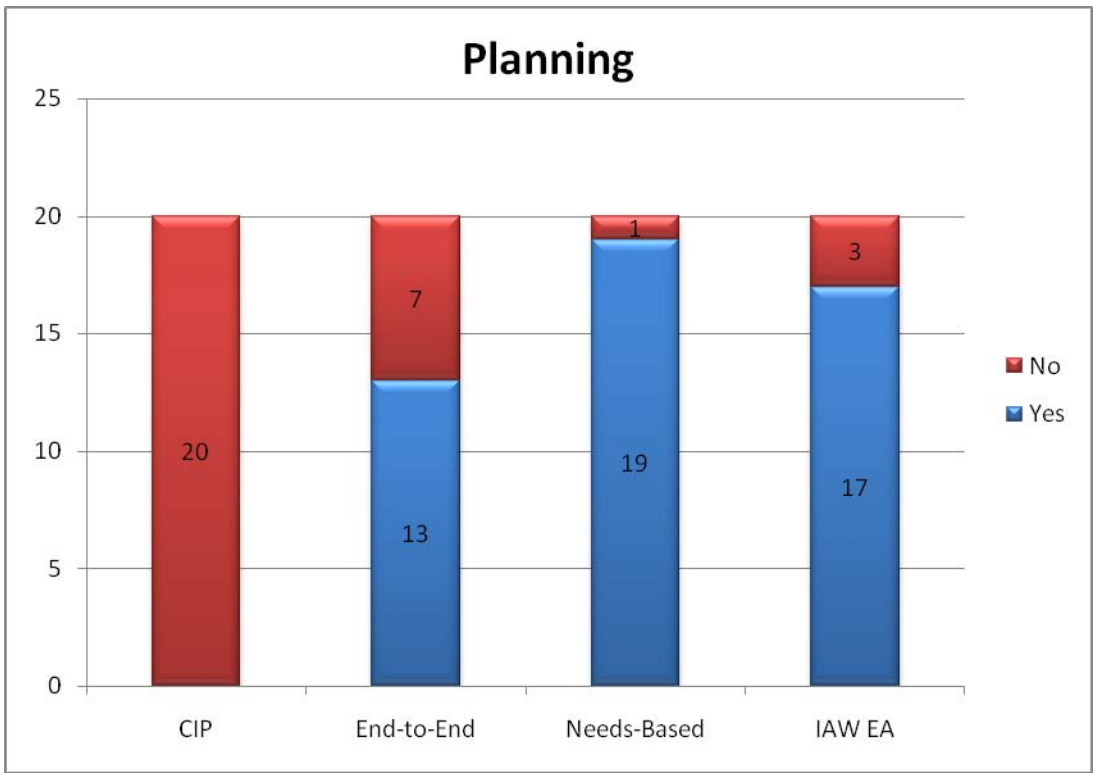


Figure 9. Level of Planning Involved With Projects Studied

Summary

This chapter described the data analysis phase of this research project in the areas of savings, intangible benefits, and capital investment planning. The analysis revealed many interesting aspects of the DMT program such as the sensitivity of savings metrics, the significance of strategic-level intangible benefits, and the importance of strategic planning as it relates to capital investing. Although the DMT projects that were studied appear to be performing successfully, when tangible and intangible benefits are considered together, there is always room for improvement. Recommendations for all three of the major areas studied are discussed in the next chapter.

V. Conclusions and Recommendations

Conclusions

This study has revealed four important considerations when making capital investment decisions. First and foremost, capital investments should be linked to organizational strategy. These strategies should be captured in a Capital Investment Plan, or similar document, in order to ensure that investment decisions are indeed strategy-based decisions. Secondly, intangible benefits should be included in the BCA/EA analysis and those having strategic impact should be made central to the decision-making process. Thirdly, intangible benefits that can be quantified in some manner, should be transformed into tangible benefits and presented to decision-makers in quantifiable terms. Lastly, capital investment decision-makers must choose the "right" metric to use when assessing potential investment projects. ROI works well when it's clear that savings will outweigh investment costs. But in situations where those costs are not expected to be recouped, alternative methods such as the BCR approach presented in Chapter II should be considered.

In addressing the problem statement in terms of investment performance, it is important to note that although 7 DMT projects were identified to have confirmed negative savings, those negative values are offset by the strategic-level intangible benefits associated with each of them. These non-monetary benefits indicate the successful implementation of these particular projects given the strategic nature of their associated benefits. Therefore, the *Null Hypothesis* presented in Chapter I is rejected (**H_o: All**

successful USAF DMT capital investments have a positive financial return) and the Alternative Hypothesis is accepted (**H_a: Not all successful USAF DMT capital investments have a positive financial return**). A positive financial ROI does not define DMT project success.

Recommendations to Sponsor

Six recommendations have been identified for AFMC/A4D consideration.

(1) *Focus future investment decisions on projects that reduce flow days and ultimately production system cycle time.* In keeping with the enterprise-wide concept of transforming depot maintenance and future capital investments, AFMC may benefit from prioritizing investment projects that reduce overall weapon system cycle time as "priority #1". As mentioned in chapter IV, a reduction in flow days is a tremendous intangible benefit associated with DMT projects at the strategic level but perhaps even greater benefits could be realized if a reduction of one or more work centers ultimately reduces the overall production system's cycle time. When this happens the entire production cycle realizes savings associated with these goals and aircraft availability is increased.

(2) *Maintain an enterprise-wide perspective on capital investment funding allocation.* In the past, DMT funding was allocated equally amongst the three depots in $50M increments each year. ALCs prioritized projects within the confines of this allocation and projects that didn't fit in to the budget constraint went unfunded. But from an enterprise perspective, what if the #1 unfunded project at Tinker (for a particular FY) was more strategically aligned with DMT goals compared to the #1 "funded" project at Hill? An

enterprise-wide perspective on investment funding would consider this and allocate investment dollars to the ALC projects that are most strategically aligned with AFMC strategies vs. simply allocating equitable amounts of money amongst three organizations.

(3) *Consider alternative methods for reporting Life Cycle Savings.* Chapter IV revealed inconsistencies in ALC-specific reporting practices with regard to projected savings for DMT projects (inconsistencies between actual/projected savings and reportable time periods). AFMC may benefit from a more realistic representation of DMT project savings by reporting either actual savings only, or actual savings plus expected (future), but not both combined in one metric. The Command may also benefit by only reporting savings through the 10 year DMT reporting period (unless MILCON). Finally, AFMC may want to consider breaking out hard, avoidance, and opportunity savings in order to more accurately identify the meaningful savings associated with DMT projects. Currently all three types of savings are included within the metric. These three approaches are likely to add fidelity to the Life Cycle Savings metric.

(4) *Consider an alternative metric to SIR when considering investment decisions.* Chapter II identified that investment projects with a calculated SIR greater than 1, generate more savings than it costs to implement the project (cost effective projects). However, the analysis phase of this study revealed that 7 DMT projects have "confirmed" negative savings. This means that the costs for these investments are greater than the projected savings. Although these 7 projects have strategic-level intangible benefits associated with them, their individual SIRs contribute to the overall ALC calculated SIRs and the aggregated DMT SIR (1.78). Perhaps the aggregated DMT SIR for the

Command could be optimized by taking the confirmed negative projects out of the SIR calculation for assessment under an alternative method such as the BCR approach discussed in Chapter II.

(5) *Include an in-depth intangible benefit analysis in the post EA.* The DMT Program Guidance-directed post EA requires a complete review of investment costs and savings no later than two years after a project has become fully operational. AFMC would benefit from including an in-depth analysis of all intangible benefits in the post EA by gaining an accurate and overall picture of both financial and non-financial benefits associated with projects.

(6) Standardize ALC reporting (savings). The inconsistencies in reporting actual vs. projected savings is a problem. Within this study, if a DMT project reported a SIR greater than 1, it was considered successful. Furthermore, if a project reported a strategic-level intangible benefit, it was also considered a success; *regardless of the SIR*. However, in the case where a DMT project was not identified to have a strategic-level intangible benefit, yet reported an "inflated" SIR greater than 1 (based on inconsistent reporting), there was no way to accurately measure its success. The inconsistencies in DMT reporting, when measuring success or failure amongst different projects, is analogous to comparing apples to oranges.

Recommendations for Future Research

Recommend AFMC/A4D further study, specifically in the area of metrics, to identify the best metrics to use for projects that are expected to have strategic-level

intangible benefits yet yield expected negative savings. In other words, projects that may be strategically aligned with DMT goals but do not return a SIR greater than 1. This could be done by applying the BCR concept, introduced in chapter II, to the 7 DMT projects identified in this study to have confirmed negative savings, yet strategic-level intangible benefits, to see if this method is applicable and beneficial to AFMC.

A second recommendation for further study is the application of the Alinean, Inc. three-dimensional approach to assessing future depot investments. The Alinean ROI Dashboard Model addresses the key areas that decision-makers must consider when making investment decisions: *risk, financial returns, and intangible benefits*. The presence of intangible benefits associated with the DMT projects studied throughout this research combined with their unique financial profiles (costs outweighing expected savings), suggests that the Alinean model could be a useful tool to consider while evaluating future depot investments.

Summary

In closing, the DMT projects assessed under this study appear to be performing successfully. Of the four identified important considerations when making capital investment decisions, AFMC does a great job of providing strategic capital investment guidance to the ALCs. However, there are potential areas for improvement. Using intangible benefits as a key element in the EA analyses and choosing the "right" metrics to use throughout the decision process are two such areas that could bring benefits to

AFMC and its Capital Purchasing Program. The recommendations presented in this chapter are intended to help in that effort.

Appendix A: Consolidated Listing of DMT Projects

ALC	Title	Total Invested	Total Saved	
WR	Modern Paint Facility & IOE	$40,233,466.00	Data Masked	
Description	The status quo alternative would continue the use of existing facilities (Buildings 89, 54, and 50) and requires contracting out workload that exceeds facility capacities. There is no available capacity in any of the existing corrosion control facilities to paint any additional aircraft. Two of these facilities are currently used for both paint and de-paint operations. Performing the paint and de-paint operation in the same building is an ineffective use of the current facilities causing bottlenecks and disruption in workflow. Building 89 is currently used only for the paint operation. All three buildings are operating three shifts and cannot provide adequate flow days to meet mission requirements. Building 54, the only facility we can paint/de-paint C-5 aircraft in, does not give the desired quality aircraft paint finish since both paint and de-paint functions are accomplished in the same facility. Projected workloads through FY06 show that the facilities are at capacity and workload is contracted out, further increasing flow days and reducing support provided to the customer. (Workload projections for status quo are documented in Section 6, Appendix C, "Interim Calculations".) selected--This alternative would construct an additional corrosion control paint facility to address the shortfall in paint facility capacity. The new facility will include the most current and modern equipment items to ensure the maximum efficiency, effectiveness and environmental compliance. This new facility allows us to complete the painting on the C-130 aircraft that are currently contracted out and provides additional capacity to complete the majority of the projected depot maintenance paint workload on all aircraft. It will eliminate the bottleneck causing increased flow days and scheduling delays and will not require additional manpower. Workload projections and work processes for Alternative 2 are contained in Section 6, Appendix C, "Interim Calculations." We have incurred additional costs and delays to the depot maintenance process by contracting out the aircraft paint shortfall. In addition, Building 55, a 35-year-old facility, will be demolished and the new facility constructed on that site.			
WR	De-paint Facility IOE and MILCON	$35,736,265.00	Data Masked	
Description	The status quo alternative would continue the use of existing facilities (Buildings 89, 54, and 50) and requires contracting out workload that exceeds facility capacities. Some aircraft corrosion control workload will need to be contracted out. In addition, there will still not be any flexibility or additional capacity for increased workload. Most important, the Status Quo alternative will not provide a facility that utilizes the SPO's preferred method of paint removal, which is the plastic media blast process. There is no available capacity in any of the existing corrosion control facilities to paint any additional aircraft. Two of these facilities are currently used for both paint and de-paint operations. Performing the paint and de-paint operation in the same building is an ineffective use of the current facilities causing bottlenecks and disruption in workflow. Building 89 and the new Paint Facility will be used only for the paint operation. All four buildings will operate on three shifts a day, 7 days a week, and cannot provide adequate flow days to meet mission requirements. Building 54, the only facility we can paint/de-paint C-5 aircraft in, does not give the desired quality aircraft paint finish since both paint and de-paint functions are accomplished in the same facility. Projected workload through FY06 shows that the facilities are at capacity and workload is contracted out, further increasing flow days and reducing support provided to the customer. (Workload projections for status quo are documented in Section 6, Appendix C, "Interim Calculations."). selected--This alternative would construct a corrosion control de-paint facility to address the shortfall in de-paint facility capacity. The new facility will include the most current and modern equipment items to ensure maximum efficiency, effectiveness and environmental compliance. It will include the SPO's preferred method of de-paint (plastic media blast process) to ensure maximum efficiency, effectiveness and environmental compliance. It will allow us to perform in house part of the corrosion control workload on C-130 and C-5 aircraft that is currently contracted out. It will also provide additional capacity for depot maintenance paint workload on all aircraft. It will eliminate the bottleneck causing increased flow days and scheduling delays and will not require additional manpower. Workload projections and work processes for Alternative 2 are contained in Section 6, Appendix C, "Interim Calculations." We have incurred additional costs and delays to the depot maintenance process by contracting out the aircraft paint shortfall. In addition, Building 56, a 42-year-old facility, will be demolished and the new facility constructed on that site. status--Approved for funding as a Congressional Insert in FY03. (Original EA requested funding in FY05.)			
WR	Airborne Electronics - ALQ-184 TPS Re-host	$469,430.95	Data Masked	
Description	Currently support for the ALQ-184 Pod consists of two Fluke 3050B test stations and two 3053C analog test racks. These Fluke 3050B testers were the last two testers of this type manufactured by Fluke and are of the late seventies and early eighties technology. As of 1989, Fluke no longer produces Automatic Test Equipment (ATE) of this type. Since Fluke is no longer in the ATE business, maintenance of this equipment is the depots responsibility. These two testers are the only ones in the AF inventory. Continued problems have been difficult to solve since parts are no longer manufactured and attempts to find commercial off the shelf substitutes have been unsuccessful due to the design of the power supply. selected--Re-host those TPSs currently on the Fluke 3050B to an in-house HP-3070 tester. This re-host will decrease the stress this station experiences and provide a more reliable test platform. status--All the Test Program Sets scheduled for re-host using this project funding are complete. The shop estimates that the runtimes for the new TPSs on the HP3070 are 2 to 3 times faster than those on the older Fluke 3050B tester.			

WR	Airborne Electronics - MATE 390 Test Station	$1,809,716.00	Data Masked	
Description	The MATE 390 is currently used to repair the circuit cards of the TEMS system. The shop has experienced a lot of downtime with the MATE 390 Test Station because of the Digital Word Generator (DWG). The DWG is a key component of the MATE 390 and renders the MATE 390 useless when it is down. The shop constantly experiences intermittent failures associated with this component because of connectivity problems. For example, removing and reinstalling circuit cards from this component has created failures itself. In FY05, the shop had to pay a contractor to come in and repair the DWG because they do not have in-house expertise. Currently, the shop only has one operational MATE 390 test station. This project will decrease downtime by as much as 50% and decrease repair time by 25% for the individual circuit cards associated with the TEMS system. selected--Purchase a new test station and re-host the TPSs to it. The increased operating speed and reliability of the new test station will allow the shop to replace the two testers with one. status--A new test station was purchased and installed. The last 5 Test Program Sets ready for sell-off. These sell-offs should be complete by the end of May 07.			
WR	Transforming Airborne Electronics - ARC - 164/190/186/230 SRU Tester	$612,543.00	Data Masked	
Description	This project was to purchase a Teradyne Spectrum 9100 test station to support the Airborne Navigation/Airborne Radio Communication (AN/ARC)-164, AN/ARC-186, AN/ARC-190, AN/ARC-222, and AN/ARC-230 systems. This project will improve the depots' core testing and repair capabilities for these systems. These Receiver-Transmitter (RT) radios are the Air Force's primary UHF and VHF communication systems used on all airborne and most ground weapons systems. Also, the acquisition will support future depot workloads on the newly developed AN/ARC-230 and AN/ARC-222 RTs. Each RT unit has several circuit card assemblies that are repaired in the next higher assembly with a manual bench top test station. The new tester will increase the depot's testing and repair capacity by 30%. It will also test the circuit card assemblies individually and automatically, which will reduce the repair time by 20 to 30%. selected--These projects provide foundational technology to modernize and improve our repair of many aircraft avionics including the F-15 and B1-B by transforming our testers from outdated technology to new generation technology. One example is the APG-63(V)1 upgrade that will improve computer and computer tool support for F-15 operational flight program (OFP) software developers by providing computer-controlled microwave test generators to ensure highly repeatable test conditions and setups, thereby reducing processing time and costs for development. Additionally, KPST upgrades will move the avionics shops from 1970's technology that is fast becoming obsolete and unsupportable, ultimately deeming the currently used test station inoperable by the end of 2005. KPST supports the F-15 and B-1B programs which will remain in service through the year 2020. Another is a project to replace the LANTIRN LFTS and LRTS testers with a new generation Laser Test Station. The LFTS and LRTS are early 1980s technology. ALQ-184 and MATE 390 Test Stations will also receive upgrades to enhance our avionics transformation. The project provides computer-controlled microwave test generators to ensure highly repeatable test conditions and setups, reducing processing time/costs for development. The project is a technology upgrade to the existing systems to provide automated testing capability across multiple components. status--The Spectrum test station has been purchased and installed. The 402 SMXG is currently developing software for this tester.			
WR	Airborne Electronics - GATEITS Rate MPACS System	$240,000.00	Data Masked	
Description	The Rate MPACS Systems currently available have instrumentation that is obsolete early 1980's technology and for which replacement and/or spacer parts are no longer available. Electronics technology has improved dramatically since the current system was designed, built and installed. Because of these problems with the GATEITS Rate MPACS systems, testing and calibration procedures have to be repeated to insure accuracy. This is a time consuming process. The unreliability of the existing MPACS causes downtime and work stoppage for all or part of the GATEITS. Aircraft and missiles of several DoD branches would have the potential of being grounded because of a lack of gyroscopes. selected--Replace the existing Rate MPACS Systems with state-of-the-art instrumentation with greater reliability, capability and flexibility and for which replacement parts are readily available. Elimination and eminate failure of the existing Rate MPACS Systems, the new Rate MPACS Systems would reduce or eliminate bottlenecks, the use of overtime, and actual work stoppages. The new equipment would use digital readouts and settings, which should be easier and quicker to use and more accurate than the current analog devices.			
WR	Airborne Electronics - GATEITS Vertical MPACS System	$475,000.00	Data Masked	
Description	The Gyro Repair Facility provides repair, calibration, and certification of aircraft gyroscopes used in instrumentation for multiple weapons systems in the DoD inventory. The Gyro Repair Facility utilizes both automatic and manual test equipment for calibration, testing and certification of all gyros serviced by the Gyro Repair Facility. The manual test equipment is required to perform repair and calibration actions. The automatic equipment is necessary for final functional testing of all gyroscopes and other similar electronics, including indicators. This equipment, along with several peripheral pieces of equipment, work together to form the Gyro Automatic Test Equipment Integrated Test System (GATEITS). Most of the GATEITS is early 1980s technology and the electronics and computers are obsolete. Repair parts or replacement units are no longer available. selected--Replace the existing Vertical MPACS Systems with state-of-the-art instrumentation with greater reliability, capability and flexibility and for which replacement parts are readily available. Eliminating the emanate failure of the existing Vertical MPACS Systems, the new Directional MPACS Systems would reduce or eliminate bottlenecks, the use of overtime, and actual work stoppages. The new equipment would use digital readouts and settings, which should be easier and quicker to use and more accurate than the current analog devices. status--Operational 1 Aug 2006.			

WR	Airborne Electronics - GATEITS Directional MPACS System	$475,000.00	Data Masked	
Description	The Gyro Repair Facility provides repair, calibration, and certification of aircraft gyroscopes used in instrumentation for multiple weapons systems in the DoD inventory. The Gyro Repair Facility utilizes both automatic and manual test equipment for calibration, testing and certification of all gyros serviced by the Gyro Repair Facility. The manual test equipment is required to perform repair and calibration actions. The automatic equipment is necessary for final functional testing of all gyroscopes and other similar electronics, including indicators. This equipment, along with several peripheral pieces of equipment, work together to form the Gyro Automatic Test Equipment Integrated Test System (GATEITS). Most of the GATEITS is early 1980s technology and the electronics and computers are obsolete. Repair parts or replacement units are no longer available. status--Replace the existing Directional MPACS Systems with the state-of-the-art instrumentation with greater reliability, capability and flexibility and for which replacement parts are readily available. Eliminating the eminate failure of the existing Directional MPACS Systems, the new Directional MPACS Systems would reduce or eliminate bottlenecks, the use of overtime, and actual work stoppages. The new equipment would use digital readouts and settings, which should be easier and quicker to use and more accurate than the current analog devices. status--Operational 1 Aug 2006.			
WR	C-130 Prop Shop Transformation	$4,400,000.00	Data Masked	
Description	Currently many processes involved with the blade refurbishment are accomplished at different locations within a building that is approximately 1M SF. The blades travel from one end of the building to the other multiple times during the refurbishment process. Additionally each location has a different supervisor. These supervisors do not report to the Prop Shop manager making it difficult support blade production in the most efficient and effective manner. Currents wastes include excessive flow days, increased work in process, excessive transportation and increased tool inventory. selected--With transformation and lean techniques applied the blade refurbishment can be accomplished in a much smaller area with the manager having complete control of the process. Certain existing equipment and processes as well as new state-of-the-art turn key processes will be arranged within a single area whereby a "pull" or or flow line process oriented product line will minimize and/or eliminate existing wastes. status--As of 16FEB07, the project completion status is 75% complete.			
WR	Lean AISF - Upgrade Radar Lab to APG-63(V)1	$8,500,000.00	Data Masked	
Description	The F-15 C/D fleet is being retrofitted with the APG-63(V)1 radar. 402 SMXG currently performs updates to the APG-63 (the precursor of the APG-63(V)1) and APG-70 Operational Flight Programs (OFP). Both the APG-63 and APG-70 workloads are performed at WR-ALC. selected--By upgrading the existing radar lab benches to incorporate the APG-63(V)1, 402 SMXG can assume this workload from the contractor, Raytheon Systems, Inc. Savings will be realized through lower man-hour costs, code reuse between the APG-70 and the APG-63(V)1, and resource sharing with the existing APG-70 OFP support assets. Economies of scale will be realized by having all F-15 radar OFP work performed at one site, since manpower can be shared among the various workloads. status--The project is ongoing and on schedule. The planned operational date is September 2008.			
WR	Wrap Around Tail Stands for C-130 De-Paint	$1,500,000.00	Data Masked	
Description	Currently we have wing stands and use portable stands for getting around the rest of the aircraft. Continually climbing up and down portable stands while wearing fully enclosed body suites, carrying large paint sprayers, and dragging multiple hoses every step makes for long exhausting days. Not only is it inefficient but quality suffers as the painters quickly wear out from heat and fatigue. selected--Wrap around stands will minimize the number of trips up and down the stairs it takes to get around the aircraft. It is faster, safer, easier on the painter, and the quality of the painting improves. Not only is the painter safer but so is the aircraft. A dragged line across an aircraft may just require an area to be repainted but a dropped sprayer or a steel toed boot can do some real damage to an aircraft.			
WR	Critical Chain Path Management (CCPM)	$624,000.00	Data Masked	
Description	Rely on the experience of the Scheduler/Production supervisor team to assign job cards in the most efficient order. Often what appears to be the most important jobs are not the ones that actually have to be worked first to keep an aircraft on schedule. Over time managers and schedulers learn by trial and error how best to sequence the work. The experience level varies between managers sequencing the work which has a direct effect on the work performed. Maintenance work is scheduled by the PDMSS system which generates the job cards in a sequence based on a logical order of progression. This prevents work from being accomplished out of order which would result in many steps in the process having to be duplicated. For example when a panel is removed then we want all the work that is to be done accomplished before the panel is re-installed. Without an organized system in place the panel might have to be removed and re-installed many times during the repair process. selected--Purchase and implement the CCPM system and use the critical path based priorities to help the team manage the assignment of the work. Instead of relying on a learning curve to figure out the best way to distribute out the job cards, the system lets them know on a day to day basis what jobs need to be done first and what the impact to the schedule will be if the start of a job is delayed. A manager/scheduler still has to know his people to be able to match the right mechanics to the right jobs but as far as sequencing the work, the system makes every manager/scheduler and expert. With the elimination of redundant work the next logical improvement to the process is to prioritize the job cards in such a way that the work is accomplished in the order that gets the aircraft finished in the shortest amount of time. This optimization is what the CCPM software adds to the existing process. status--The software has been purchased and is being used by the C-5 company to manage their schedule. The C-130 are in the process of going to this system and next year it will be integrated into the F-15 and C-17 maintenance processes.			

WR	Machine Shop CNC Equipment	$3,100,000.00	Data Masked	
Description	402 CMXG uses multi-axis machining centers for the manufacture of large, intricate aerospace components. These structural repair parts for the maintenance and repair of F-15, C-5, C-17 and C-130 aircraft produced for PDM efforts require precision tolerance capability. The machines are also used to manufacture components for DLA and the base supply system. The non-availability of these machines can significantly impact the PDM mission at WR-ALC. selected--The new equipment will provide the required precision tolerance capability with the additional provision of a state-of-the-art controller. They will provide the maximum benefits of newly integrated technology for manufacturing systems, making it possible to get correct parts and resulting repairs to the war fighter faster. This project will allow the machining processes for the individual machines to be less costly and more flexible and adaptable to planning and scheduling issues when required PM downtime or workload or emergency orders demand priority. status--One of the machines has been received and is being installed by the Vendor. When installation is complete, sample test parts will be machined for final acceptance. Then Operators, Mechanics, and Electricians will be trained.			
WR	CBR FY06 - Enviro-Strip Blasting Units	$881,280.00	Data Masked	
Description	The current metal bond and composite repair operations process require chemical stripping of an entire asset or the partial striping of an entire asset or the partial stripping utilizing hand sanding. The chemical stripping is located in B180 requiring the assets to be moved into and out of the facility multiple times. The hand sanding for partial stripping is performed in B169 but is time consuming and can result in injury for the mechanic. selected--The Environ-Strip process eliminates the need for the majority of chemical stripping and reduces hand sanding by 90% enhancing the ergonomic program. The improved process directly supports current Lean process initiatives by eliminating the requirement to move aircraft components to and from the de-paint facility located in building 180 resulting in an optimized flow of the assets. It further enhances transformation of the metal bond capabilities by increasing the flexibility of the facility, reducing travel time, eliminating process moves and placing critical support equipment near the individual shops in B169. status--Equipment design is complete. SOW is in final review, fabrication and installation is scheduled for July 07.			
WR	5 Axis Vertical Machining Center CNC	$816,000.00	Data Masked	
Description	The manufacturing facility in B140 manufactures aircraft component parts to support WR-ALC Programmed Depot Maintenance (PDM). Due to the intricate geometry of the design of many aircraft structural components, manufacture at WR-ALC must be accomplished on 5-axis computer numeric controlled (CNC) Machining Centers within the 402d CMXG. These structural repair parts for the maintenance and repair on the F-15, C-130, C-5 and C-17 aircraft produced for PDM efforts require precision tolerance capability. The machines are also used to manufacture components for DLA and the base supply system. selected--This new machining center is designed to operate at much higher spindle speeds, thereby reducing the actual production time per part. Existing new equipment of this type has proven to save up to 66% of the production time on some aluminum structural wing parts. The new equipment is required in order to expedite the component manufacturing process and reduce downtime for the affected aircraft by providing a more reliable source for 5-axis machining. status--This new machine has been received and partially installed. Operator Training is scheduled to start on March 19th and turned over to production by April 1st.			
WR	Laser Tracker 800	$371,000.00	Data Masked	
Description	Currently, the Aircraft Maintenance Division generates an estimated 2000 panels annually in support of the C-130, C-5, C-17 and F-15 during their PDMs. If maintenance does not have the required mold in the inventory to generate a new panel when required, then a new mold must be manufactured to ensure accurate replication. Currently, the process of replication is performed by "guesswork" as well as undedicated machinery within the support shop processes. This process leads to inefficiencies and numerous reworks before an accurate replication can be achieved. Additionally, during the annual inspection of the approximate 700 molds in inventory, maintenance personnel are unable to ensure that the molds have retained their contours. selected--The LTD800 provides state of the art capability to accurately digitize existing panels, so that an accurate mold can be manufactured. Additionally, the LTD800 will also be used to inspect existing molds to ensure that their size and contours remain accurate. Reduced tooling rework costs will be experiences by removal of existing guesswork and errors incurred during the reverse engineering process.			
WR	Screen Printer with Conveyors/Un-loaders	$158,135.00	Data Masked	
Description	Current equipment utilizes manual calibration via micrometer adjustments made by an operator. Therefore, the quality of products is affected by the potential of operator error. The existing equipment is adequate for very simple circuits. However, manufacturing more complex designs has historically resulted in high failure rates due to the level of accuracy of the equipment. For example, a recent manufacturing job required the production of a 10-layer substrate. This portion of the manufacturing job was outsourced due to lack of capability of the existing equipment resulting in the loss of paid work hours. selected--Screen Printer w/ Conveyors/Un-loaders: The proposed printer is controlled by Programmable Logic Controllers (PLC). PLC control will increase quality and repeatability of the process while lowering product failure rates. Coupled with the conveyors/un-loaders system, this purchase will increase through-put capability resulting in the ability to take on increased workload. Personnel changes will not be required for this alternative. Purchased equipment will replace the existing printer and will fit in the facility where the existing printer is located.			

WR	MMTS Testers	$2,250,000.00	Data Masked	
Description	Traditionally, the Air Force has purchased one-of-a-kind automatic test equipment (ATE) to perform each new workload. The Electronics Depot has approximately 240 testers and the average age of the testers is 24-25 years - some were purchased in the early 1960s. The design on approximately 120 of these testers is currently obsolete and they are extremely difficult to support. The depot is currently faced with the problem of maintaining several different configurations of ATE. Each workload, repaired on a unique test station, can no longer be produced when the tester is down for maintenance or calibration. Downtime prevents the production shop from meeting the required production for the F-15, F-16, B-52, -130 & A-10 workloads supported by the ATE that is down. selected--The Versatile Depot Automatic Test Station (VDATS) is an organically designed, developed, and delivered solution to combat obsolescence, minimize sustainment issues, reduce proliferation of hardware, and provide flexibility of work loading. These common testers allow transportability of workloads, improving the ability to support core electronics workloads while providing the infrastructure to support future workloads. status--The 402 EMXG and SMXG team is in the process of assembling the hardware, designing the software, and writing the technical data for the VDATS program. The first VDATS is assembled and SMXG is developing self-test and calibration software.			
WR	Lean AISF Embedded Instrumentation Upgrade	$1,349,000.00	Data Masked	
Description	This alternative continues to use the existing VAX computer systems (circa 1980s) to build F-15 OFPs. Building an F-15 Central Computer OFP involves compiling the ADA source code, assembling the MIL-STD-1750A assembly language source code, linking the object modules, and creating an aggregate load module. The computer technology currently in use is obsolete and maintained by a third party vendor. The time to compile, link, and format executable OFP files, i.e., the "build cycle time", using this hardware is several hours. selected--The F-15 AISF, like many existing AISFs, was built in the early 1990s. It is based on older hardware that is obsolete and expensive to maintain. This alternative replaces the old equipment with new servers that run VAX emulators, a form of virtualization. The time to compile, link, and format executable OFP files, i.e., the "build cycle time", using modern hardware is significantly less. Cycle time reduction is a key tenet of Lean software development, since it results in less waste and lower costs. The new hardware will not require any facility changes, nor will it require changes in personnel. This project extends the transformation activities that were accomplished during the Lean AISF I project.			
WR	Sheet-metal	$4,000,000.00	Data Masked	
Description	The sheet metal manufacturing shop produces approximately 135,653 aircraft parts per year. Each of these parts is subject to a myriad of processes including cutting of raw stock, forming, cleaning, heat treatment, assembly, painting and inspections. At some point in the manufacturing process all parts cross one of two water jets or a Numerically Controlled Turret Punch. Due to the large workload these machine stay constantly busy, and have begun to wear prematurely resulting in unplanned downtime. selected--Replace old equipment that has become increasingly difficult to support and will provide additional new equipment and capabilities. Purchasing the Water jets and CNC/Laser Punch Press and refurbishing the Hydro form Press, Paint Booth, Vapor Degreaser, Material Handling Systems, CNC Shear, and an 8-foot sheet metal roller will reduce operating costs and decrease the time required for repair or production of aircraft components. This initiative replaces obsolete equipment and processes with state-of-the art technology and methods improving our capabilities to meet production schedules and accept new workloads. status--The following equipment was installed and turned over to production: Water Jet (100 HP) - 09 Jun 2006 / Water Jet (50 HP) - 08 Dec 2006 / Laser-Punch Press 26 Oct 2006. The De-burr should be turned over to production by 26 Feb 2007.			
WR	MAI Automatic Test Equipment and Software Upgrade, Phase 1 (AKA: Transforming Avionics Repair Through Like-Instrumented Testers and Software Translation Tool, Phase 1)	$13,013,500.00	Data Masked	
Description	This alternative purchases 8 new ATE in FY06 that have the same configuration and will replace 16 old ATE stations. This will allow the depot to shift workloads among like-configured test stations during maintenance and calibration periods. Support for the war fighter will not stop because of a test station downtime. The work is simply shifted to another test station at a different location in the shop. This concept is a radical and transformational departure from current practice. By replacing the obsolete testers in FY06, the depot can avoid the high costs associated with maintaining aging and obsolete equipment. If measures are not taken now to begin the transformation to more modern ATE, the WRALC-MAI Depot could lose the current repair capacity and the possibilities for future workloads.			
WR	Sheet Metal & Heat Treat Transformation Phase II	$6,000,000.00	Data Masked	
Description	The sheet metal manufacturing shop produces thousands of sheet metal parts per year. Each part is produced from raw stock sheet metal--cut, trimmed, and formed into a finished part. The bulk of these finished pars must undergo anywhere from one to four cycles of heat treatment. This requires the routing of these parts to the areas which provide the full process required for adequate heat treatment of metal. In the heat treatment cycle parts are subjected to specific time and temperature combinations that result in the required toughness, hardness, and corrosion resistance as required by the parts associated technical order as well as current industry standards. The vast majority of aircraft components produced must undergo at least one heat treat cycle with many components requiring numerous cycles. Prior to and after each heat treatment cycle each fabricated aircraft component must be routed to another outlying shop to be properly cleaned and preserved. selected--This project re-configures the current shop floor process to a Lean "pull" manufacturing operation. Besides the shop reconfiguration this project includes the upgrade and replacement of obsolete equipment providing new technology and additional capabilities. This transformation project will dramatically change the processing of parts, resulting in a dramatic increase in productivity and customer support. status--Data Acquisition portion of project will be accomplished by MXSG project with an ECD of June 2007. Budget proposals have been acquired for the aging ovens. Steel furnaces, vacuum furnace, and endothermic generators are in spec development.			

WR	FY06 Transform Metal Bond Process	$4,770,000.00	Data Masked	
Description	The current facility configuration of building 169 does not lend itself to optimizing the flow of component panels through the shop making it difficult to repair and /or manufacture aircraft components to close tolerances in a timely manner required by PDM workloads of the C-5, C-17, C-130 and F-15 aircraft. The current lay up room in building 169 is a bottleneck for the metal bond process resulting in production delays and increased overtime. The process requires that all metal bond lay up be performed in an environmentally controlled area. The limited space available in the lay up room adds flow days and inhibits the ability to respond to changing workloads. selected--This project transforms the metal bond repair operation from its current, open shop environment to a minimal clean room operation similar to that in the lay-up room. This change allows the lay-up operation to take place at any location within the facility thereby eliminating a major process backlog. This project directly supports our current Lean initiatives by reducing the movement of aircraft components (some very large, heavy and bulky) resulting in reduced component flow days and a greatly improved working environment. This project includes a shop rearrangement that will provide multiple easily accessible, segregated sanding/grinding areas. Incorporated in the new clean room operations are required support equipment such as ovens, transportation dollies and carts, vacuum equipment and supply lines, electrical equipment, and shop air supply lines. status--The Floor improvement project is 40% complete. The sanding booths have been moved to their permanent position. 50% of the utility centers are installed. The humidity control for the facility is in place. The other equipment is awaiting award, sonic cutter, blast booth, sheet metal equipment etc.. The lean events for shop layout and mechanic training are complete. The design for the anodized shop is at 85%.			
WR	Transforming Avionics Repair Through Like-Instrumented Testers and Software Translation Tool PH2	$10,784,000.00	Data Masked	
Description	Traditionally, the Air Force has purchased one-of-a-kind automatic test equipment (ATE) to perform each new workload. The Electronics Depot has approximately 240 testers and the average age of the testers is 24-15 years - some were purchased in the early 1960s. The design on approximately 120 of these testers is currently obsolete and they are extremely difficult to support. The depot is currently faced with the problem of maintaining several different configurations of ATE. Each workload, repaired on a unique test station, can no longer be produced when the tester is down for maintenance or calibration. Downtime prevents the production shop from meeting the required production for the F-15, F-16, B-52, C-130 & A-10 workloads supported by the ATE that is down. selected--The Versatile Depot Automatic Test Station (VDATS) is an organically designed, developed, and delivered solution to combat obsolescence, minimize sustainment issues, reduce proliferation of hardware, and provide flexibility of work loading. These common testers allow transportability of workloads, improving the ability to support core electronics workloads while providing the infrastructure to support future workloads. status--Contracts are being developed/awarded for hardware and software.			
WR	Advanced Metal Finishing Facility Phase I & II	$55,000,000.00	Data Masked	
Description	Current operations in the metal treatment and blasting facility are decades old and involve labor-intensive processes. For wet processes, personnel are required to manually dip parts, either by hand or through use of a hoist, into hazardous chemical tanks. Our current facility and equipment has no dry process (plasma spray, high velocity oxygen fuel (HVOF), etc.) capability. The current operations contribute significant pollution to the environment and are heavy users of chemicals and utilities. selected--This project will transform our metal finishing operations into state-of-the-art processes consisting of the latest technologies. Items such as robotic shot penning, programmable hoists and material handling equipment, vapor less plating tanks, computer controlled tank solution monitors, modern ventilation scrubbers, water recycling equipment, and robotically controlled dry plating processes will bring the metal treatment and blasting processes to the forefront of the industry. Reductions in product and process variation, material wastes, flow days, and human errors will be realized. Standard work, as recommended by Lean process improvement techniques, will result from this transformation. This project incorporates energy efficient processing and support equipment to reduce the utility and natural resource burden of the shop. It also includes a substantial amount of pollution control equipment. status--RFP is near 100% complete. Initial source selection scheduled to take place in mid Mar 07. Contract award is projected in Aug 07.			
WR	Software Support Transformation Lean AISF PH2	$893,460.00	Data Masked	
Description	This alternative continues to use the existing VAX computer systems (circa 1980s) to build F-15 OFPs. Building an F-15 Central Computer OFP involves compiling the ADA source code, assembling the MIL-STD-1750A assembly language source code, linking the object modules, and creating an aggregate load module. The computer technology currently in use is obsolete and maintained by a third party vendor. The time to compile, link, and format executable OFP files, i.e., the “build cycle time”, using this hardware is several hours. selected--The F-15 AISF, like many existing AISFs, was built in the early 1990s. It is based on older hardware that is obsolete and expensive to maintain. This alternative replaces the old equipment with new servers that run VAX emulators, a form of virtualization. The time to compile, link, and format executable OFP files, i.e., the “build cycle time”, using modern hardware is significantly less. Cycle time reduction is a key tenet of Lean software development, since it results in less waste and lower costs. The new hardware will not require any facility changes, nor will it require changes in personnel. This project extends the transformation activities that were accomplished during the Lean AISF I project.			

WR	Secure Collaboration Integrated Digital Environment (SCIDE)	$5,000,000.00	Data Masked	
Description	Currently WR-ALC develops and implements point to point (PTP) communications systems between each different operation and platform facilities. Because of security issues, and the sensitivity and cultural diversity between "collaborators," these PTPs do not currently operate in a data-sharing mode. In-house data systems are located on separate configurations or networks and classified systems are normally isolated, stand-alone systems or personal computers. This means that even though two systems are connected PTP data must be manually manipulated to be shared between the two systems. This adds complexity and additional infrastructure costs for PTP leases, hardware, interfaces, delays, etc. selected--The SCIDE will enable WR-ALC to support software development, integration, documentation, configuration management, test, and maintenance. SCIDE's design affordably accommodates and maintains pace with "state-of-the-art" technology advancements, transforming software development and maintenance activities into a network centric enterprise operation. Enhanced network collaboration capabilities will enable tighter industry coupling with depot activities, minimizing redundant nonrecurring investment burdens. SCIDE will allow established partnerships to function in a dynamic environment, constantly redefining divisions of labor and task assignments, to maximize output and value. Seamless collaboration facilitates depot/industry partnerships that mark a major shift in task execution from a serial alignment to an integrated workspace that synchronizes complex activities - concurrently introducing new technology, capability and supportability upgrades. status--FY07 CPP funds have been received and project manager is working on obligation.			
WR	Transforming Incoming Support Process	$8,600,000.00	Data Masked	
Description	F-15 Purge, corrosion control. and in-coming operations are located at the north end of the flight-line, stripping operations are located east of the far south east corner of the flight line, and PDM operations are located at the far south western end of the flight-line. Each aircraft makes large numbers of trips across the ramp, tying up the aircraft, a tow truck, and a crew of mechanics who have to escort the aircraft from building to building. The loss of man-hours and the increase in flow-days equates to fewer aircraft being on stations ready to support the mission. selected--This project Leans the process flow of the F-15 PDM process by locating functions/operations in close proximity to one another. The project consolidates the F-15 incoming operations and results in reduced aircraft towing requirements. The facility can be used by C-130 aircraft as well as F-15s. Mechanics spend their time working on the aircraft instead of walking the aircraft from building to building. status--This project is in the final stages of design and the contract to award construction and the construction of the facility itself will start this year.			
WR	Lean Aircraft Component Repair Process	$22,000,000.00	Data Masked	
Description	This alternative will continue the aircraft component repair operations in the facilities where they are currently located (Bldgs 142, 146, 148, 163, 180, 323, 255, 350, 364, 318, 603 and 605). These buildings, totaling 97,975 square feet, are scattered across Robins AFB which does not allow for consolidation of similar workloads or the opportunity to improve the utilization of facility space. Buildings 255, 318, 350, 364, 603 and 605 are located away from the industrial complex area. Since personnel are constantly traveling between buildings, communications among personnel and supervisory controls are hampered, reducing organization efficiency. Three of the buildings (bldgs. 318, 603, and 605) are classified as condition code 6 (an Air Force approved disposal). Continued use of these three buildings would require maintenance upgrades totaling $2,379,940 (FY08$). While periodic maintenance and regular maintenance and repair costs are required to support all buildings, these maintenance costs and energy consumption increase as the buildings grow older. In addition, the existing processes involve more mechanical (sanding/grinding) operations on painted surfaces than in the past. These increased sanding requirements combined with inadequate ventilation systems have caused dust exposure levels to rise. Since pending regulations will further reduce the limits on allowable exposure to hazardous materials, it is imperative that protection be provided for our personnel and for the environment. selected--This project provides a modern efficient facility that consolidates, downsizes, and improves productivity of aircraft component repair functions at WR-ALC. This project provides for the consolidation of repair operations that are currently scattered in five located at different ends of the base. The facility will be located in an area close to the flight line to reduce travel time. status--This EA is currently being re-accomplished due to a change in scope.			
WR	Transforming Avionics Repair, Phase III	$23,608,000.00	Data Masked	
Description	Traditionally, the Air Force has purchased one-of-a-kind automatic test equipment (ATE) to perform each new workload. The Electronics Depot has approximately 240 testers and the average age of the testers is 24-15 years - some were purchased in the early 1960s. The design on approximately 120 of these testers is currently obsolete and they are extremely difficult to support. The depot is currently faced with the problem of maintaining several different configurations of ATE. Each workload, repaired on a unique test station, can no longer be produced when the tester is down for maintenance or calibration. Downtime prevents the production shop from meeting the required production for the F-15, F-16 and B-52 workloads supported by the ATE that is down. selected--The Versatile Depot Automatic Test Station (VDATS) is an organically designed, developed, and delivered solution to combat obsolescence, minimize sustainment issues, reduce proliferation of hardware, and provide flexibility of work loading. These common testers allow transportability of workloads, improving the ability to support core electronics workloads while providing the infrastructure to support future workloads. status--This initiative relates to item 12 "Improve Depot Maintenance Performance" of the WR-ALC Balanced Scorecard. Specifically this initiative addresses timely delivery of cost effective and quality avionics components.			

WR	Transforming Cargo Aircraft Maintenance	$22,000,000.00	Data Masked	
Description	Continuing to operate in the current facilities and conditions without expansion will restrain the C-130 workload capabilities. This results in about half of the PDM work being for additional work accomplished on ramp positions and half in hangar positions. Selected--Build Hangar: The new facility is designed to support a mix of mid-size aircraft to meet not only our current needs but also projected long term requirements. Incorporating our long-term requirements into the design ensures the utility of the facility for decades to come. The investment cost of this alternative is estimated at $23.5M (FY09$). Benefits include a better, more productive, and safer work environment for our mechanics, reduced flow-days, lower costs for our customers, and the ability to compete			
WR	Ramp - Transforming the Functional Test Process	$13,998,000.00	Data Masked	
Description	The objective of this project is to provide for the detection and analysis of all chemical elements down to beryllium in samples from aircraft components that are from the C-5, C-17, C-130 and F-15 aircraft first article programs, failure analysis projects, special rush projects, local shop and production support projects and corrosion control projects. Existing Scanning Electron Microscope/Spectrometer Systems use 11+ year old technology. Due to security concerns they cannot be networked to pass timely results to customers. selected--The new system will fulfill security requirements. Additionally, the system will allow connectivity to the base computer network which will allow the input of data, spectra, numerical information, graphs and other information from the analysis of aircraft components to be shipped digitally to our customers in the C-5, C-17, C-130 and F-15 aircraft groups. status--Unit has been received and is being installed.			
WR	Scanning Electron Microscope	$307,177.00	Data Masked	
Description	The objective of this project is to provide for the detection and analysis of all chemical elements down to beryllium in samples from aircraft components that are from the C-5, C-17, C-130 and F-15 aircraft first article programs, failure analysis projects, special rush projects, local shop and production support projects and corrosion control projects. Existing Scanning Electron Microscope/Spectrometer Systems use 11+ year old technology. Due to security concerns they cannot be networked to pass timely results to customers. selected--The new system will fulfill security requirements. Additionally, the system will allow connectivity to the base computer network which will allow the input of data, spectra, numerical information, graphs and other information from the analysis of aircraft components to be shipped digitally to our customers in the C-5, C-17, C-130 and F-15 aircraft groups. status--Unit has been received and is being installed.			
WR	Like-Instrument Testers, Phase III (Versatile Depot Automatic Test System - VDATS)	$25,525,541.00	Data Masked	
Description	Traditionally, the Air Force has purchased one-of-a-kind automatic test equipment (ATE) to perform each new workload. The Electronics Depot has approximately 240 testers and the average age of the testers is 24-15 years - some were purchased in the early 1960s. The design on approximately 120 of these testers is currently obsolete and they are extremely difficult to support. The depot is currently faced with the problem of maintaining several different configurations of ATE. Each workload, repaired on a unique test station, can no longer be produced when the tester is down for maintenance or calibration. Downtime prevents the production shop from meeting the required production for the F-15, F-16, B-52, C-130 & A-10 workloads supported by the ATE that is down. selected--The Versatile Depot Automatic Test Station (VDATS) is an organically designed, developed, and delivered solution to combat obsolescence, minimize sustainment issues, reduce proliferation of hardware, and provide flexibility of work loading. These common testers allow transportability of workloads, improving the ability to support core electronics workloads while providing the infrastructure to support future workloads. status--Contracts are being developed/awarded for hardware and software.			
WR	Construct Midsize Aircraft Hangar Phase I of II (Transformation MILCON)	$24,100,000.00	Data Masked	
Description	C-130 Depot Maintenance is worked here at WR-ALC. C-130 Workloads include the PDM program, The J Model Program, Center Wing Program, Clear Program, and the AMP program just to name a few. We have more work that requires inside hangar space than we have hangar space. To get the work out we are having to shuffle aircraft in and out of hangars multiple times which add flow days and additional work to every C-130 we produce. selected--Constructing a new 4 place C-130 Hangar will dramatically reduce the number of Aircraft moves required to get all the inside work accomplished improving our efficiency, reducing the costs, and returning the aircraft back to the mission ready line faster which effectively increases the size of the fleet. status--awaiting funds			
OO	A-10 Sanding Booth	$550,000.00	Data Masked	
Description	Bead blasting and hand sanding taking place in the same area, bottlenecks the process. Selected--Aircraft can move immediately out of the bead blast area and into the sanding booth making room for the next aircraft to enter the bead blast.			

OO	Lean Manufacture Cell Concept B505, 507, 510	$45,170,000.00	Data Masked	
Description	Lean Mfg Cell Implementation in Bldg 505, 507, 510, Projects 200601 and 200705 are the same project as 200503. Due to the way the project has been funded, HQ-AFMC has counted it as three projects. Therefore no cost data will be entered for projects 200601 and 200705 Also all Previous FY04 Surfaces Restoration Projects were included in this project as a revision to the original EA. selected-- Transform the landing gear existing production environment from a process oriented to a product oriented flow by using cellular design methodology. status--Completed April 2007			
OO	Streamlined Avionics Test Equipment	$16,317,000.00	Data Masked	
Description	6 obsolete avionic test station configurations that have exceeded their useful life. This project and OO-ALC 200903 are the same project but have been funded over two separate years. Selected--Purchase 4 new Rack mount Improved Avionics Intermediate Shop test stations.			
OO	Power Systems Component Repair Facility	$12,000,000.00	Data Masked	
Description	Current space and configuration in Bldg 238 is not sufficient. Selected--This project will provide a facility and advanced technology to increase quality; reduce work in progress (WIP), reduce flow days from 150 to 75 for engines and improve throughput.			
OO	Hydraulics Flight Control	Data Masked	Data Masked	
Description	Bldg needs expansion to house future workload. Selected--The Hydraulic Flight Controls Branch proposes transforming the repair and overhaul process by building a 20,000 square foot addition outfitted with state of the art repair equipment and reorganizing the entire facility layout and repair process.			
OO	Transforming Gun Range and Overhaul Process	$1,000,000.00	Data Masked	
Description	Currently guns have to be shipped to Eglin AFB to test fire. Selected--This project entails a building a new med caliber gun overhaul facility and 30mm gun test range.			
OO	Optical Recognition Riveter/De-riveter Transformation	$4,620,000.00	Data Masked	
Description	Currently the removal of fasteners is a labor intensive and time-consuming task. Damage can be done to the skin and spars resulting in additional repairs being required. Selected--The Optical Recognition Riveter/De-riveter will support increasing core workload and reduce the level of customer backorders by as much as 12 weeks.			
OO	C-130 PDM Dock Transformation	$2,080,000.00	Data Masked	
Description	Due to the size of the C-130 aircraft, most technicians must use some kind of work stand or scissor lift to elevate them high enough to perform the required work. Selected--Provides new work stands, designed specifically to support the PDM processes performed on the aircraft while in the dock.			

OO	Transforming ICBM Propellant Analysis Complex (MILCON Insert FY05)	$8,740,341.00	Data Masked	
Description	Construct a 24,000 square foot quality control propellant lab complex in the MAMS area. Should be completed Sep 2007			
OO	Horizontal Situation Indicator	$3,344,140.00	Data Masked	
Description	Horizontal Situation Indicator (HIS) has exceeded it 's useful life and the aging equipment has degraded to the point where replacement is essential to the testing workload. The existing test stations are over 35 years old. Selected--The HIS test equipment is automated, requires less setup time and is run from automated control panels for ease of operation.			
OO	Transforming Software Support Facility (Phase 1)	$21,505,948.00	Data Masked	
Description	Current facility is too small selected--This project provides a 144,000 square foot addition to our Software Support Facility.			
OO	Transforming Avionics Repair, Common Automatic Test Sets (CATS)	$15,000,000.00	Data Masked	
Description	The test stations are approaching the end of serviceable life due to obsolescence/parts non-availability. Selected--Project will eliminate all supportability and obsolescence issues associated with existing stands that often result in sporadic down time. status--Should be completed Dec 2009			
OO	Low Observable Coating Removal And Application Transformation	$9,200,000.00	Data Masked	
Description	Low observable coating removal and application transformation. Need to improve the coatings removal and application process for off airframe components. Current process of removing coatings from off-airframe components is very labor intensive and involves significant hazardous waste materials. selected--Two large booths will be installed that cure off airframe components at 120 degrees, reducing cure time by 50% or more. status--Should be completed March 2008			
OO	Air Turbine Stator Tester	$2,600,000.00	Data Masked	
Description	The test stands are currently being built at the OEM facility. Selected--New test stands incorporate computer controlled electrical motor loading and 2 permanent inertia wheels that do not need to be removed. Reduction in test and maintenance requirements will result in higher production and fewer MICAPS as well as reduced overtime.			
OO	World Class Aircraft Maintenance Operations	$16,613,000.00	Data Masked	
Description	World Class Aircraft Maintenance Operations need lean cellular configurations in the aircraft production facilities. Selected--Established 4 C-130 work cells, F-16 and C-130 material issue cents and upgraded F-16 fuel dock facilities. Status--Completed March 2007			

OO	Westinghouse 1650 Replacement	$1,845,000.00	Data Masked	
Description	Current test stands are antiquated and obsolete, they are no longer supportable due to parts availability. Selected--The new test stand will replace the old test stands responsible for testing electronic parts for numerous weapons systems.			
OO	Replace Cadmium Line	$1,500,000.00	Data Masked	
Description	This program will transform the landing gear existing production environment from a process oriented to a product oriented flow by using cellular design methodology.			
OO	Paint Booth Equipment (Down Draft)	$1,954,000.00	Data Masked	
Description	The current system utilized to accomplish the ICBM paint workload employs a cross-flow circulation system. The cross-flow circulation creates excessive amounts of overspray which flow back over the painted missile components and painters. Selected--Building a new paint booth and installing downdraft equipment that will apply the paint in a downward direction from an overhead flow circulation system.			
OO	Open Architecture State-of-the-Art Digital Test Station	$4,165,000.00	Data Masked	
Description	The Test Program Sets (TPS) require maintenance for anomalies and require extensive research to determine the maintenance necessary. Selected--Utilizing engineering owned assets eliminates the delay and difficulty of imposing on production time and assets to investigate, repair and deliver corrections to anomalies and incorporate new capability for new requirements. status--2 DATS testers have been procured along with numerous new investigative tools and systems that allow the Engineers better ability to troubleshoot the problems. Completed March 2007			
OO	F-16 Avionics Digital Test Station	$7,250,000.00	Data Masked	
Description	The ADTS tester and TPS's that are currently supporting this workload have become inoperable and non-repairable. A temporary work-around is being used to perform the workload using a similar test station in another area on the weekends. Selected--This project will purchase a new Digital Test Station with associated TPS with versatility and features that would enable the electronics shop to accomplish the workload efficiently and reliably.			
OO	Rapid Fabrication of Critical Components	Data Masked	Data Masked	
Description	This project will replace an old, non-functional 3 axis milling machine with a 5 axis machine. In addition to purchasing a 5 axis milling machine, this project will also allow us to manufacture complex parts which are beyond our current capability.			
OO	Ground Power Generator Wash, Blast and Paint Facility	$3,100,000.00	Data Masked	
Description	Due to the size and weight of the items that go through this shop, much time and effort is required to route the components through the repair process. Selected--This project will significantly reduce the manpower and process flow-time of the repair process, as well as reducing rework due to material handling damage.			

OO	High Velocity Oxygen Fuel Transformation	$16,606,007.00	Data Masked	
Description	Replace current chrome-plating operations to landing gear and hydraulic components with a tungsten-carbide-cobalt (WCCo) flame spray (HVOF). Goal is to eliminate process waste by eliminating/reducing time in applying/removing mask-ants, chrome plating, rinsing, heat treat, and finish grind. In addition, substantial hazardous waste expense reduction is anticipated. status--Should be completed December 2007			
OO	Ultra High Pressure Water Jet Coating Removal	$3,165,500.00	Data Masked	
Description	Current Methylene Chloride stripping methods require the wheels to be hung on a conveyor, soaked in MC for 30 minutes, run through a rinse, dried de-hung, blasted with plastic media blast, and re-hung for further processing. Selected--The process will be a robotically controlled system that generates high pressure water forced through a rotating nozzle with pressures up to 40K.			
OC	Bldg 3001 Revitalization, Phase I - MILCON	$19,060,000.00	Data Masked	
Description	The revitalization of Building 3001 focuses on modernizing the primary infrastructure of this aging building. Building 3001 has had no significant upgrades to its infrastructure since 1985, and those only affected the northern portion of the building. The Bldg 3001 Revitalization, Phase I - MILCON project will support the MRO Transformation Program by upgrading the building utility distribution systems and allowing the production shops to be relocated with a minimum of disruption. This crucial first phase of the Building 3001 Revitalization initiative, conjoined with future follow-on phases, will ensure Bldg. 3001 and the operations performed within, provide the AF with state-of- the-art, world-class MRO support. This project revitalized a 60+ year old facility to improve working conditions, and upgrade the infrastructure to support modern MRO requirements. This project has been completed. The intangible benefits are: Upgrade Main OG&E Substation Complete 15 KV “Pratt-Whitney” Electrical Loop Add/Replace Substations in Bldg 3001 Replace/Repair sixteen, 150HP Air Handling Units Central Plant System Improvements Chilled Water System Improvements Replaces Team Condensate Pumps See Tab A for More Intangible Benefits.			
OC	B-2 Avionics Test Set Upgrade	$6,500,000.00	Data Masked	
Description	This supports the B-2 Avionics repair which is a core capability. The proposed Test Program Sets provide an updated method of repair and test for the B-2 Avionics components, which enhances the ability to complete the repair faster and more accurately. For each TPS developed, the depot will have a stand-alone repair capability for that LRU/SRU. There is proprietary information that supports this analysis. Details of contractor costs and the actual units repaired, or their numbers, are not disclosed in this template. Workload will transition to organic depot maintenance over several years. Full Operational Capability for first repair article is in FY08. The number of repair generations is a critical factor in determining actual annual savings. Savings go up as repair generations increase. Savings decline if repair generations are below planned estimates. Repair generations are based on a historical four-year average from FY03-FY06, which is the most conservative estimate available. Once an item transitions to organic repair the contractor will no longer accomplish the repair. Therefore, actual contractor rates will not be available for a direct comparison of future year costs. PBD 716 levied a 5 percent reduction in Depot Maintenance customer accounts, beginning in FY07. Savings reported in this template have already been taken by the Air Force as part of PBD 716 and are not available for budget reduction.			
OC	Commodities Business Unit	$111,580,178.00	Data Masked	
Description	The Commodities Business Unit will require the implementation of lean production cells, in over 40 buildings including Building 3001- the largest covered industrial complex in DoD. This project includes all design, shop floor preparations (painting, lighting, steel structures, utilities, etc.), equipment refurbishment/replacement/relocation and employee training. The Commodities Business Unit dramatically decreases production flow time, movement of parts, work-in-progress, and inventory levels/costs and increases throughput to meet current and forecasted customer requirements. Implementation enhances the AF's ability to support the war-fighter in an environment that provides the most cost-effective and efficient core depot-level capability within existing facilities.			
OC	F100 Business Unit	$94,854,700.00	Data Masked	
Description	The F100 Business Unit transformation requires the implementation of 33 total lean cells, and spans more than 10 acres within Building 3001- the largest covered industrial complex in DoD. This project includes all design, shop floor preparations (painting, lighting, steel structures, utilities, etc.), equipment refurbishment/replacement/relocation and employee training. The F100 Business Unit transformation dramatically decreases production flow time, movement of parts, work-in-progress, and inventory levels/costs and increases throughput to meet current and forecasted customer requirements. Implementation enhances the AF's ability to support the war-fighter in an environment that provides the most cost-effective and efficient core depot-level capability within existing facilities. Very good savings info in excel file.			

OC	Tanker Business Unit	$95,685,908.00	Data Masked	
Description	The Tanker Business Unit will require the implementation of lean production cells, in over 6 primary hangars including Building 3001- the largest covered industrial complex in DoD. This project includes all design, shop floor preparations (painting, lighting, steel structures, utilities, etc.), equipment refurbishment/replacement/relocation and employee training. The Tanker Business Unit dramatically decreases production flow time, movement of Aircraft, Aircraft in work, and inventory levels/costs and increases in throughput to meet current and forecasted customer requirements. Implementation enhances the AF's ability to support the war-fighter in an environment that provides the most cost-effective and efficient core depot-level capability within existing facilities.			
OC	Consolidated Fuel Test, Repair and Overhaul Facility	$44,127,239.00	Data Masked	
Description	Status Quo: the Status Quo alternative calls for the continued use of existing facilities (Buildings 3108, 3001 and 3902) to perform the overhaul, repair and testing of fuel controls. Portions of Building 3108 are over 60 years old, are in deplorable condition and require major investment on a continuous basis to maintain in a safe and operable condition and to correct the most urgent and serious problems. Even with ongoing repairs there is a potential for utilities and structural failure due to the age and degraded condition of the facility. repair, but recognizes that this was, at best, a "band-aid" fix. The base replaced deteriorated World War II vintage asbestos tile with sheetrock. We were shown instances in which water leakage from the roof is already causing the sheet rock to deteriorate. Building 3108 is in the aircraft accident clear zone. Relocating the facility removes a threat to personnel and equipment by aircraft crash, as well as an impact object for an aircraft in an emergency situation. Building 3108 is in the aircraft accident clear zone. Relocating the facility removes a threat to personnel and equipment by aircraft crash, as well as an impact object for an aircraft in an emergency situation. selected--This alternative calls for the construction of a new 12,987 square meter (140,000 square foot) Consolidated Fuel Test Repair and Overhaul Facility. The new facility will be custom configured for the workload it houses, incorporating the most up to date industrial production methods. Additionally, the new facility will be located adjacent to Building 3902, thereby eliminating the need to transport commodity items over long distances and reducing response time for overhaul mechanic assistance when trouble shooting during testing. The new facility will provide the optimum environment for the implementation of lean cellular manufacturing practices, which will lead to a step change improvement and will produce substantial savings in direct labor, direct materials and overhead.			
OC	3-Bay Multi-Aircraft Hangar	$49,000,000.00	Data Masked	
Description	The existing Maintenance, Repair and Overhaul (MRO) facility was designed and built in the 1940s as a C-47 aircraft manufacturing plant. Over the past 60 years, distinctively different maintenance workloads (commodities, engines, large aircraft, etc.) were shoe-horned into available space using a functionally aligned, batch/queue, process oriented factory concept. Therefore, the existing MRO facility is too small and the layout and workflow processes are inefficient, antiquated and behind industry standards and customer expectations. selected--The 3 Bay Multi-Aircraft Hangar (3-BMAH) is the first of the three projects to transform the C/KC-135 Maintenance, Repair and Overhaul (MRO) into the world's most cost effective C/KC-135 Business Unit. Building the 3-BMAH generates interim production space to continue uninterrupted production during the One-Dock One-Door transformation of the B3001 docks. One-Door, One Dock dramatically transforms aircraft MRO, decreasing production flow time, movement of parts, work-in-progress, inventory levels/costs and increasing throughput, quality, and timeliness to meet current and forecasted customer requirements. Implementation enhances the AF's ability to support the war-fighter in an environment that provides the most cost-effective and efficient core depot-level capability within existing facilities. The completion of the 3-Bay Multi-Aircraft Hangar will result in documented benefits to WCF. The cost savings stem directly from eliminating approximately 20 moves for 1/3 of the aircraft undergoing PDM at Tinker. There is lost labor productivity from downtime as maintenance stops on the production line while aircraft in different stages of maintenance are moved. Labor costs consist of both moving crews and the cost of idled maintenance crews during aircraft movements. The new facility also provides a platform to base lean implementation upon. The original certified Economic Analysis (EA), submitted under the Military Construction (MILCON) program, included cost efficiencies stemming from lean implementation. These efficiencies are now included in the Business Case Analysis for the Tanker Business Unit and are duplicative. The original 3-BMAH economic analysis cannot be accumulated with the Tanker BCAs for a total savings from transformation. Therefore, the initial report includes only efficiencies from the elimination of excessive aircraft movement. PBD 716 levied a 5 percent reduction in Depot Maintenance customer accounts, beginning in FY07. Savings reported in this template have already been taken by the Air Force as part of PBD 716 and are not available for budget reduction.			

Appendix B: Intangible Benefits Identified for DMT Projects Studied

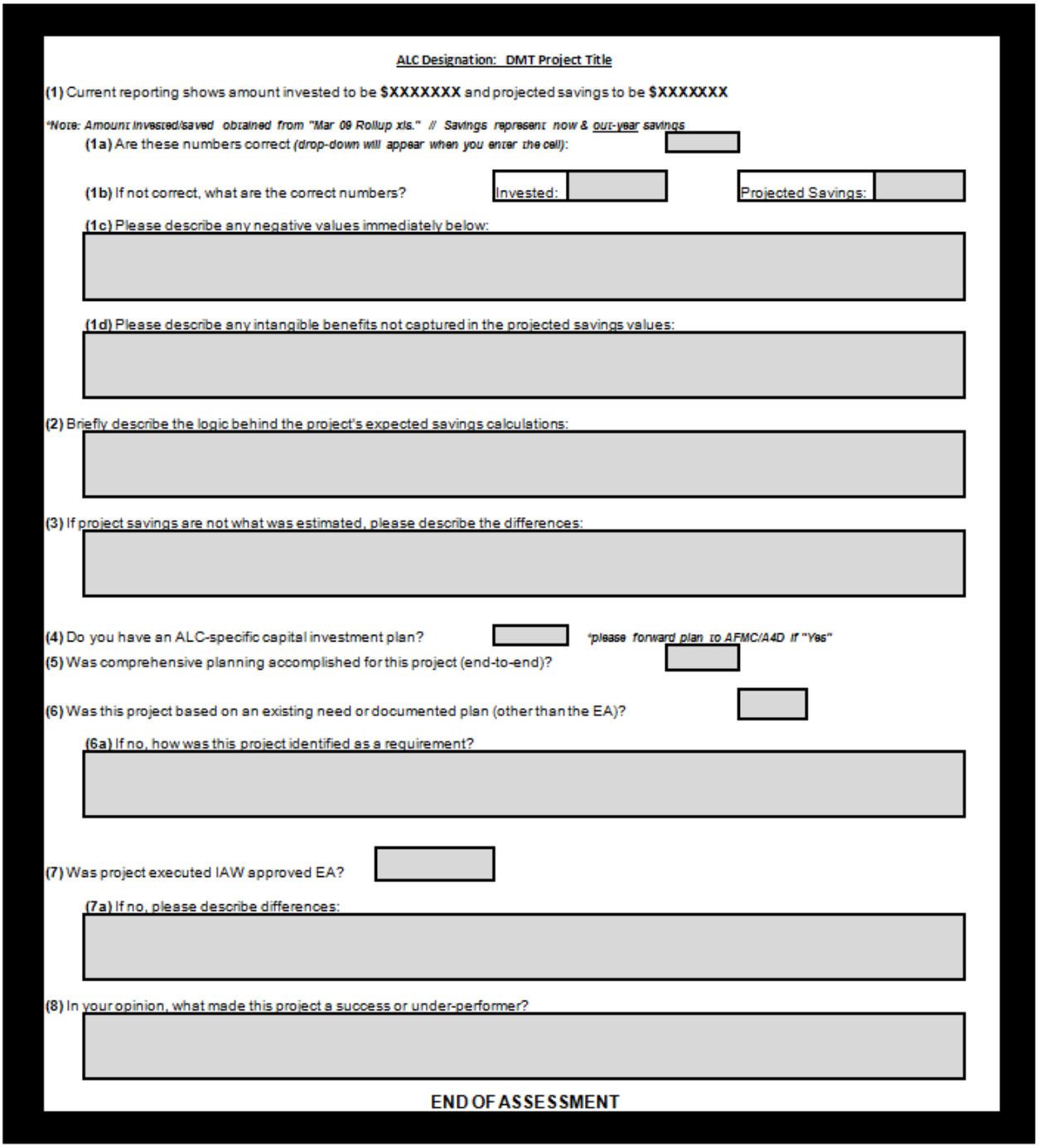
ALC	Project Name	Benefit Type	Benefit Category	Benefit Impact	DMT Goal	Benefit Description
WR	Ramp - Transforming the Functional Test Process	Enduring	Production	Improved safety	N/A	Safety - The gain in ramp space and the major reduction in scheduling conflicts in functional repair add to the availability of AC parking locations for PDM work. The more open area around each AC's parking location allows for the safe, on-site storage of gov't maintenance equipment and components that have been repaired and are being returned from back-shop repair operations
		Enduring	Production	Environmental	N/A	Environmentally Proactive - The add'l space increase separation between the AC so that any type of spills may be more easily contained and the spill cleaned up more easily and quickly. Quality - By meeting quality req'ts (Size, Fit, and customer operational req'ts) the AC can be produced according to schedule, without delays
		Measurable	Production	Improved performance / worker productivity	N/A	The add'l capability keeps the AC schedules on track, efficiently moving AC through PDM operations, eliminating schedule delays which translate into capability to overhaul more AC within the same time period
WR	Transform Metal Bond Process	Measurable	Strategic	Improved performance / worker productivity	WIP	The Process flow layout allows for 1 part flow, flexible workforce, reduced WIP
		Measurable	Strategic	Strategic Advantage	TAT	The optimize process flow allows the support equipment to be placed next to the Point of Use, improving maintenance, reducing flow days, and overtime
		Perishable	Organizational	Improved morale/job satisfaction	N/A	Organizational Moral - Reduce stress associated with delays, excessive overtime, and uncertainty of schedule compliance.
WR	Sheetmetal and Heat Treat Transformation	Measurable	Strategic	Improved performance / worker productivity	WIP	Productivity - Decrease part routing and queue times which increases the productivity of the production shops
		Perishable	Organizational	Improved morale/job satisfaction	N/A	Ease of Operation - Provide more efficient process changes
		Enduring	Production	Improved quality	N/A	Standard Compliance - Increase the level of effectiveness to satisfy all requirements dictated in Industry and Air Force Standards.
WR	Scanning Electron Microscope (**Confirmed Negative Savings**)	Enduring	Strategic	Customer responsive	Legacy	The intangible benefits are that the organization now has an all digital piece of equipment that they are able to use on the network. The new equipment is supportable, reliable, and accomplishes the mission without delays

WR	Transforming Cargo Aircraft Maintenance (**Confirmed Negative Savings**)	Measurable	Strategic	Strategic Advantage	TAT	Reduction in number of flow-days for aircraft.
		Perishable	Organizational	Organizational climate	N/A	Training - Consolidated workforce allows for group and one on training in one facility which improves training and efficiency, efficiency increases due to more space and higher morale
		Measurable	Production	Improved performance / worker productivity	N/A	Floor Space - Improved flexibility and productivity due to more efficient layout
		Enduring	Production	Improved safety	N/A	Working inside and out of the weather causes fewer complaints, accidents, and quality issues.
WR	Transforming Avionics Repair Phase III (**Confirmed Negative Savings**)	Enduring	Production	Improved performance / worker productivity	N/A	The new testers are more versatile and can handle various workload shifts while other testers are being repaired
		Enduring	Production	Improved performance / worker productivity	N/A	New testers are more reliable
		Enduring	Strategic	Not otherwise specified	COTS	New testers are based on COTS and are easier to repair and maintain
		Perishable	Organizational	Not otherwise specified	N/A	The new testers are more standardized and easier to train people on
		Enduring	Production	Improved performance / worker productivity	N/A	Floor Space - replacing old testers will free up floor space for other workload.
WR	Advanced Metal Finishing Facility Phase I & II (**Confirmed Negative Savings**)	Enduring	Production	Environmental	N/A	Bio-Environmental - Less exposure to hazardous chemicals. Environmental - Reduced pollution and compliance with environmental standards
		Measurable	Strategic	Improved quality	QA	Quality - Reduced defect rate due to higher quality facilities
		Measurable	Production	Improved performance / worker productivity	N/A	More efficient facility layout which increases production
		Perishable	Organizational	Organizational climate	N/A	Manageability - Consolidated personnel into one area.
WR	MAI Automatic Test Equipment & Software Upgrade	Enduring	Production	Improved performance / worker productivity	N/A	Floor Space- using less space for the current workload will help the shop prepare for new workloads in the future
WR	Transforming Airborne Electronics - ARC 164/190/186 (**Confirmed Negative Savings**)	Measurable	Strategic	Customer responsive	WIP	test the circuit card assemblies individually and automatically, which will reduce repair time.
		Enduring	Production	Improved performance / worker productivity	N/A	Process Improvement- the newer tester has increased the depot's testing and repair capacity

WR	Airborne Electronics - MATE 390 Test Station (**Confirmed Negative Savings**)	Measurable	Production	Improved performance / worker productivity	N/A	Production- Re-hosting the TPSs to the newer IFTE Test Station has increased the station time available for production by decreasing downtime. The station downtime for the newer tester would probably be 10% as opposed to 50% for the MATE 390
		Measurable	Strategic	Improved performance / worker productivity	Legacy	The re-host of the TPSs to the APST and HP 3070 Test Stations has reduced the required maintenance currently experienced with the MATE 390. The newer, more modern test stations have more reliable instruments, which require less maintenance. Also, the replacement parts, required to maintain the newer test stations, is available.
WR	Modern Paint Facility & IOE	Measurable	Production	Improved performance / worker productivity	N/A	Mission Impact- The additional facility allows the schedulers more flexibility in scheduling aircraft and eliminates the bottleneck situation that occurs within the status quo.
		Enduring	Production	Environmental	N/A	Environmental Impact- The new building will contain state-of-the-art equipment that will satisfy the limited quantity of chemicals and hazardous materials introduced to the environment
		Perishable	Organizational	Improved morale/job satisfaction	N/A	Morale- This will increase personnel's ability to have more room and area to work harder, faster and produce a better product.
OO	Transforming Gun Range & Overhaul Process	Measurable	Production	Improved performance / worker productivity	N/A	Under the current facilities set up, personnel must haul the guns to the gun range located on the opposite side of the flight-line, approximately four miles from the overhaul facility.
		Measurable	Strategic	Strategic Advantage	TAT	Streamlining the process and reducing component flow days directly supports the mission
		Enduring	Strategic	Brand image/advantage & Reputation	N/A	customer confidence
		Enduring	Organizational	Organizational climate	N/A	Also the new gun repair shop will free up congestion in bldg 509 where the process currently resides.

OO	Transforming Software Support Facility	Enduring	Production	Improved safety	N/A	Provides additional security because the addition to the existing building is inside a secured area located on an Air Force Base
		Enduring	Organizational	Culture	N/A	Allows for better synergy between the various flights within the Software Group by enhancing productivity, shortening lines of communication and developing a team atmosphere
		Enduring	Organizational	Improved morale/job satisfaction	N/A	Retention of hard to acquire software engineers due to increased morale by providing a state of the art facility
OO	Air Turbine Starter Tester (**Confirmed Negative Savings**)	Measurable	Strategic	Customer responsive	WIP	Repair times will be greatly reduced from an older tester to that of a new tester
		Enduring	Strategic	Improved quality	QA	Modern technology is utilized in this tester to produce the workload with few defects and in a timely manner.
OO	World Class Aircraft Maintenance Operations	Enduring	Organizational	Culture	N/A	Due to integrating the organization into a single area and consolidating similar skills, equipment and missions into a cohesive workload
		Measurable	Strategic	Strategic Advantage	TAT	This project streamlines current work processes reducing time aircraft spend in the depot maintenance cycle and increasing the availability of the aircraft
OO	F-16 Avionics Digital Test Station	Measurable	Production	Improved performance / worker productivity	N/A	Extended periods of downtime will be eliminated with the purchase of the new tester
		Enduring	Strategic	Improved quality	QA	Test reliability will increase with new test equipment and the quality of repaired assets should increase.
OO	High Velocity Oxygen Fuel Transformation	Measurable	Strategic	Improved performance / worker productivity	TAT	By installing the HVOF equipment, backlogs for the remaining chrome plated parts will be reduced allowing faster turn around times for the remaining parts. This will result in additional inventory reductions for these remaining parts
		Measurable	Strategic	Improved quality	QA	Increased asset life for reduction of hydrogen embrittlement imparted to the asset in the chrome plating process. Rework will be reduced by 5% for HVOF coated parts.
OC	Tanker Business Unit	Measurable	Strategic	Strategic Advantage	TAT	The original goal of the project was to reduce flow days from 200 to 100 days. The contracted transformation planning project was unfunded; the KC-135 group is pursuing flow day reductions through organic efforts.
OC	Bldg 3001 Revitalization (MILCON)	Enduring	Organizational	Organizational climate	N/A	Upgraded electrical/chilled water & steam infrastructure.

Appendix C: Assessment Tool Format



ALC Designation: DMT Project Title

(1) Current reporting shows amount invested to be **$XXXXXXX** and projected savings to be **$XXXXXXX**

**Note: Amount invested/saved obtained from "Mar 09 Rollup xls." // Savings represent now & out-year savings*

(1a) Are these numbers correct *(drop-down will appear when you enter the cell)*:

(1b) If not correct, what are the correct numbers? Invested: Projected Savings:

(1c) Please describe any negative values immediately below:

(1d) Please describe any intangible benefits not captured in the projected savings values:

(2) Briefly describe the logic behind the project's expected savings calculations:

(3) If project savings are not what was estimated, please describe the differences:

(4) Do you have an ALC-specific capital investment plan? **please forward plan to AFMC/A4D if "Yes"*

(5) Was comprehensive planning accomplished for this project (end-to-end)?

(6) Was this project based on an existing need or documented plan (other than the EA)?

(6a) If no, how was this project identified as a requirement?

(7) Was project executed IAW approved EA?

(7a) If no, please describe differences:

(8) In your opinion, what made this project a success or under-performer?

END OF ASSESSMENT

Appendix D: Blue Dart

How is Depot Maintenance Transformation (DMT) performance measured? To answer that question, this project looks beyond the traditional views of return on investment. Beginning in 2003, $900 million was infused into the three Air Logistics Centers (ALC) over a six year period in order to modernize technologies, facilities, and processes. Sixty-six capital investment projects were initiated under DMT; 35 at Warner Robins, 24 at Ogden, and 7 at Oklahoma City. The chosen metric used to gauge project success was the savings to investment ratio (SIR) which measures the amount of savings returned from an investment. In theory, a project should generate more savings than it costs to implement. Mathematically, a SIR greater than one is considered cost beneficial but a SIR less than one costs more than the project is expected to save. The overall SIR for the 66 DMT projects is 1.78, yet ALC-specific SIRs for Warner Robins ALC, Ogden ALC, and Oklahoma City ALC are 0.80, 1.97, and 2.30 respectively. Warner Robins projects underperformed in comparison to the other two ALCs in the purely financial sense, but the SIRs don't solely define individual project success or failure for two primary reasons. First, many of the DMT projects never intended to realize savings. In fact, over half of the 66 projects were initiated based on their strategic alignment with DMT program goals despite having SIRs less than 1 resulting from high investment costs compared to expected savings. Second, the ALCs are reporting investment costs and savings values differently. Some projects only report actual costs and/or savings realized (year-to-date) where as others report projected savings into the year 2035. One project even reported actual investment costs that differed from the projected costs by $72M but never updated the associated expected savings which turned an original project SIR of 4

into an erroneously inflated SIR of over 17. This miss-matched dynamic of actual vs. projected savings and investment costs is calculated into individual project SIRs, ALC-specific SIRs, and the overall DMT SIR resulting in a loss of metric fidelity.

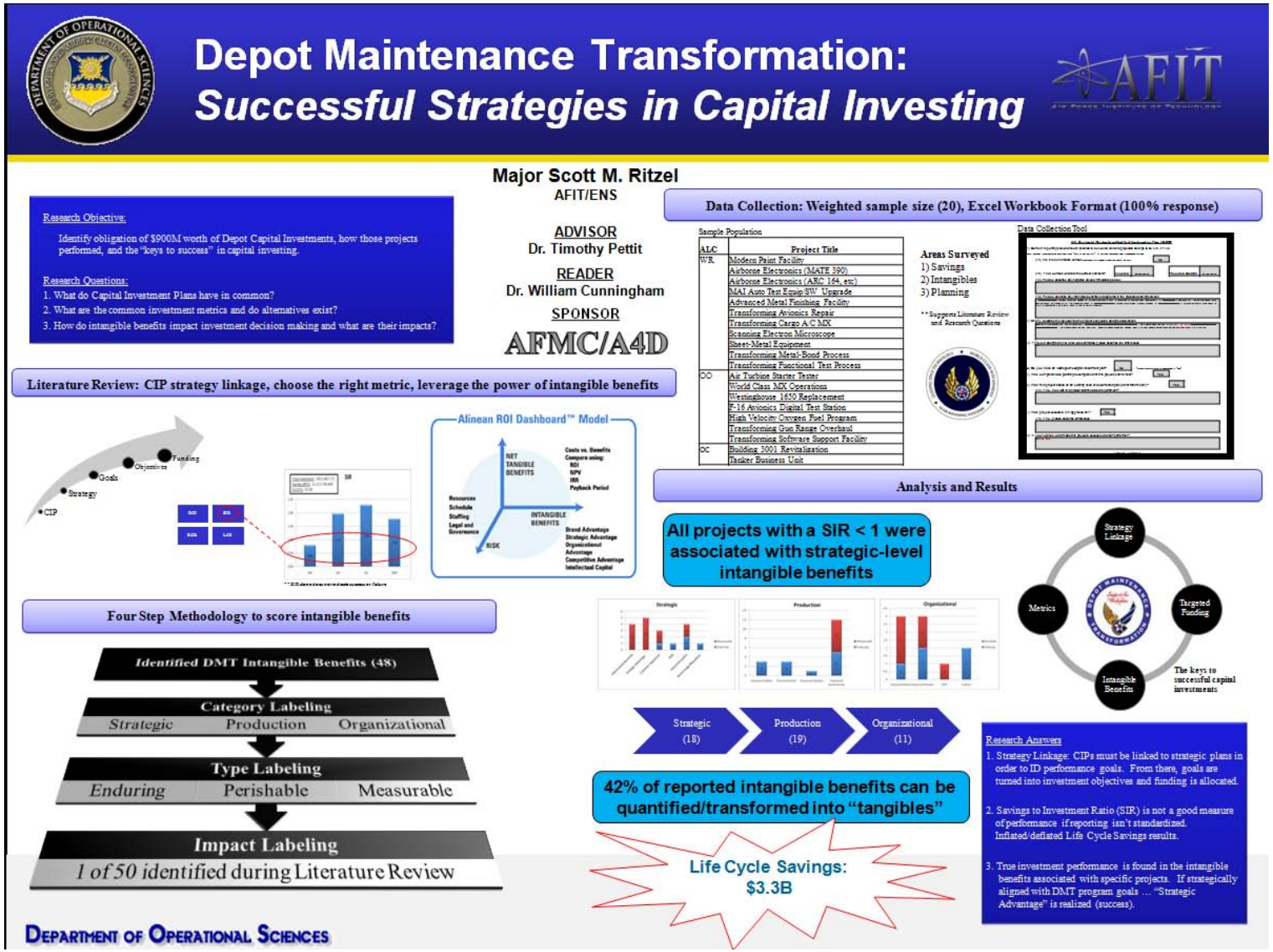
Therefore, the first and most immediate step is to standardize ALC reporting requirements to ensure the centers are reporting either actual or projected values. The second step is to consider an alternative metric to the SIR. The Benefit/Cost ratio (BCR) is a metric used primarily in the public sector when costs outweigh expected savings yet the overall benefits to society offset investment costs. Over half of the DMT projects have investment costs that outweigh expected savings and could possibly benefit from the application of the BCR metric. Using BCR as an alternative metric requires an in-depth understanding of the non-quantitative benefits associated with individual projects such as enhanced safety, process efficiencies, and environmental friendly operations.

If performance can't be gauged by a SIR alone, how is DMT performance measured? The answer lies within the intangible benefits of the DMT projects. Some of the intangible benefits reported by projects were simply "improved morale" or "task is easier," but some projects reported hard-hitting intangible benefits that meet specific DMT program goals such as reductions in flow-days or quality defects. In the commercial sector, "Strategic Advantage" is an intangible benefit that is achieved by working towards or meeting overall corporate goals. To apply this idea to DMT, any project that meets a DMT program goal is said to return the intangible benefit of "Strategic Advantage" and therefore identified as a successfully performing project (regardless of the SIR). The idea of "Strategic Advantage" (as an intangible benefit) has already been applied to 20 of the 66 projects. Of the 20 that had SIRs less than 1, all met

specific DMT program goals and were labeled as yielding the intangible benefit of "Strategic Advantage" and subsequently identified as successful projects.

Given the unique financial profiles of the DMT projects (costs that outweigh expected savings), DMT performance is measured primarily by the intangible benefits of individual projects. "Strategic Advantage", as a result of strategic alignment with DMT program goals is a key indicator of overall project success. All of the DMT projects in this study (25% of total projects) were identified as successful but until the intangible benefits of the remaining projects are studied, the overall DMT program performance remains unknown.

Appendix E: Quad Chart



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Vita

Major Scott M. Ritzel enlisted in the United States Air Force on 10 July 1990. He began his Air Force career as an aircraft structural repair technician supporting MC-130, MH-53, HH-60, and UH-1 airframes. Upon completion of his Bachelor's Degree in Professional Aeronautics, through Embry Riddle Aeronautical University, Major Ritzel was accepted to the Air Force Officer Training School at Maxwell AFB, Alabama. He later earned a Masters degree in Business Administration from Webster University.

As a career Maintenance Officer, Major Ritzel has supported many different weapon systems while deployed and at home station. His maintenance expertise includes cargo and fighter aircraft, ground-based missile warning and deep-space tracking radar systems, as well as conventional, precision and nuclear munitions. He has been a Flight Commander six times and has also served as a Weapons Safety Officer, Nuclear Surety Manager, Wing Chief of Maintenance and most recently, Squadron Commander of the 651st Munitions Squadron, Lackland AFB, TX. Upon graduation, he will be assigned to Air Force Headquarters, Strategic Plans and Programs Directorate at the Pentagon.

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14. ABSTRACT
In 2000, it was determined that the three Air Logistics Centers were underfunded compared to commercial industry. Specifically, the depots were not funded enough to allow reinvestment into capital assets. This determination was based on the fact that commercial industry reinvests 6% of its profits into capital programs while the Air Force depots reinvest only 3%. To keep the three Air Logistics Centers competitive, Congress injected $900M into the depots over a six year period, beginning in 2003. This Depot Maintenance Transformation (DMT) strategy was implemented so that the depots would increase profits over each of the six years to a point that would allow them to reinvest a sustained 6% (organically) at the end of year 6 in order to stay on par with the private sector. As the DMT program nears completion, the urgency to identify the aggregate benefits of the DMT program is increasing. However, this is not an easy task because many of the projects have intangible benefits that are hard to capture by quantifiable means. Additionally, of the tangible benefits associated with the DMT projects, 21% are reported to have negative projected savings in the out-years beyond initial investment. This makes the task of identifying the aggregate benefits that much more difficult to do. So, six years later, the question still remains: *how well is the $900M DMT program performing* ... but more strategically, *what are the important considerations when making capital investment decisions?* This Graduate Research Project addresses this important question.

15. SUBJECT TERMS
Depot Maintenance Transformation, Capital Investment Plans, Capital Investment Performance, Metrics, Intangible Benefits, Return on Investment, Savings to Investment Ratio, Benefit/Cost Analysis

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