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A COMPARATIVE STUDY OF THE WARRIOR SUPPORT TOOL AND THE AGILE MUNITIONS SUPPORT TOOL

THESIS

John C. Lofton III, Captain, USAF

AFIT/GLM/ENS/03-07

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AFIT/GLM/ENS/03-07

A COMPARATIVE STUDY OF THE WARRIOR SUPPORT TOOL AND THE AGILE MUNITIONS SUPPORT TOOL

THESIS

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

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Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

John C. Lofton III, BS

Captain, USAF

March 2003

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John C. Lofton III

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ABSTRACT

... The purpose of this research is to ascertain if the United States Air Force (USAF) is duplicating effort with the development of the two IT applications, the Warrior Support Tool (WST) and the Agile Munitions Support Tool (AMST), or if one will effectively meet requirements. Specifically, this thesis sought to answer four research questions addressing customer needs for a munitions IT application, identifying the capabilities of the two research IT applications, determining how well each application met the needs of the customer, and determining how supportable each application was in terms of information needs versus existing munitions systems. A mixed qualitative and quantitative paradigm was used to conduct a gap analysis and verification occurred through the use of surveys. Sixty-five munitions users participated in a surveying session to identify differences between the two systems as well as the relative merits of each. Overall, munitions users chose WST as the more favorable application. All but two construct measures supported the overall rating of the application. Munitions personnel liked the screen layout of AMST better than that of WST even though WST seemed to be the application that better used terminology familiar to munitions personnel. WST was also the easier of the two applications to manipulate although the AMST help features were identified as the better of the two. The Warrior Support Tool provided information in a timelier manner than did the Agile Munitions Support Tool.

A COMPARATIVE STUDY OF THE WARRIOR SUPPORT TOOL AND THE AGILE MUNITIONS SUPPORT TOOL

I. Introduction

Overview

The way the United States military plans to fight and support the war fighter has changed in recent years. The logistics community was tasked to provide Focused Logistics. Department of Defense (DoD) Joint Vision (JV) 2020 states that

> Focused Logistics is the ability to provide the joint force the right personnel, equipment, and supplies in the right place, at the right time, and in the right quantity, across the full range of military operations. This will be made possible through a real-time, web-based information system… (DoD JV 2020, 2000)

However, very little has changed in the way we gather information to improve that support. The 1990s began a surge in the growth of information technology. Many creative ways of collecting and managing information were established to provide useful data to decision makers to improve the decision making process. Currently, a lot of munitions data is collected and documented, but it is scattered through many disparate databases and is often untimely. A great deal of time and effort is spent manually retrieving, compiling, and analyzing data to provide meaningful information. There

exists a need for an Information Technology (IT) application that can automatically pull munitions data from ammunition information systems and combine that data to paint a complete picture for the user. Such a technology would provide commanders and munitions users the tools and information necessary to make the timely and proactive decisions necessary to keep our United States military poised to respond to world crises. The purpose of this research is to investigate the ability of two information technology systems to meet this need.

Background

In order to make accurate munitions decisions, one must understand the status of the munitions inventory, what weapons are being produced, what weapons are planned for production, how expenditures rates may impact planning, and how future weapons could replace current assets by providing increased capability. This information can only be properly analyzed through the use of a decision support tool. Decision support tools come in many forms and are distinguished by the level of interaction with the user. The *Logistics Control and Information Document* states that low-interaction support tools require a lot of inputs and manipulations of mathematical equations from the developer to enable the tool to perform complex processes in minimum time. High-interaction tools rely on the user to provide processing information (Paperless Acquisition Initiative, 1997). An application that displays all information relevant in a decision process allows the user to determine what is important or not. Two applications, the Warrior Support Tool (WST) and the Agile Munitions Support Tool (AMST) have, for the first time,

proposed to provide munitions planners the ability to view and understand these interrelationships within an integrated application.

Rob Roy, president of Decision Sciences Incorporated (DSI), states in Warrior Support Tool literature that "WST currently supports the mission of the Air Armament Center (AAC) by providing enterprise level visibility of critical munitions within a web-based environment" (Rob Roy, July 11, 2002). AAC, the Air Force's test and development center for munitions assets, is located on Eglin Air Force Base (AFB), in Ft. Walton Beach, Florida. A DSI storyboard presentation states "WST provides display of inventory availability, munitions status, on-going and planned acquisition, and allows for predictive analysis of future inventory based on current planning and industrial base considerations" (Rob Roy, July 11, 2002).

Similarly, literature from Synergy Incorporated states that "AMST is a web-enabled application with an Oracle database that facilitates access to Combat Ammunition System (CAS) Ammunition Control Point/Air Logistics Center (CAS-A) data and allows different echelons of munitions management to query, extract, and analyze asset balance data" (Synergy Inc., 2002). AMST is currently in use at Hill AFB, the Air Force (AF) depot for air-to-ground munitions. The Synergy user guide states, "AMST will interface with Army Depot Systems, the Global Transportation Network (GTN), and other systems necessary to provide maximum visibility of all Air Force munitions assets and in-transits" (Synergy Inc., 2002).

Near real-time information updates from official sources such as CAS are integrated by both applications to provide munitions planners the ability to make timely decisions on how to manage munitions assets. Rob Roy states, "The WST application is

comprised of the integration of system software, system hardware, and personal computer displays to provide a tool for munitions tracking, predictions, identification of platform compatibility, and responsive capabilities of accelerated production for acquisition planning" (July 11, 2002). The AMST User Guide states:

> The AMST application is hosted on a dedicated Dell Power Edge 440 Server running the Windows NT (Service Pack 5) operating system. The Oracle 8i database is hosted on a dedicated Sun Enterprise 450 Server and runs under the Sun Server (Version 8) operating system and operates in the System High Mode at the UNCLASSIFIED-SENSITIVE level and employs Class C2, Controlled Access Protection, and Trusted Computing Base security protection *features* and *functionality* configured in accordance with Department of Defense 5200.28-STD, AFMAN 33-229, and AFSSI 5024, volume 1. (2002)

WST and AMST both appear to have the capability to provide the information needed to support munitions operations. This study will investigate the applications in detail to determine how well they meet munitions needs.

Problem Statement

All of the pertinent information for good weapon planning is available in the munitions legacy systems; however, the information is viewed in a piecemeal and disjointed fashion. Munitions planners and users need a source for real-time munitions information that can provide an accurate picture of munitions capabilities. The information needs to be integrated and presented in the proper format for decision-making.

Research Question

This investigation seeks to address the problem by answering two related research questions. First, how well do WST and AMST meet the decision support needs of the retail munitions community? Also, what limitations or shortcomings are present in the two models?

Investigative Questions

Decision makers need to know the strengths and weaknesses of the Warrior Support Tool versus the Agile Munitions Support Tool. The purpose of this research is to ascertain if the USAF is duplicating effort with the development of the two IT applications and if so, if one will effectively meet requirements. Additionally, the issues involved in producing the needed information need to be identified. In an attempt to address these requirements, this research focuses on four primary questions:

1. What are the customer needs?
2. What does each, WST and AMST, provide?
3. How well does each application meet the needs?
4. How supportable is each application in terms of information needs versus existing systems?

Limitations

The IT applications that are compared in this study are new to the munitions community. As such, not a lot of literature exists about the applications. As mentioned earlier, both applications are web-based, which complicates the process of obtaining an accurate count of actual users of the system. Additionally, WST is only in use on the Secure Internet Protocol Router Network at AAC, Eglin AFB (Greg Jenkins, May, 2002), which complicates the situation more. The users manual for WST is still in production while the users guide for AMST is only a year old. Subject matter experts must be used almost exclusively to facilitate an accurate understanding of the developmental and operational aspects of both systems. Even though this is the best time to conduct a test, this aspect of the study presents the opportunity for system developer and potential user bias toward the application that may be available and in use in their area.

An unbiased scenario for the operational testing of both applications must be created as well as an adequate understanding of the operational aspects of the applications. Resistance to change and a learning curve is inevitable when new processes, ideas, or applications are introduce in an organization. To overcome these aspects of change, this thesis effort focuses on the ease of using the applications, the actual performance of the applications, and if the applications meet the needs of the user.

Scope

To answer the research questions, the research design will follow a mixed qualitative and quantitative paradigm to conduct a gap analysis. Archival data and survey

information will be gathered from briefings, documents, and interviews with developmental contractors for WST and AMST, AFRL, and munitions personnel to determine the capabilities of each system. Survey information will be used to identify the level of difficulty involved in manipulating the applications, the performance of the application and the extent to which the application meets user needs. Using the gathered information, the gap analysis aims to identify differences between the two systems as well as the relative merits of each.

Summary

This chapter has presented the overall context this research. There is a need for an IT application that can pull munitions data from existing ammunition information systems and combine it to provide a complete picture of munitions status and capabilities for the user. This research will investigate the potential abilities of two proposed information systems (WST and AMST) to satisfy these IT needs.

The remaining chapters of this thesis will present a literature review, the study methodology, findings and analysis, and a conclusion with recommendations. The literature review builds a background as to the importance and need for a munitions IT application. Chapter three, the methodology chapter, describes how the research data was collected and analyzed through archival sources and survey data. Chapter four presents findings and the analysis. Chapter five examines the results and presents recommendations for further study.

II. Literature Review

Expeditionary Aerospace Force and the Air Force Core Competencies

Joint Vision 2020 outlined a new role for the logistics community. "The overarching focus of this vision is full spectrum dominance – achieved through the interdependent application of dominant maneuver, precision engagement, focused logistics, and full dimensional protection" (DoD JV 2020, 2000). An aspect that assists in achieving such dominance is superior information. Information superiority is defined as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to so the same" (DoD JV 2020, 2000). Accurate and timely logistics information plays such a key role in obtaining information superiority that it is one of the key tenets of Focused Logistics. Focused Logistics "will be made possible through a real-time, web-based information system providing total asset visibility as part of a common relevant operational picture effectively linking the operator and logistician across services and support agencies" (DoD JV 2020, 2000).

The USAF implemented the Joint Chiefs' vision for the future and developed the concept of Global Engagement, which required the Air Force to organize under the Expeditionary Aerospace Force (EAF) concept. The EAF concept was a fundamental change for the Air Force that is grounded in responsiveness, flexibility, and combat effectiveness. It motivated an organizational culture shift towards an expeditionary warrior mindset and provided a new vision for how the Air Force organized, trained,

equipped, and sustained aerospace forces to meet the requirements of national military strategy and the challenges of the changing global security environment (Brian Peters Presentation, 1999). In order to achieve the goals of the EAF concept, the U.S. Air Force organized into Aerospace Expeditionary Forces or AEFs. These AEFs are airpower packages tailored to quickly deploy and meet the tasking of the national command authorities and the regional commander in chief. Each AEF has equivalent capabilities made up of fighter squadrons, bomber squadrons, theater lift, tanker forces, and appropriate combat support units. The packages bring all the necessary capabilities that are critical for combat success to the table including "the ability to achieve air superiority; suppression of enemy air defenses; air-to-ground bombing and precision munitions; mobility; combat support; and tactical level leadership" (HQ USAF website). However, the packages are made up of units from across the Air Force, which makes it essential to have comprehensible and timely information to support mission requirements. This research endeavor focuses on the availability of timely and dependable munitions information.

The previously mentioned capabilities are met through the Air Force's core competencies. "Core competencies are at the heart of the Air Force's strategic perspective and thereby at the heart of the Service's contribution to our nation's total military capabilities" (AFDD 1, 1997). The Air Force's core competencies are Air and Space Superiority, Precision Engagement, Information Superiority, Global Attack, Rapid Global Mobility, and Agile Combat Support. Each of these is dependent on timely and accurate munitions information. In addition to the core competencies, Air Force Doctrine Document 2-4 identifies five core combat support principles: responsiveness,

survivability, sustainability, time-definite re-supply, and information integration (1999). The availability of timely munitions information is vital in providing the flexibility to: support responsiveness for munitions needs; meet the requirements for time-definite re-supply of munitions to aircraft and areas of conflict; sustain deployed forces when needed; and to play a part in integrating information to improve command and control (C2).

Command and Control

The Department of Defense Dictionary of Military and Associated Terms defines command and control as:

> The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission. (JP1-02, 2000)

The Joint Chiefs state that there are two main parts in implementing proper command and control: "command structures and processes, and the information systems and technologies that are best suited to support them" (DoD JV 2020, 2000).

Air Force doctrine identifies two tenets of C2. The first, unity of command, is an essential aspect, which requires all parties to understand the chain of command and adhere to it. "Vertical information flow is fundamental to centralized control" (AFDD 2-8, 2001). This flow of information provides commanders with the information they need to make good decisions. "Horizontal information flow is essential for common

situational awareness" and enhances operator initiative and reduces uncertainty between peer levels (AFDD 2-8, 2001). Centralized control and decentralized execution reinforces the tenet of unity of command.

The second tenet is informed decision making. "Command and control should support an informed and timely decision-making process at all levels of command" (AFDD 2-8, 2001). Improving the timeliness and accuracy of munitions information directly supports this tenet. When the Joint Chiefs published JV 2020, they continued explaining that the tenet includes "planning, directing, coordinating, and controlling forces and operations, and is focused on the effective execution of the operational plan," but emphasized, "the central function is decision making" (DoD JV 2020, 2000). Command and control activities can benefit from improvements in information centralization and accessibility. By making information readily available, decision makers can come to informed decisions in a more time efficient manner.

Decision Support Systems

A Decision Support System (DSS) is used to aid decision makers in their efforts to acquire, organize, process, present, and use information for making decisions. Characteristics of a good DSS focuses on "increased individual and organizational effectiveness rather than on increased efficiency in processing masses of data" (Alter, 1980). Vlatko Ceric (Ceric, 1997) and Sprague (Sprague, 1989) combined the work of Alter (Alter, 1980) and Keen (Keen, 1981) with their own work to outline six necessary qualifications for good DSSs. Ceric summarized DSS characteristics as being able to:

1. Assist the users in semi-structured decision tasks
2. Support managerial judgment
3. Improve the effectiveness of decision-making
4. Be used by non-computer specialists in an interactive manner
5. Combine use of models with data
6. Adapt to the decision-making approach of the user (Ceric, 1997).

The above themes are widely agreed upon standards for DSSs. Sprague theorized that because improving performance is the ultimate objective and knowledge workers are the clientele, any DSS framework must be created adjusting for variation (Sprague, 1989). The DSS does not have to accommodate all levels of management but it should consider the relationship the user has with system. Herbert Simon first identified this concept as "bounded rationality" (Simon, 1945). Simply put, any DSS framework must account for the limiting capabilities of the user.

Supporting munitions operations is not an easy task. However, highly capable and inexpensive computer systems are readily available that can assist in the munitions decision-making process when the appropriate software is installed to provide the necessary intelligence.

> The situation is improved when decision support system designers incorporate interface considerations so that (a) the complexity of the domain is appropriately captured, and (b) this representation is effectively communicated to the user. A user-friendly DSS should support a variety of user behavioral characteristics and needs…A DSS should consist of a human-computer interface that accurately and simply conveys the information in the computer to the user, and the user's desires to the computer. (Smith, 1998)

Due to the number of actions required to get good information, munitions personnel often keep paper logs or local spreadsheets and/or databases in addition to the official entries in munitions legacy systems. This is especially true for data that is time

sensitive or needed on a recurring basis. Although these actions solve problems, they also result in loss of data integrity and neglect of feedback and updates to the contributing legacy systems. When copies of data are kept locally as well as in legacy systems, differences occur and the question arises as to which source of information is correct. The challenge is to provide munitions personnel with the convenience, usefulness, and timeliness of local copies of combined legacy system data, while preserving the data management of the source data provided by the legacy systems (Paperless Acquisition Initiative, 1997). The necessity for a DSS has become increasingly important to munitions decision makers due to the increasing complexity and rapid nature of the decisions they must make. Even the Air Force policy on centralized C2 and decentralized execution expands the expected use of a DSS to a potentially non-managerial level, which translates into many of the decisions responsibilities being made at the job site.

A potential solution lies in the use of intelligent agents and information brokers to gather munitions information from legacy system data. "Intelligent Agents" are defined as computer programs that have special skills that engage and help humans in complex tasks (Paperless Acquisition Initiative, 1997). Intelligent agents used in conjunction with information brokers could potentially gather munitions data on demand, at a predetermined time, or when certain conditions are met. An intelligent agent strives to meet five characteristics:

1. Integrated, supporting an understandable, consistent interface.
2. Expressive, accepting requests in different manners and displaying more than characters.
3. Goal-oriented, determining when and how to achieve a user's goal.

4. Cooperative, collaborating with the user.
5. Adaptable to different users (Paperless Acquisition Initiative, 1997).

A true intelligent agent should be capable of autonomous goal-oriented behavior, acting as a personal assistant or representative of the user (Paperless Acquisition Initiative, 1997).

An example of a simple intelligent agent is the POINT CAST system that scans the world wide web (WWW) search engines directories for news or special interest items that the user designates in a user profile and continuously downloads the results to the users local web browser (Steve Powers, June 26, 2002). More sophisticated intelligent agents mine for information from data warehouses. These tools use several techniques to extract and display data and data trends to users. These techniques include: rule-based, decision trees, neural net-based, statistical analysis, visual and fuzzy logic discovery, knowledge-based, or combinations of the techniques (Scott Fagan, June 26, 2002).

Information brokers act as intermediaries between two or more sources of data (Clark Moskop, June 26, 2002). They can handle multiple formats of data from multiple sources and help overcome the need for expensive direct interfacing of legacy systems. An example of an information broker given during the LOCIS Critical Design Review was the Electronic Data Interchange/Value Added Network ventures that supply common interfaces for commercial purchasing and supply systems (Steve Powers, June 26, 2002). Broker examples today can range from activities as simple as finding information via "spiders" on the WWW to more complex activities such as building data warehouses.

Munitions Databases and Decision Support Systems

Computer-assisted decision-making is needed to meet the increasing demands that are put on munitions decision makers. A vast amount of munitions information exists on many different systems to facilitate informed munitions decision-making, however, the information is often viewed in absence of each other. Munitions, missiles, and systems are tracked throughout the munitions process using various information systems and "homegrown" programs. CAS is the primary munitions reporting system used by the Air Force. CAS-Base (B) is used at the base level to provide management support and custody control. CAS-Deployable (D) is a deployable version of CAS-B. Although it is not as functionally complex as CAS-B, CAS-D is able to maintain current and accurate munitions information. CAS-Command (C) provides Major Commands (MAJCOMs) command-level munitions visibility and planning functions. CAS-A, the Ammunition Control Point (ACP), provides national-level munitions planning and control for the ACP at the Air Logistics Centers and Air Staff. CAS-B provides asset and expenditure information to CAS-C and CAS-A. Requisitions are also passed from CAS-B to CAS-C, which feeds it to CAS-A. Munitions allocations are passed from CAS-C to CAS-B so that the system can provide conventional and nuclear munitions maintenance and inventory control functions such as: requirements forecasting, storage planning, movement execution, complete round assembly, resource management, production scheduling, vertical reporting, support flow plans, inventory control, and stockpile conditions tracking. CAS-D supports deployed units and the Regional Ammunition Control Point with munitions information. Munitions asset data from CAS-B are loaded

into CAS-D by disk or manually entered from a hard copy. Likewise data from CAS-D are retuned to CAS-B by disk or hard copy.

D023K and D035K are depot-level information systems used in the munitions community. D023K manages shipments; receipts; asset movements from one location to another; inspections, test and warranty information; as well as inventory counts. It also reports the status of requisitions and munitions available. D035K is the accountable wholesale and retail receipt and shipment system. D035K maintains the accountable record of the munitions asset inventory and feeds asset balances to CAS-A. Asset data are fed from both systems to CAS-A and on to the Global Transportation Network (GTN). The GTN system then tracks in transit munitions through the shipment and receipt process.

Other information systems used to assist in munitions operations include: the Theater Allocation Buy-Budget System (TABBS), which is used to determine allocations and Buy Budget based on requirements. The data are fed to CAS-A. Allocations and Requirements are also fed from TABBS to the Ammunition Control Point Analysis Tool (ACPAT). ACPAT provides the allocations and requirements to CAS-A as well as analysis reports. The Tactical Missile Record System tracks configuration data and maintenance requirements for missiles while Munitions Control 2000 tracks all munitions maintenance actions. The Core Automation Maintenance System is also used in munitions to track personnel training actions and requirements.

To make effective decisions concerning munitions issues, munitions personnel often require data from one, if not all, of the legacy systems previously mentioned. To obtain the data, they access the legacy system or systems that are suspected of having the

data, review large quantities of data to find what they need, call or talk to other people, request reports and then either combine, print, copy, or move the data to a location where it is used. This process is time consuming and usually requires a person to have adequate computer skills. Whether all the data is found or not usually depends on the skill and attention to detail of the person performing the search and the amount of time allowed performing the search. Due to continual offline or inefficient information systems, spreadsheets and work-around programs are often developed to support munitions operations. Munitions planners and users need a source for real-time munitions information that can provide an accurate picture of munitions capabilities in a user-friendly environment that avoids the "homegrown" remedies.

If operations continue as they do today, munitions personnel will be expected to know what information is needed, where to find it, and how to access the necessary systems to get the information. They will also need to have the time and talent to find, retrieve, and combine the data to create meaningful munitions information. Through the use of intelligent agents and information brokers, a DSS could be developed to potentially enable munitions personnel to ask for information in simple terms without knowing exactly where the information is. The benefits would be the quick availability of reliable information whenever it was needed; the elimination of separate records or other local documents, along with the required time to maintain them; and the maintainability of accurate, timely information in munitions legacy databases.

Discussion on Warrior Support Tool and Agile Munitions Support Tool

The Warrior Support Tool

No matter what methodology is followed in the development of a DSS, the system must do what it was developed to do as well as be usable by the people it was developed for. The Warrior Support Tool was designed to track critical munitions. Real-time munitions information is updated from remote locations and integrated into the analysis tool to give weapon planners the ability to make timely decisions on how to manage, respond to, and re-supply areas of weapons deficiencies, to ensure that the war fighter has the weapon of choice and need (Rob Roy, July 11, 2002).

Timely information about the availability of combat ready munitions assets is critical in the execution of aerospace combat.

> Two hundred years ago Napoleon declared that successful campaigns were based on timely information. The Warrior Support program is designed to identify, track, and furnish predictive forecasting of munitions within the USAF inventory and provide a real-time status update at a Department of Defense Identification Code (DODIC) level. (Rob Roy, July 11, 2002)

The application is a web-based system that consists of software, system hardware, and a personal computer display, which is structured on using server connectivity to obtain munitions data.

Through interviews with WST developers and the DSI web page, the system capabilities were identified. In the tracking mode, a list of munitions at a selected location can be displayed. The total quantity of All Up Rounds (AURs) for each configuration can be calculated and displayed based on the availability of DODIC items

required to build up the selected AUR. The user can select a unique configuration from an available list of munitions and see a DODIC breakdown for the particular configuration. A listing of DODIC items by quantity that make up the selected munitions and the limiting DODIC item(s) are also presented in this mode. Additionally, a picture of the selected munitions, the DODICs, and a detailed description of the asset are provided. The application can also identify airbases that store the needed components to assist munitions planners in understanding the war-ready inventory of munitions assets.

In the prediction mode, the information changes to a screen allowing a priority build-up of munitions to meet desired scenarios or an evaluation of the capability to meet a desired selection and quantity of munitions from the DODICs available. The user can select munitions for specific targets and see the availability of DODIC resources for the selected munitions at selected locations. This information leads to the capability of performing an analysis of munitions availability versus munitions needs.

In both the tracking and prediction modes, the user is provided with a network of locations that represent the critical supply points from depots and air bases storing munitions assets. From this display, the decision-maker can select among any of the locations to gain insight into the availability of the type and quantity of munitions at each location. In addition, the user can select a specific type of munitions and see a worldwide view of the quantity of that asset by location.

The WST application allows for two-way communication between Munitions Control personnel at any location and the database information using nothing more than a browser. This feature allows Munitions Controllers to access, verify, and communicate critical information to the appropriate personnel in a real-time format. Effective

implementation of WST may improve the availability of information for the war fighter as well as provide a capability for improved efficiency of Air Force munitions planning and operations for the future.

The Agile Munitions Support Tool

The Agile Munitions Support Tool is also a web-enabled IT application that can be used by Air Force munitions managers to achieve a higher level of munitions accountability.

> AMST automates a number of programs, centralizing and integrating the data from systems such as CAS, GTN, and the Joint Hazard Classification System (JHCS). AMST was developed in response to the lessons learned from U. S. military intervention in Kosovo and the Air Force's Munitions Business Process Reengineering effort. (Synergy, 2002)

The Air Staff identified a need to consolidate stockpile, transportation, and hazard safety data thereby providing total asset visibility for logistics analysis and contingency assessment in support of mission requirements (Kevin Spease, August 12, 2002). AMST came into existence to satisfy this need.

The application provides integrated, up-to-date asset visibility for munitions personnel at locations worldwide to support mission requirements. AMST was designed to facilitate easy interface with the CAS-A database (Kevin Spease, August 12, 2002). It allows different levels of munitions management to query and extract asset balances, requisitions, allocations, levels, and indicative and other ancillary data with a set of easy-to-use analytical tools. The system is available during war, as well as in peacetime, with no degradation in functionality or loss of data integrity (Synergy, 2002).

AMST was developed in the Oracle 8i architecture. The Munitions Agile Combat Support Model (MACSM) is currently being developed as part of the AMST tool. MACSM will enable munitions personnel to assess critical munitions variables, perform What-If analyses and report munitions support requirements (Synergy, 2002). Integrated with the total asset visibility provided in AMST, this tool will enable the Air Staff and MAJCOMs to assess not only combat munitions requirements but training assets as well.

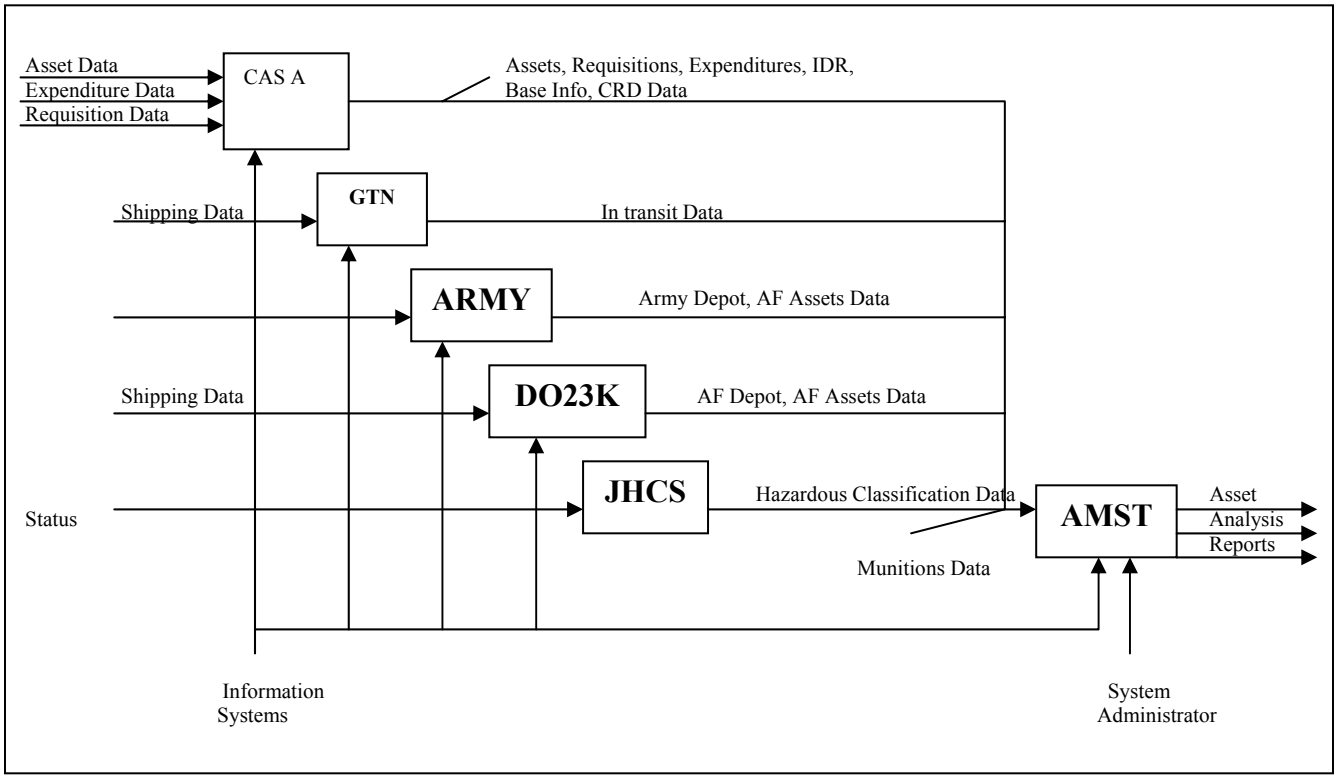

Figure 1. AMST Information Flow (Adapted from AMST Training Manual)

Figure 1 depicts the flow of data from various sources into AMST. AMST receives feeds from CAS-A, GTN, JHCS, and the Army system. One must understand that AMST, as well as WST, are only as good as the data they receive. AMST has the capability to maintain data, which helps munitions managers track assets that have been expended, received or shipped that CAS-A has not reported (Synergy, 2002). The AUR

process provides asset visibility not only to the current stockpile but also the built-up status of the stockpile. The Expenditure Query Screen is set up in a way where you must select the date range for the expenditure rates you are trying to retrieve. You can either specify a date range by month and year or select one or more fiscal years (Synergy, 2002). The in transits query screen compares open CAS-A requisitions with GTN cargo records that represent the set of current in transit records. GTN Cargo data is also available by itself through this screen. The Requisition History mode shows all available in transit assets and requisition information on those assets. The available information is put into the system at different times from various sources, forming a history of a requisition. Another very useful feature, the Items of Special Interest Report (ISIR) allows authorized users to define a set of ISIR reference numbers (Synergy, 2002).

Summary

The way the United States military plans to fight and support the war fighter has changed. However, very little has changed in the way we gather information to improve that support. A lot of munitions data is collected and documented, but it is scattered through many disparate databases and is often untimely. A great deal of time and effort is also spent manually pulling, compiling, and analyzing data to provide meaningful information. There exists a need for an IT application that can automatically pull munitions data from ammunition information systems and combine that data to paint a complete picture for the user. The purpose of this research is to investigate the ability of WST and AMST to meet this need. The research will also ascertain how well each

application meets the decision support needs of the retail munitions community as well as identify strengths and weaknesses of WST versus AMST. Additionally, the research will attempt to predict the ease of manipulating each application.

III. Methodology

Introduction

This chapter describes the methodology used in conducting the gap analysis and administering the user surveys. A gap analysis is a survey instrument used to determine the gaps between a service offered and a customer's expectations (Foster, 2001). The gap analysis in this study aims to identify differences between the needs of the user and the abilities of WST and AMST. With the assistance of the data collected from user surveys, the analysis exposed gaps that existed between the needs and abilities of the applications. Additionally, pertinent information about the applications was gathered and a Likert scale was used to assist in addressing the identified gaps as well as the importance of the other features that are present in the applications.

Description of The Gap Analysis

The gap analysis process consisted of five phases. The phases were developed based on discussions in *Managing Quality: Gap Analysis* (Foster, 2001).

Phase I - Identified the munitions user's needs

Phase II - Identified application capabilities

Phase III – Consisted of a matching exercise

Phase IV - Identified the recognized gaps

Phase V - Provided recommendations for further action.

Each phase is described in more detail in the following pages.

Phase I: Determine Munitions User's Needs

This phase of the analysis sought to determine the needs of the munitions user. To conduct this process, a content analysis was conducted by gathering information through literature, interviews, and needs assessment documents. At the conclusion of Phase I, a list of needs for a munitions IT application was developed. To identify the needs, a matrix as depicted in Figure 2 was used. This matrix provided the baseline for the gap analysis.

User Needs	**Source$_1$**	**Source$_2$**	**Source$_n$**
User Need$_1$	=	=	=
User Need$_2$	=	=	=
User Need$_n$	=	=	=

Gap	-
Capability Met	=
Additional Capability	+

Figure 2. Needs Matrix Example

Phase II: Determine Application Capabilities

The second phase of the analysis sought to identify the capabilities of the applications by conducting an analysis of WST and AMST. Application capabilities were identified using archival data in the following formats:

1. Presentations from system developer
2. Future planning documents available via the web
3. Subject matter expert interviews
4. Literature devoted to WST and AMST application capabilities
5. Manipulation of the applications.

In addition, a survey was developed for munitions users to identify the capabilities and ease of manipulating the applications. Like the needs assessment, the

capabilities were organized in a matrix with each column listing the application and each row representing a capability. Figure 3 provides an example of the capability matrix. The result of Phase II provided a picture of the capabilities of WST and AMST.

Capabilities	$Source_1$	$Source_2$
$Capability_1$	=	=
$Capability_2$	=	=
$Capability_n$	=	=

Gap	-
Capability Met	=
Additional Capability	+

Figure 3. Capability Matrix Example

Phase III: Conduct Matching Analysis

A matching analysis was conducted in two sub-phases; an information phase and survey phase, to determine where needs and capabilities matched up. The information phase helped in identifying user needs and application capabilities through interviews and archival data. The survey phase collected data to assist in ensuring the validity of the user needs that were identified and the application capabilities that were listed. A matrix displaying user needs along the rows and system capabilities along the columns was developed to facilitate the needs and capability matching exercise based on information obtained from the subject matter expert interviews, archival data, and user surveys. In conducting the matching analysis, any needs that were not met by a capability presented a gap and were labeled with a minus sign (-). Needs that were met by an application capability identified a match and were labeled with an equal sign (=). Any capability present without an identified need presented a capability in excess of a need and was labeled with a plus sign (+). Figure 4 provides an example of the matching matrix. Once

the matching analysis matrix was completed, existing gaps were identified for further analysis in Phase IV.

Matching Analysis	$Capability_1$	$Capability_2$	$Capability_3$	Capability	Aircraft Compatibilit
$Need_1$	=	=	=	+	-
$Need_2$	-	=	-	=	=
$Need_3$	=	=	=	+	=
$Need_n$	=	=	=	-	=

Gap	-
Capability Met	=
Additional Capability	+

Figure 4. Matching Analysis Matrix Example

Phase IV: Gap Analysis

Phase IV sought to take all gaps uncovered in Phase III and address them based upon their level of importance to the munitions planner. One of the goals of this research was to ascertain if one system would suffice for the munitions planner. The final product accompanied by inputs from the user surveys administered to personnel in the munitions community, will provide decision-makers with a list of strengths and weaknesses for both systems. The product will also identify the performance capabilities and approval of each system by the user. Examples of the questionnaires that were used are presented in Appendix A of this study.

Phase V: Recommendations

Taking the results of Phase IV, the study concluded with recommendations for action and/or further research to eliminate the gaps. The analysis provides decision makers with an accurate identification of the needs of the users as well as the capabilities of the systems. It also identifies if one system will suffice in the munitions community.

Data Collection

As previously mentioned, two sub-phases were used in collecting the data to allow for the matching analysis to take place. The information phase used interviews and archival data to obtain needed information as to user needs and application capabilities. The survey phase collected data to assist in ensuring the validity of the user needs that were identified and the application capabilities that were listed. The Phases are discussed in more detail in the following paragraphs.

Information Phase: Conducting Interviews

Subject matter expert interviews produced the majority of the information used in this research. An interview is a method for obtaining needed information, facts, and opinions held by subject matter experts. It is described as a "conversation with a purpose" (Fowler and Mangione, 1990). A benefit of conducting interviews lies in the fact that the one-to-one nature of the interview allows for concerns and questions to be directly addressed (Leedy, 2001). Mistakes and misunderstandings are quickly identified and cleared up in an interview environment.

The interview process consisted of three steps: planning the interview, running the interview, and reporting the results of the interview. In following the steps:

> Determine what information is desired and prepare an interview schedule. The interview schedule should be a set of topics and/or questions that need to be answered to obtain the necessary information. Once the interview schedule is developed, decide on the order in which the topics will be covered. Develop a prompt and an explanation of each topic to ensure that a tactic exists to assist in asking for the information and explaining the topic if the interviewee does not understand the prompt. Finally, decide how to record the responses. The avenues available in order of preference are: your memory, concurrent written notes by yourself, tape recorder, or video (Preece et al, 1994).

From that point, the intended audience was contacted to ensure that the topics developed would facilitate obtaining and presenting meaningful and useful interview results.

The biggest danger in using interviews as a method of data gathering is the unstructured nature of reporting the resulting data, which can easily be misinterpreted or censored (Leedy, 2001). One must remain unbiased in reporting results of interviews. The primary method of analysis that helps guard against censoring information that is difficult to handle or unexpected is to break up the text or notes from each interviewee into a set of simple propositions, using the interviewee's own words as much as possible (Preece et al, 1994). These propositions can then become the input to a content analysis activity.

The interviewing process should not be taken lightly because it can be the source of very valuable first-hand information. Other methods of collecting information from users include questionnaires, observation of users, and user participation in the context of user analysis, and focus groups or brainstorming. The interview process accompanied with a user survey presented itself as the most viable method of collecting information for this research.

Survey Phase: Conducting User Surveys

The user survey is a means of finding out how a particular software or web site is likely to be used by a specific set of users and who those users are likely to be (Laurie Quill, June 2002). Because it is possible to survey a large number of users, usage profiles from user surveys can be relied upon if the correct methodology is developed. User surveys can be analyzed statistically, giving moderately hard, objective data (Alkin et al,

1974). However, many sources of bias exist and a poorly designed survey can do more harm than good.

There are a number of methods in existence for carrying out surveys. The usability net identifies the following as core survey processes that should be followed: focus the survey, create the survey instrument, test the survey, conduct the survey, analyze the survey, and present the results.

In focusing the survey, find out what the major decision points are and areas of uncertainty in regard to the usage of the product and focus in on those areas. Akin et al.'s book, *Evaluation and Decision Making: The Title VII Experience,* discusses analysis of decision points and is a good source of information to begin this process.

A number of guidelines exist on how to develop questions and lay out surveys to make them "respondent friendly". Reliable questions focus on simple things that occur relatively infrequently. An important element in conducting a survey is to develop the concept of trust between yourself and the respondents to assist in obtaining good data (Lt Col. Swartz, September 13, 2002). Use open-ended questions sparingly, but always include an "Other (please specify):" option at the end of a list of choices. Dillman's book *Mail and Internet Surveys: The Tailored Design Method* is an excellent guide to developing surveys.

It is absolutely essential to test the survey before releasing it. A survey test must be conducted in conditions as close to the real conditions as possible (Lt Col. Swartz, September 13, 2002). A useful technique for testing a survey is to conduct a "walk through" of the survey with a small number of participants and ask them what they think and understand about each question as they go through the survey. If your participants

have questions, your actual survey population may have questions. When the sampling frame is established, everyone in the frame must be afforded the same opportunity to reply to the survey questions. Sampling theory is complex, and is best left to a statistician for an in depth discussion. However, in providing a brief concept behind the idea of the theory, one has to state how the total population from whom the information will be obtained is defined, and then how an unbiased sample from that population will be conducted.

Identifying how the results will be analyzed should be clear. Coding and tabulating the data should be as automatic as possible, so as to rule out possibilities for random error or bias to creep in (Fowler and Mangione, 1990). A spreadsheet is a very useful tool for keeping raw survey results because it allows for easy manipulation and can be exported to a statistics package such as SPSS.

How to effectively present the results of a survey is always a challenge. There is no right or wrong way but there are accepted techniques. When presenting results, always give the headline news first, then follow that up with a detailed analysis of how you got there, and finish with a conclusion based on the data (Lt Col Swartz, September 13, 2002). Opinions and biases are naturally formed when data is manipulated. These opinions are important and should be presented but, "Do so by carefully marking them as your extrapolations from the data so as not to confuse objective fact with subjective opinion" (usabilitynet.org).

Subjective Assessment

An abundance of surveys exist but the most appropriate survey for this research endeavor was the subjective assessment survey. Subjective assessments tell the evaluator

how the users feel about the software being tested (Laurie Quill, June 2002). This is a distinct difference from a performance test, which tells how efficiently or effectively users perform with the software. The benefit of using a subjective assessment was that, "In a discretionary use scenario, user satisfaction is most probably the largest single key factor, which will influence the user's decision whether or not to continue with the software…in a mandatory use scenario, poor satisfaction leads to absenteeism, fast turnover, and complaints from the workforce" (usabilitynet.org). Subjective assessments also produce a list of satisfying and unsatisfying software features, which can be especially useful during an application's development.

It is customary to use a closed-ended questionnaire if one is available. This allows for the gathering of quantitative data, which minimizes the opportunity for the results of the activity to be vague and open to interpretation (Preece et al, 1994). In this research endeavor, once a questionnaire was identified for use, a group of users to fill out the questionnaire was identified. A profile section was used to get background data on each potential respondent (e.g. computer experience, job level, frequency of use of the software being evaluated). It was important that the respondents were not prompted as to how they should reply to questions. If a respondent complained that a question was inapplicable or wrong, they were told words to the effect that it was up to them to make their own judgment about each question, and that there were no right or wrong answers. However, they were encouraged not to leave questions blank.

Likert Scales

Likert scales provide a method for presenting data in an easily understood manner (Barbara Masquelier, March 2002). Subjective questionnaires usually have a scoring scheme based on Likert-style scaling techniques. In fact, most questionnaires only require that the scores obtained from respondents be summed together to determine the

survey score. The first step in developing a Likert scale is to define what it is you are trying to measure (Trochim, 2001). A scale can have any number of dimensions but most only have a few. A dimension is nothing more than a number line and if a construct is measured, a decision must be made as to whether the construct can be measured with one or more number lines. If one number line can measure a construct, it is probably a one-dimensional construct (Trochim, 2001).

Once a construct of measure is identified, create the potential scale items. These should be items that can be rated on a 1-to-5 or 1-to-7 Disagree-Agree response scale. Sometimes scale items can be created from understanding of the subject matter…but more often than not, it's helpful to engage a number of people in creating the items (Trochim, 2001). The next step is to have a group of people rate the items using a 1-to-5 rating scale where:

1 = strongly unfavorable to the concept

2 = somewhat unfavorable to the concept

3 = undecided

4 = somewhat favorable to the concept

5 = strongly favorable to the concept

The people that rate the items are not identifying what they believe; they are judging how favorable each item is with respect to the construct of interest (Trochim, 2001).

Upon verification of the rating scale, compute the intercorrelations between all pairs of items, based on the item ratings received. There are several analyses that can be conducted to assist in deciding which items to keep for the final scale:

> 1. Throw out any items that have a low correlation with the total (summed) score across all items…Statistics packages make it relatively easy to compute this type of Item-Total correlation. First, create a new variable, which is the sum of all of the individual items for each respondent. Then, include this variable in the correlation matrix computation. As for throwing out the low rated correlation items, there is no fixed rule. Correlations have been eliminated that had total scores less that .6.
>
> 2. Get the average rating for the top quarter of judges and the bottom quarter for each item. Then, do a t-test of the differences between the mean value for the item for the top and bottom quarter judges. High t-values mean that there is a greater difference between the highest and lowest judges. Items with higher t-values are better discriminators, so you want to keep these items. In the end, you will have to use judgment as to which items are retained. You want a relatively small number of items on your final scale (e.g., 10-15) and you want them to have high Item-Total correlations and high discrimination (e.g., high t-values) (Trochim, 2001).

There are a variety of response scales (1-to-7, 1-to-9, 0-to-4) that exist in Likert scaling. Odd-numbered scales have a middle value that is often labeled neutral or undecided, which is very friendly to the respondent but may not help the researcher. It is possible to use a forced-choice response scale with an even number of responses and no middle neutral or undecided choice (Leedy, 2001). In this situation, the respondent is forced to decide whether they lean more towards the agree or disagree end of the scale for each item. The final score for the respondent on the scale is the sum of their ratings for all of the items.

Survey Development

The amount of satisfaction experienced by a user of an application is a critical measure of any application's success. There are many possible ways to evaluate the human-computer interface. Chin states that there are five different types of dependent

measures for evaluating interfaces: speed, accuracy, time to learn a system, retention of knowledge, and user acceptance (1988).

> For many tasks, speed and accuracy are two related performance measures that affect a person's attitude toward a system. The time it takes to learn a system and the retention of acquired knowledge over time also affect the utility of a system. User acceptance of a system (i.e., subjective satisfaction) is also a critical measure of a system's success. Although a system may be evaluated favorably on every performance measure, the system may not be used very much because of the user's dissatisfaction with the system and its interface. (Chin, 1988).

The data for the survey used in this study came from six sources; system developer need assessment documents, application planning documents, subject matter expert interviews, literature devoted to WST and AMST capabilities, manipulation of the applications, and existing survey tools. The key to selecting the appropriate data was to find variables that were relevant to the research and to obtain a large enough sample to represent the munitions community when the survey was administered. To ensure a large yet diverse sample, munitions personnel attending 7-level training as well as those attending the Munitions Inspector Course at Sheppard AFB were surveyed. Munitions Instructors at the enlisted and officer schoolhouses and Munitions Officers attending classes were also surveyed. To complete the sampling population, survey sessions were also conducted with 6 Aircraft Maintenance Officers with at least 1-year experience in the munitions community. In all, 65 participants, 3 civilians, 41 enlisted ranging from Airman First Class to Master Sergeant, and 21 officers ranging from Second Lieutenant to Captain were surveyed. Their level of computer experience varied from very little software experience to those that were very capable software programmers. Everyone

had used Microsoft Office applications in one way or another and 60% of those who reported using CAS (n=30), used the system more than 4 hours a week.

An adaptation of the Questionnaire for User Interface Satisfaction was used to measure the user's subjective rating of WST and AMST. The original questionnaire consisted of 80 questions. Six questions were demographics questions, six were overall reaction ratings of the system, thirteen referred to the screen, seventeen referred to the terminology and system information, twenty-one referred to learning the system, and seventeen referred to the capabilities of the system. Every question, except the demographics questions, had a rating scale ascending from 1 on the left to 9 on the right. The scales were anchored at both ends with conflicting adjectives so that they were always positioned in a way that the scale went from a negative adjective on the left to a positive adjective on the right. Each scale also had a 'not applicable' choice.

The original questionnaire was modified into two sections with a total of 49 questions asked. Section 1 consisted of eleven questions aimed at developing the demographics of the sampling population. Participants were asked to identify their sex, rank, duty title, AFSC, years in that AFSC, their major command, time spent with the study application, time spent on computers in general, time spent on CAS, their perceived experience with computer applications, and to identify the sort of tasks they performed on computers. Section 2 was a modified version of the original questionnaire with the difference being a rating scale of 1 to 7 and a reduction in the number and types of questioned asked. Thirty-eight questions were distributed across eight constructs; three questions referred to the overall reaction rating of the systems, three referred to the screen, three to the terminology and system information, eleven to learning the system,

three to help features of the system, three to speed of the system, and five each on the importance and performance of the features. Three versions of the survey were also developed to ensure that reliable ratings were received from the participants. The reliability of the questionnaire was good. Cronbach's α, an estimation of reliability based on the average intercorrelation among items, indicated that the reliability in the items ranged from .78 to .97, above the suggested measurement of .70 the limit suggested for research designed to make decisions affecting groups (Huck and Cormier, 1996).

A factor analysis was conducted to determine mathematical relationships in the user surveys that would predict the ease of use and likeability of WST and AMST. Prior to performing the analysis, the data was tested for suitability. A number of tests were conducted in order to test for suitability: a correlation matrix, Bartlett's Test of Sphericity, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy, and the anti-image correlation. Evidence, which will be explained in the next chapter, emerged from the tests to prove that significant patterns existed.

Procedure

It was important to administer the questionnaire in an unbiased manner. Bias can be accounted for either statistically or methodologically. For this study, the latter was chosen as a means of controlling for bias. The experiment was conducted in a computer lab with groups of 9 – 12 people. The applicable questionnaire was distributed to the participants as they entered the room. The participants were randomly assigned with the only requirement being that the same rank structure and number of people was adhered to

for each survey session. If nine people in the ranks of Sra to TSgt were in one group, another group with the same characteristics was required.

Equivalent groups were processed one behind the other to allow a controlled environment to present the power point presentation that familiarized the participants with the applications they would manipulate. The topics that were covered in each presentation were a brief history on the development of the applications and information on their features. The same number of slides was afforded to each application with the same number of bullet statements.

It is believed that users tend to favor the first thing they see. To control this user bias, the presentation and manipulation of the applications were alternated. For the inspector course students, A1C to MSgt, half of the subjects received a presentation and manipulation period on WST first then the other half received it on AMST first. The 7-level course students, which were all SSgt, received presentation of the AMST application first. The enlisted instructors, TSgt to MSgt, received a presentation on WST first. When the officers were surveyed, a presentation covering both applications was given up front and the applications were ran on alternating computers to ensure randomness. The survey period lasted an hour for each group. Scenarios were developed that were common to both applications. The users were given 25 minutes to manipulate each system and answer the survey pertaining to that system. 5 minutes were allotted for presenting the power point presentation on each application.

Paired Sample T-Test

A Paired Sample T-Test with a .05 significance level was conducted to determine if there was a significant difference between the mean ratings received for the WST and

AMST applications. The significance level of 5% is generally accepted as a cut-off point for a significant versus a non-significant result (Devore, 2000). The null hypothesis states that there is no difference in the ratings or that the average of the differences between the paired ratings is zero.

$$H_0: \mu_1 - \mu_2 = 0$$

The alternative hypothesis states that there is a significant difference in the mean ratings for WST and AMST. If the calculated P-value is less than the given significance level, the conclusion is that the mean difference between the paired ratings is significantly different from 0.

$$H_1: \mu_1 - \mu_2 \neq 0$$

A two-tailed P-value was appropriately used because the differences between the ratings can occur in both directions: either negative or positive, the mean of one rating can be smaller or bigger than the other. Since this study is designed to uncover a difference in the two applications in question, one should be willing to accept that there is a difference even when the P-value is as large as .10 (Devore, 2000). To avoid the mistake of interpreting a shift in P-value (.047 to .051) as a change from significance to non-significance, the actual P-values are reported to enable the reader to make his or her own interpretation.

Summary

This chapter began with a description of the gap analysis process and continued with a description of the instrument design, sample population, and administration of the

survey. In the following chapter, the results from the application of this methodology will be presented. There, the comparative results between the Warrior Support Tool and the Agile Munitions Support Tool will be analyzed and the ideal application presented. Suggestions for further research will also be presented.

IV. Results

Overview

This research began with the objective of identifying how well WST and AMST met the decision support needs of the retail munitions community and to determine if one IT application would suffice in the munitions community. The analysis and results presented in this chapter are an attempt to identify how well the applications support the munitions community and determine if one will suffice. In order to answer the investigative questions and confirm how well the applications supported the needs of the munitions community, a gap analysis and survey were accomplished with personnel in the munitions community having at least 3 months experience and Aircraft Maintenance Officers with at least one year of munitions experience.

What are the customer needs?

A content analysis was conducted and over 100 different needs were identified from the needs assessment documents, which were eventually categorized under 6 major headings. At the conclusion of the analysis, the list of identified needs for a munitions information technology application were placed in rows, and the user that identified the need was placed in the column of the matrix. The needs matrix depicted in Figure 5 is the result of the content analysis and provides the baseline for the gap analysis.

User Needs	MAJCOM	Needs Analysis	Munitions Personnel	Depot
Track Munitions assets & AURs	=	=	=	=
Track Munitions Expenditures	=	=	=	=
Identify Munitions shortages	=	=	=	=
Identify Munitions Availability	=	=	=	=
Track in transit assets	=	=	=	=
Provide requisition history	=	=	=	=

Figure 5. Needs Matrix

The identified needs are critical in the execution of aerospace combat. They all help in tracking critical munitions to provide weapon planners the ability to make timely decisions on how to manage, respond to, and re-supply areas of weapons deficiencies, to ensure that the weapon of choice and need is available. By tracking, identifying, and providing requisition history on assets and expenditures, the total quantity for a given configuration can be calculated and displayed based on the availability of the DODIC items required to build the asset. The information also enables munitions planners to identify airbases that store needed components, which acts as a force multiplier by furthering the planners understanding of the war-ready inventory of munitions assets.

What does each application provide?

The next step was to develop the capabilities matrix. Like the needs assessment, the capabilities were organized in a matrix with each column listing the application and each row representing a capability. The application capabilities were identified through

the use of presentations and interviews with system developers, planning documents available via the web, literature devoted to WST and AMST application capabilities, and manipulation of the applications. In addition, a survey was developed for munitions personnel to identify the capabilities and ease of manipulating the applications. Figure 6 shows the results of the capability matrix exercise.

Capabilities	AMST	WST
Asset Location	=	=
Asset Balance	=	=
Condition Codes	=	=
Expenditures	=	=
Aircraft Compatibility	-	=
Simulation Capabilities	=	=
Requisition History	=	-
In transit Assets	=	-
ISIR Information	=	-

Figure 6. Capability Matrix

To determine where user needs and application capabilities were met, two additional matrices were created. These matrices displayed user needs along the rows and the application capabilities along the columns. At that point, a needs and capability matching exercise was conducted using subject matter expert interviews, archival data, and user surveys to ensure validity. All needs and capabilities were labeled with a minus sign (-) if a gap existed, an equal sign (=) if a match existed, and a plus sign (+) for a capability in excess.

Figure 7 and 8 provide the matching matrices for WST and AMST respectively. Once the matching analysis matrices were complete, gaps were identified to allow for further analysis and discussion.

WST Matching Analysis	Asset Location	Asset Balance	Condition Codes	Expenditures	Aircraft Compatibility	Simulation Capabilities	Requisition History	In transit Assets	ISIR Information
Track Munitions assets & AURs	=	=	=	=	+	+	-	-	-
Track Munitions Expenditures	=	=	=	=	+	+	-	-	-
Identify Munitions shortages	=	=	=	=	=	=	-	-	-
Identify Munitions Availability	=	=	=	=	=	=	-	-	-
Track in transit assets	-	-	-	-	+	+	-	-	-
Provide requisition history	=	=	-	-	+	+	-	-	-

Figure 7. WST Matching Analysis Matrix

AMST Matching Analysis	Asset Location	Asset Balance	Condition Codes	Expenditures	Aircraft Compatibility	Simulation Capabilities	Requisition History	In transit Assets	ISIR Information
Track Munitions assets & AURs	=	=	=	=	-	+	=	=	=
Track Munitions Expenditures	=	=	=	=	-	+	=	=	=
Identify Munitions shortages	=	=	=	=	-	=	=	=	=
Identify Munitions Availability	=	=	=	=	-	=	=	=	=
Track in transit assets	-	-	=	-	-	+	=	=	=
Provide requisition history	=	=	-	-	-	+	=	=	=

Figure 8. AMST Matching Analysis Matrix

How well does each application meet the needs?

The WST gap analysis identified the ability to track in transit assets and provide requisition history as gaps in the application. During the survey exercise, munitions personnel identified the asset condition code feature as the most important feature in the WST application (mean=5.43). Asset expenditure rates and balances were the next two most important features respectively (mean=5.28, 5.28). To make accurate munitions decisions, planners must understand the status of munitions inventory, what weapons are being produced, how expenditures may be impacting the mission, and the status of re-supply assets. The ability to track in transit assets plays a major role in planning future munitions operations and production forecasts. WST received praise even though the in transit-tracking feature was lacking. As for the requisition history feature, the application did not provide an in-depth report of requisition history. Requisition history information can be obtained from the application but it has to be done so through reverse engineering and deductive reasoning, which may lead to miscalculations. Additionally, extreme concern was expressed as to the level of security available for the application. Munitions personnel acknowledged the understanding that CAS was being declassified but were concerned with the fact that the available munitions information was still sensitive in nature.

The AMST gap analysis did not identify gaps between user needs and application capabilities. AMST received excellent praise but concern was expressed as to the security features of the application, its speed, and the fact that too much information had to be manually input into the application. The application tended to bog down as

searches were performed. Munitions users also favored the point and click feature of WST over the required information input feature of AMST.

Based on the results of Phase IV, recommendations for action and/or further research were given to complete Phase V of the gap analysis process. The recommendations that were formulated will be presented in the following chapter.

Factor Analysis

An exploratory factor analysis was accomplished to determine if one factor to represent each characteristic would emerge. However, prior to performing the analysis, the data had to be tested to determine if it would be suitable for factor analysis. A correlation matrix of the items was analyzed to determine a factor pattern in the WST survey (see Appendix B). Eleven item correlations on the WST survey were .023, .034, .073, .101, .119, .140, .153, .199, .203, .259, and .289, which provided evidence that more than one factor would emerge because Hair states that, for factor analysis, correlations above .30 give evidence that only one factor is present (1995). The results of the correlation matrix led to an exercise in determining the correct number of factors present in the survey. Upon further manipulation of the data in SPSS, eight factor patterns emerged for the survey. The factors were entitled overall satisfaction of the system, the screen layout, text communication and terminology of the system, ease of learning and using the system, help features of the system, speed and functionality of the system, importance of system features, and performance of system features respectively. All the item correlations were above .549 to provide the necessary evidence that the factor patterns were identified.

Next, the Bartlett's Test of Sphericity yielded chi-squares of 106.494, 75.284, 54.777, 660.102, 75.629, 97.441, 351.963, and 274.589 respectively with a p-value of .000 for all results. The Bartlett's Test checks the null hypothesis that the variables in the population correlation matrix are uncorrelated. A p-value less than the significance level that is set, rejects the null hypothesis and gives evidence that the population is correlated. Another test, the Kaiser-Meyer-Olkin Measure (KMO) of sample Adequacy, yielded .727, .708, .722, .898, .721, .726, .886, and .864. Hair suggests values above .70 are desirable and below .50 are undesirable (1995). Finally, the anti-image correlation produced small and negative numbers, also deemed appropriate by Hair (1995). Therefore, these test provided evidence that the data was suitable for factor analysis.

A principle components analysis was also accomplished where factors with eigenvalues greater than 1 were extracted. The eigenvalue is an index that reflects how much variance in a survey item can be accounted for each factor. The eight factors that emerged had eigenvalues greater than 2.242 with the highest being 8.328. All of the factors explained over 74.734% of the variance in each factor. This data supported the determination that the developed scale was appropriate for measuring the ease of use and likeability of WST. See the factor loading in Table 1.

Table 1. WST Survey Construct Validity

Construct	Standardized α	KMO	Chi^2	P-value	Eigenvalue
Overall Satisfaction **WQ1-3**	.8984	.727	106.494	.000	2.495
Screen Layout **WQ4-6**	.8465	.708	75.284	.000	2.297
Text Communication & Terminology **WQ7-9**	.8309	.722	54.777	.000	2.242
Ease of Use/Learning **WQ10-20** - *Learning (10-12)* - *Intuitive (13-15)* - *Presentation (16-18)* - *Novice Friendly (19-20)*	.9677	.898	660.102	.000	8.328
Online Help **WQ21-23**	.8873	.721	75.629	.000	2.450
Speed **WQ24-26**	.8866	.726	97.441	.000	2.446
Importance of Features **WQ27-31**	.9716	.886	351.963	.000	4.491
Performance of Features **WQ32-36**	.9606	.864	274.589	.000	4.321

The same procedures were followed to determine if a recognized factor pattern developed in the AMST survey (see Appendix C). However, only three item correlations emerged, .252, .255, and .283, which still provided evidence that more than one factor would emerge. Eight factor patterns were developed and the same titles were given to the factors. The item correlations on the AMST survey were above .562, which again provided the necessary evidence that factor patterns were identified. The Bartlett's Test of Sphericity yielded chi-square values of 54.864, 100.186, 68.835, 628.779, 99.868, 164.650, 220.543, and 247.348 with p-values of .000 for all the results. The Kaiser-Meyer-Olkin Measure of sample Adequacy, returned values of .700, .738, .737, .932, .733, .749, .894, and .886. The last test, the anti-image correlation, also produced small and negative numbers leading to the conclusion that factor analysis could be conducted on the AMST data. AMST principle components analysis was also accomplished with eigenvalue factors greater than 1 being extracted. The eight factors that emerged had values greater than 2.256 with the highest being 8.305. The factors also explained over 75.207% of the variance for each factor, supporting the determination that the scale was

appropriate for measuring the ease of use and likeability of the Agile Munitions Support Tool. Table 2 gives the factor loading.

Table 2. AMST Survey Construct Validity

Construct	Standardized α	KMO	Chi^2	P-value	Eigenvalue
Overall Satisfaction **AQ1-3**	.8343	.700	54.864	.000	2.256
Screen Layout **AQ4-6**	.8896	.738	100.186	.000	2.458
Text Communication & Terminology **AQ7-9**	.8622	.737	68.835	.000	2.352
Ease of Use/Learning **AQ10-20** - *Learning (10-12)* - *Intuitive (13-15)* - *Presentation (16-18)* - *Novice Friendly (19-20)*	.9672	.932	628.779	.000	8.305
Online Help **AQ21-23**	.9036	.733	99.868	.000	2.517
Speed **AQ24-26**	.9417	.749	164.650	.000	2.687
Importance of Features **AQ27-31**	.9498	.894	220.543	.000	4.174
Performance of Features **AQ32-36**	.9655	.886	247.348	.000	4.394

Paired Sample T-Test

The results of the T-test revealed that only five survey questions (6, 12, 21, 22, and 28) showed significant differences at a .05 significance level. For question number 6, the user was asked about the ease of going back to a previous screen. The mean rating for WST was 4.90 (SD = 1.471) and the mean rating for AMST was 5.34 (SD = 1.606). The test was significant, $t_{(57)} = 2.061$, $p < .05$. Question 12 inquired about the required time to learn how to use the applications. The mean rating for WST was 4.56 (SD = 1.512) and the mean rating for AMST was 4.09 (SD = 1.567). The test was significant, $t_{(54)} = -2.106$, $p < .05$. Question number 21 asked about the quality of the help messages. The mean rating for WST was 4.43 (SD = 1.615) and the mean rating for AMST was 4.85 (SD = 1.660). The test was significant, $t_{(45)} = 2.036$, $p < .05$. For question number 22, a question about the speed of the application was posed. The mean rating for WST was 4.60 (SD = 1.629) and the mean rating for AMST was 5.26 (SD = 1.626). The test

was significant, $t_{(49)} = 2.557$, $p < .05$. For question number 28, the mean rating for WST was 4.98 (SD = 1.375) and the mean rating for AMST was 4.62 (SD = 1.423). The test was significant, $t_{(46)} = -2.027$, $p < .05$. However, a difference was inevitable for question 22 because two different questions were asked. On the WST survey, the users were asked to rate the performance of the asset location feature and on the AMST survey; they were asked to rate the performance of the in transit feature. When the confidence interval was relaxed to a 90% confidence interval, only two additional differences were discovered (questions 24 and 32). Question number 24, asked users to rate the time it took the applications to display needed information. The mean rating for WST was 4.94 (SD = 1.329) and the mean rating for AMST was 4.42 (SD = 1.816). The test was significant at .10, $t_{(61)} = -1.978$, $p < .10$. Question number 32 was another paired set where a difference was inevitable because different questions were asked. For WST, the users were asked to rate the performance of the condition code feature and the mean rating was 5.08 (SD = 1.499). For AMST, the users were asked to rate the performance of the expenditure feature. The mean rating for that question was 4.69 (SD = 1.504). The test was significant, $t_{(47)} = -1.831$, $p < .10$. The results from the survey are presented in Table 3.

Table 3. Paired Differences

Pairs	Mean	Std. Dev	Std. Error Mean	Lower 95% CI	Upper 95% CI	t	df	Sig. (2-tailed)
AQ1 – WQ1	-.28	1.748	.226	-.73	.17	-1.256	59	.214
AQ2 – WQ2	-.24	1.622	.239	-.72	.24	-1.000	45	.323
AQ3 – WQ3	.00	1.758	.235	-.47	.47	.000	55	1.000
AQ4 – WQ4	-.07	1.375	.179	-.43	.29	-.379	58	.706
AQ5 – WQ5	.20	1.711	.219	-.24	.63	.898	60	.373
AQ6 – WQ6	***.45***	***1.656***	***.217***	***.01***	***.88***	***2.061***	***57***	***.044***
AQ7 – WQ7	.12	1.499	.197	-.27	.51	.613	57	.542
AQ8 – WQ8	-.08	1.426	.198	-.47	.32	-.389	51	.699
AQ9 – WQ9	-.24	1.648	.233	-.71	.23	-1.030	49	.308
AQ10 – WQ10	-.15	1.827	.238	-.63	.32	-.641	58	.524
AQ11 – WQ11	-.07	1.745	.225	-.52	.38	-.296	59	.768
AQ12 – WQ12	***-.47***	***1.665***	***.225***	***-.92***	***-.02***	***-2.106***	***54***	***.040***
AQ13 – WQ13	-.12	1.534	.201	-.52	.28	-.599	57	.551
AQ14 – WQ14	-.14	1.515	.199	-.54	.26	-.693	57	.491
AQ15 – WQ15	.09	1.478	.194	-.30	.47	.444	57	.659
AQ16 – WQ16	-.05	1.594	.209	-.47	.37	-.247	57	.806
AQ17 – WQ17	-.20	1.531	.205	-.61	.21	-.960	55	.341
AQ18 – WQ18	-.16	1.499	.200	-.56	.24	-.802	55	.426
AQ19 – WQ19	.00	1.451	.191	-.38	.38	.000	57	1.000
AQ20 – WQ20	.03	1.605	.207	-.38	.45	.161	59	.873
AQ21 – WQ21	***.41***	***1.376***	***.203***	***.00***	***.82***	***2.036***	***45***	***.048***
AQ22 – WQ22	***.66***	***1.825***	***.258***	***.14***	***1.18***	***2.557***	***49***	***.014***
AQ23 – WQ23	.26	1.725	.252	-.25	.76	1.015	46	.316
AQ24 – WQ24	***-.52***	***2.055***	***.261***	***-1.04***	***.01***	***-1.978***	***61***	***.052***
AQ3 – WQ25	-.36	2.099	.273	-.90	.19	-1.303	58	.198
AQ26 – WQ26	-.34	2.298	.302	-.95	.26	-1.143	57	.258
AQ27 – WQ27	.26	1.259	.178	-.10	.62	1.461	49	.150
AQ28 – WQ28	***-.36***	***1.223***	***.178***	***-.72***	***.00***	***-2.027***	***46***	***.048***
AQ29 – WQ29	.17	1.267	.174	-.18	.52	.976	52	.334
AQ30 – WQ30	-.23	1.567	.217	-.67	.21	-1.062	51	.293
AQ31 – WQ31	-.06	1.049	.150	-.36	.24	-.409	48	.685
AQ32 – WQ32	***-.40***	***1.498***	***.216***	***-.83***	***.04***	***-1.831***	***47***	***.074***
AQ33 – WQ33	.00	1.161	.169	-.34	.34	.000	46	1.000
AQ34 – WQ34	-.14	1.457	.222	-.59	.31	-.628	42	.533
AQ35 – WQ35	.00	1.155	.176	-.36	.36	.000	42	1.000
AQ36 – WQ36	-.02	1.387	.217	-.46	.41	-.113	40	.911

Survey Results

Overall, munitions users chose WST as the more favorable application. All but two construct measures supported the overall rating of the application. Munitions personnel liked the screen layout of AMST better than that of WST even though WST seemed to be the application that better used terminology familiar to munitions personnel. WST was also the easier of the two applications to manipulate although the AMST help features were identified as the better of the two. The Warrior Support Tool provided

information in a timelier manner than did the Agile Munitions Support Tool. The importance and performance of the features available in each application was also in favor of WST. Table 4 displays the results of the survey.

Table 4. Survey Summary Statistics

Construct	AMST μ	AMST σ	WST μ	WST σ	Diff of Mean
Overall Satisfaction **(1-3)**					
Q1	4.50	1.589	4.78	1.180	-.28
Q2	4.41	1.641	4.65	1.494	-.24
Q3	4.48	1.595	4.48	1.362	.00
Screen Layout **(4-6)**					
Q4	4.75	1.625	4.81	1.332	-.07
Q5	5.08	1.666	4.89	1.450	.20
Q6	5.34	1.606	4.90	1.471	.45
Text Communication & Terminology **(7-9)**					
Q7	5.40	1.426	5.28	1.268	.12
Q8	4.69	1.591	4.77	1.409	-.08
Q9	4.14	1.414	4.38	1.338	-.24
Ease of Use/Learning **(10-20)** *- Learning (10-12)* *- Intuitive (13-15)* *- Presentation (16-18)* *- Novice Friendly (19-20)*					
Q10	4.44	1.695	4.59	1.452	-.15
Q11	4.78	1.833	4.85	1.471	-.07
Q12	4.09	1.567	4.56	1.512	-.47
Q13	4.50	1.625	4.62	1.531	-.12
Q14	4.67	1.560	4.81	1.444	-.14
Q15	4.66	1.573	4.57	1.476	.09
Q16	4.60	1.533	4.66	1.433	-.05
Q17	4.55	1.572	4.75	1.430	-.20
Q18	4.27	1.578	4.43	1.425	-.16
Q19	4.26	1.639	4.26	1.562	.00
Q20	4.27	1.517	4.23	1.630	.03
Online Help **(21-23)**					
Q21	4.85	1.660	4.43	1.615	.41
Q22	5.26	1.626	4.60	1.629	.66
Q23	4.60	1.570	4.34	1.632	.26
Speed **(24-26)**					
Q24	4.42	1.816	4.94	1.329	-.52
Q25	4.22	1.811	4.58	1.522	-.36
Q26	4.21	1.971	4.55	1.569	-.34
Importance of Features **(27-31)**					
Q27	5.32	1.377	5.06	1.504	.26
Q28	4.62	1.423	4.98	1.375	-.36
Q29	5.45	1.338	5.28	1.536	.17
Q30	4.79	1.473	5.02	1.407	-.23
Q31	5.37	1.334	5.43	1.486	-.06
Performance of Features **(32-36)**					
Q32	4.69	1.504	5.08	1.499	-.40
Q33	5.28	1.394	5.28	1.542	.00
Q34	4.74	1.399	4.88	1.159	-.14
Q35	5.14	1.320	5.14	1.597	.00
Q36	4.66	1.296	4.68	1.422	-.02

The survey participants were also asked to identify any features they thought should be added to the applications to enable them to better meet the needs of the munitions community and to rate their overall experience with each application. In general, all users were satisfied with the applications. No one was "awed" by the capabilities of the application nor were they completely disenchanted with the capabilities. Appendix C provides the comments that were made in regards to the applications.

Open forum interviews were also conducted after the surveying period to identify any additional concerns or thoughts about the applications. An issue that cannot go unmentioned is that a noticeable pattern emerged in the interviews. Senior level munitions personnel favored the information provided by the Agile Munitions Support Tool over the Warrior Support Tool and the exact opposite was true for junior level munitions personnel. Senior level munitions personnel (MSgt – Capt) gave mention to the fact that AMST provided the exact information they needed to keep mission commanders informed during contingency operations, in transit information. Junior level munitions personnel felt that WST was useful at the craftsman level because of the illustrations and DODIC information. Significant analytical patterns emerged to support the statements in regards to specific information but not for the applications overall. The differences were noticed in questions 3-5, 8-13, 15, 19, and 21for AMST and questions 2-4, 9-19, 21, 24, and 26 for WST. Table 6 shows the mean ratings for the questions as well as the significant level. The complete table can be viewed in Appendix D and the specific questions can be referenced in Appendix A.

Table 5 ANOVA Results

Question	Group	Mean	Sig.
AQ3	Jr./Sr.	5.03/4.04	.015
AQ4	Jr./Sr.	5.34/4.11	.002
AQ5	Jr./Sr.	5.53/4.63	.034
AQ8	Jr./Sr.	5.23/4.13	.006
AQ9	Jr./Sr.	4.64/3.67	.012
AQ10	Jr./Sr.	4.85/3.70	.010
AQ11	Jr./Sr.	5.22/4.11	.017
AQ12	Jr./Sr.	4.47/3.54	.022
AQ13	Jr./Sr.	5.00/3.81	.004
AQ15	Jr./Sr.	5.17/4.15	.012
AQ19	Jr./Sr.	4.77/3.62	.006
AQ21	Jr./Sr.	5.19/4.29	.043

Question	Group	Mean	Sig.
WQ2	Jr./Sr.	5.11/4.12	.007
WQ3	Jr./Sr.	4.89/4.00	.012
WQ4	Jr./Sr.	5.11/4.42	.039
WQ9	Jr./Sr.	4.75/3.91	.020
WQ10	Jr./Sr.	5.00/4.08	.011
WQ11	Jr./Sr.	5.23/4.35	.018
WQ12	Jr./Sr.	5.00/4.00	.010
WQ13	Jr./Sr.	5.14/4.00	.003
WQ14	Jr./Sr.	5.17/4.33	.026
WQ15	Jr./Sr.	5.15/3.80	.000
WQ16	Jr./Sr.	5.03/4.30	.042
WQ17	Jr./Sr.	5.06/4.35	.047
WQ18	Jr./Sr.	4.91/3.88	.004
WQ26	Jr./Sr.	4.97/3.96	.011
WQ19	Jr./Sr.	4.67/3.73	.015
WQ21	Jr./Sr.	5.00/4.00	.027
WQ24	Jr./Sr.	5.25/4.52	.028

On the surveys, questions 1 through 3 referred to the overall rating of the applications. Questions 4 through 6 aimed to identify which application had the better screen layout. Questions 7 through 9 considered the communication and terminology of the applications. Questions 10 through 18 as well as 25 and 26 referred to the ease of using the applications. Questions 19 through 21 focused on the help features of the applications and 22 through 24 attempted to get a rating on the speed and functionality.

How supportable is each application in terms of information needs versus existing systems?

Based on the results of the survey and interviews with developers, both applications are very supportable in terms of information needs versus existing systems. Both applications receive munitions information from the legacy systems that are currently in use in the munitions community. The applications only show the information

that is fed to them in a more user-friendly nature. Two major concerns that were identified in terms of the supportability of the applications were:

1. Security measures for the applications need to b
   e addressed since they are both web-based applications that display sensitive information.
2. Some sort of training class or program needs to be developed to assist users in manipulating the applications more effectively.

With both applications receiving information from legacy systems, the user needs to be aware of the garbage in garbage out syndrome. The accuracy of the information received on either application is only as good as the individual putting the original information in one of the given legacy systems.

Summary

In this chapter, the comparative results between the Warrior Support Tool and the Agile Munitions Support Tool were presented. Discussion as to the ideal application was also presented as well as suggestions for further research. Munitions users determined that a useful munitions IT application would track assets and expenditures, identify munitions shortages and availability, and provide requisition history information. WST was able to track assets and expenditures, identify munitions shortages and availability, and provide simulation capabilities and aircraft compatibility features. AMST was able to track assets and expenditures, identify munitions shortages and availability, provide requisition history information, and track ISIR information. Overall, each application

met users' needs and was supportable versus existing systems because they are fed by the existing legacy systems however, WST was chosen as the more favorable application. In the following chapter, the research questions will be discussed a bit further to provide insight as to the driving force behind this research.

V. Conclusion and Recommendations

Overview

This chapter discusses the results of the statistical analyses performed in Chapter IV. The analyses are discussed in reference to the investigative questions that were posed and conclusions regarding this research are drawn. Additionally, this chapter discusses the limitations of the research as well as the theoretical and practical implications of the research results. The final section of this chapter suggests further research focusing on the munitions information technology applications that were studied.

Summary of Findings

What are the customer needs?

126 specific needs were identified from the analysis of the documents, which were eventually categorized under 6 major headings. For an IT application to be useful in the munitions community, it had to:

1. Track munitions assets and all up rounds.
2. Track munitions expenditures.
3. Identify munitions shortages.
4. Identify available munitions.
5. Track in transit assets.
6. Provide requisition history for assets.

What does each application provide?

The application capabilities were identified through the use of presentations and interviews with system developers, planning documents available via the web, literature devoted to WST and AMST application capabilities, and manipulation of the applications. A survey was also developed for munitions personnel to identify and/or validate the capabilities and ease of manipulating the applications. It was found that WST is capable of providing asset locations, balances, condition codes, expenditure rates, asset and aircraft compatibility, and simulation capabilities. The AMST application was found to be able to provide asset locations, balances, expenditure rates, simulation capabilities, asset requisition history information, in transit asset visibility, and ISIR information.

How well does each application meet the needs?

WST does not adequately track in transit assets or provide requisition history. However, the Warrior Support Tool received praise on all of the other features it provided. As for the requisition history feature, the application did not directly provide an in-depth report of requisition history but the information can be obtained through reverse engineering and deductive reasoning. One must be aware that by obtaining the information through reverse engineering, miscalculations can be made.

AMST also received excellent praise but concern was expressed as to the speed of the application and the fact that too much information had to be manually input into the application. Munitions users preferred the point and click features that were available through the WST application over the NSN input requirement of the AMST application.

Extreme concern was expressed as to the level of security provided for both applications. Munitions personnel acknowledged the understanding that CAS was being declassified but were concerned with the fact that the available munitions information was still sensitive in nature.

Based on these inputs, the following recommendations for action and/or further research were presented to rectify the concerns.

1. Investigate the requirements and feasibility of incorporating an in transit tracking feature and requisition history feature in the Warrior Support Tool.
2. Investigate avenues available to limit the amount of information input required by the user to manipulate the Agile Munitions Support Tool.
3. Conduct an in-depth study into the required hardware needed to effectively manipulate the applications to ensure availability of timely information.
4. Conduct an in-depth study into the security issues surrounding military sensitive information and the use of web-based IT applications.

How supportable is each application in terms of information needs versus existing systems?

Based on the results of the survey and interviews with developers, both applications are very supportable in terms of information needs versus existing systems. Both applications receive munitions information from the legacy systems that are currently in use in the munitions community. The applications only show the information

that is fed to them in a more user-friendly nature. Two major concerns that were identified in terms of the supportability of the applications were:

1. Security measures for the applications need to be addressed since they are both web-based application that display sensitive information.
2. Some sort of training class or program needs to be developed to assist users in manipulating the applications more effectively.

With both applications receiving information from legacy systems, the user needs to be aware of the garbage in garbage out syndrome. The accuracy of the information received from either application is only as good as the individual putting the original information in one of the given legacy systems.

As to the objective of identifying if one IT application will suffice in the munitions community, the answer is yes but a determination as to which application should be used needs to be determined through further analysis. Cost analysis and more in-depth field-testing should be administered before such a decision is made. This research only lays a foundation for the development of such future research endeavors.

Limitations

It quickly became apparent that the most significant limitation of this research was that the IT applications that were being compared in this study were new to the munitions community, which limited the amount of valuable user knowledge available for the research. As such, subject matter experts were used almost exclusively to

facilitate an accurate understanding of the operational aspects of both applications. The subject matter experts were mostly developers that were responsible for fielding the applications, which brought about another limitation in that bias could have crept in to the study. A system developer will naturally favor the system or application that he or she is developing.

Another limitation emerged during the surveying sessions. An unbiased scenario for the operational testing of both applications was created as well as an adequate understanding of the operational aspects of each application. However, the computer lab that was used experienced a number of computer problems during the application manipulation sessions. Gateway Pentium 3 computers were in use but many of them locked up or timed out when munitions users were attempting to retrieve information. To overcome the frustration that some of the sampling population may have experienced, actual users of the applications were going to be sampled. However, with the applications being web-based, it was hard to obtain records of actual users of the system. The number of accounts that were awarded was known but the frequency of use was not. That aspect made identifying actual "full-time" users almost impossible.

Comments accompanying the survey responses suggested another limitation. The sampling population could have been a bit larger because a learning curve may have been present in that computer literate people may have pick up on the manipulation of the applications quicker than those that did not spend a great deal of time on computers. Everyone was asked to perform the same tasks, however, there may have been munitions users in the sampling population that did not know how to perform a given task.

Implications

The 1990s began the surge in the growth of information technology. Many creative ways of collecting and managing information were established to provide useful data to decision makers to improve the decision making process. A great deal of time and effort is spent manually pulling, compiling, and analyzing munitions data to provide meaningful information to facilitate the decision making process. A munitions IT application that can automatically pull munitions data from existing legacy ammunition information systems and combine that data to paint a complete picture for the user will provide a noticeable edge to the flexibility of administering munitions power. Such a technology will provide commanders and munitions users the tools and information necessary to make the timely and proactive decisions necessary to keep our United States military poised to respond to world crises**.** The benefits would be the quick availability of reliable information whenever it was needed; the elimination of separate records or other local documents, along with the required time to maintain them; and the maintainability of accurate, timely information in munitions legacy databases.

Recommendations for Action/Further Research

The recommendations for further research involve security measures and Internet capabilities. First, WST and AMST will display information contained in CAS over the Internet. Although munitions information in CAS has been declassified, it is still sensitive. Munitions planners and users need to understand the security features and measures of the two applications as well as the plan and reliability of the applications to

protect sensitive munitions information. Specifically, they must determine how well WST and AMST provide necessary security measures for the protection of sensitive munitions data in order to meet the needs of the munitions community. A few investigative questions that may lead to an answer are:

1. What are the security measures incorporated in WST and AMST?
   a) How do the security features operate?
   b) What backup procedures are available to meet security requirements?
2. How well do WST and AMST guard against hacking?
   a) What security guards have been developed?
   b) How reliable is the up time of the security guards?
3. How can the applications be improved to better provide secure munitions information?

Secondly, munitions planners and users need to understand the contingency plan to provide needed munitions information under austere working conditions where Internet connections are not available. In particular, they must determine how to provide web-based munitions information to locations that do not have access to fiber optic cables for Internet connectivity. Some investigative questions that may lead to an answer are as follows:

1. What contingency plans or equipment have been developed to enable successful manipulation of the WST and AMST applications in austere environments?
   a) How detailed is the contingency plan?
   b) What is the cost of additional equipment to support operational needs?

2. How well do WST and AMST operate in austere conditions?

   a) Are there significant differences in the performance time of the systems?

   b) Are security measures compromised?

3. How can the applications be improved to better provide munitions information in austere working conditions?

Finally, an addition to this comparative study that could warrant further research is an analysis of each application by expert users of the opposite application. Specifically, have a fluent user of WST manipulate the AMST application and AMST users manipulate WST to determine how easy and user friendly the applications are. Additionally, they should truly be able to identify how well each application meets the needs of the munitions community.

APPENDIX A

QUESTIONAIRES

AFIT-2002-09-WST

Purpose: The purpose of this research is to investigate the ability of the Warrior Support Tool (WST) to meet the needs of the munitions community.

Participation: You are one of several munitions subject matter experts asked to participate in this research. Thank you in advance for participating—your answers are very important.

Confidentiality: All answers are anonymous. No identification of individual responses will occur.
Privacy Notice

In accordance with AFI 37-132, Paragraph 3.2, the following information is provided as required by the Privacy Act of 1974:

Authority: 10 U.S.C. 8012, Secretary of the Air Force; powers and duties; delegation by; implemented by AFI 36-2601, Air Force Personnel Survey Program.

Purpose: To obtain information regarding the capabilities of WST.

Routine Use: No analysis of individual responses will be conducted and only members of the research team will be permitted access to the raw data.

Participation: Participation is VOLUNTARY. No adverse action will be taken against any member who does not participate in this survey or who does not complete any part of the survey.

This survey is designed to determine the ability of the WST to meet the needs of the munitions community.

SECTION 2: User Profile:

Sex (*please check one*): ____ Male ___ Female MAJCOM: _____

Duty Title: _____ Rank: _____

AFSC: _____ Years in AFSC: _____

How much previous experience do you have with the WST application? _____ hours

In a typical week, how much time do you spend on a computer? _____ hours

In a typical week, how much time do you spend with CAS? _____ hours

Rate your experience with computer applications. novice expert

1 2 3 4 5 6 7

Briefly describe the sorts of tasks you perform on computers in general.

_____

_____

_____

SECTION 2: General Knowledge Level:

Please rate the series of questions *based on your perceived knowledge level of each category.* Please circle the numbers that most appropriately reflect your impressions about using WST. Not Applicable = N/A

1. Novices can accomplish tasks knowing only a few commands. difficultly easily
   1 2 3 4 5 6 7 n/a
2. Time it takes WST to respond during operations. slow fast
   1 2 3 4 5 6 7 n/a
3. Accessing help messages. difficult easy
   1 2 3 4 5 6 7 n/a
4. Task completion follows a logical sequence. rarely always
   1 2 3 4 5 6 7 n/a
5. How would you rate operating with WST? frustrating satisfying
   1 2 3 4 5 6 7 n/a
6. Getting started with WST. difficult easy
   1 2 3 4 5 6 7 n/a
7. Arrangement of information on screen. illogical logical
   1 2 3 4 5 6 7 n/a

8. Messages that appear on the screen.	confusing	1	2	3	4	5	6	7 clear	n/a
9. Exploration of WST features.	risky	1	2	3	4	5	6	7 safe	n/a
10. Are terms related to munitions operations?	unrelated	1	2	3	4	5	6	7 related	n/a
11. Speed of application.	slow	1	2	3	4	5	6	7 fast	n/a
12. Help messages.	confusing	1	2	3	4	5	6	7 clear	n/a
13. Is task performance straightforward?	never	1	2	3	4	5	6	7 always	n/a
14. Are needs of experienced and inexperienced users considered?	never	1	2	3	4	5	6	7 always	n/a
15. Overall, how would you characterize WST?	difficult	1	2	3	4	5	6	7 easy	n/a
16. Learning to operate WST.	difficult	1	2	3	4	5	6	7 easy	n/a
17. Exploration of WST features by trial and error.	discouraging	1	2	3	4	5	6	7 encouraging	n/a
18. Were the screen layouts helpful?	never	1	2	3	4	5	6	7 always	n/a
19. Time it takes WST to display information.	slow	1	2	3	4	5	6	7 fast	n/a
20. How would you rate the performance of WST?	rigid	1	2	3	4	5	6	7 flexible	n/a
21. Going back to the previous screen.	impossible	1	2	3	4	5	6	7 easy	n/a
22. Discovering new features in WST.	difficult	1	2	3	4	5	6	7 easy	n/a
23. Users can control amount of feedback	never	1	2	3	4	5	6	7 always	n/a
24. Completion of a sequence of steps.	unclear	1	2	3	4	5	6	7 clear	n/a
25. Time to learn WST.	slow	1	2	3	4	5	6	7 fast	n/a

26. Quality of help messages. inadequate adequate
1 2 3 4 5 6 7 n/a

27. How important is the asset location feature? unimportant important
1 2 3 4 5 6 7 n/a

28. Rate the performance of the asset location feature. marginal outstanding
1 2 3 4 5 6 7 n/a

29. How important is the asset balance feature? unimportant important
1 2 3 4 5 6 7 n/a

30. Rate the performance of the asset balance feature. marginal outstanding
1 2 3 4 5 6 7 n/a

31. How important is the condition code feature? unimportant important
1 2 3 4 5 6 7 n/a

32. Rate the performance of the condition code feature. marginal outstanding
1 2 3 4 5 6 7 n/a

33. How important is the expenditure feature? unimportant important
1 2 3 4 5 6 7 n/a

34. Rate the performance of the expenditure feature. marginal outstanding
1 2 3 4 5 6 7 n/a

35. How important is the compatibility feature? unimportant important
1 2 3 4 5 6 7 n/a

36. Rate the performance of the compatibility feature. marginal outstanding
1 2 3 4 5 6 7 n/a

37. Identify any features that you feel should be incorporated in the WST application.

_____

_____

_____

38. Overall, how would you rate your experience with WST?

_____

_____

_____

AFIT-2002-09-AMST

Purpose: The purpose of this research is to investigate the ability of the Agile Munitions Support Tool (AMST) to meet the needs of the munitions community.

Participation: You are one of several munitions subject matter experts asked to participate in this research. Thank you in advance for participating—your answers are very important.

Confidentiality: All answers are anonymous. No identification of individual responses will occur.
Privacy Notice

In accordance with AFI 37-132, Paragraph 3.2, the following information is provided as required by the Privacy Act of 1974:

Authority: 10 U.S.C. 8012, Secretary of the Air Force; powers and duties; delegation by; implemented by AFI 36-2601, Air Force Personnel Survey Program.

Purpose: To obtain information regarding the capabilities of AMST.

Routine Use: No analysis of individual responses will be conducted and only members of the research team will be permitted access to the raw data.

Participation: Participation is VOLUNTARY. No adverse action will be taken against any member who does not participate in this survey or who does not complete any part of the survey.

This survey is designed to determine the ability of the AMST to meet the needs of the munitions community.

SECTION 2: User Profile:

Sex (*please check one*): ____ Male ___ Female MAJCOM: _____

Duty Title: _____ Rank: _____

AFSC: _____ Years in AFSC: _____

How much previous experience do you have with the AMST application? _____ hours

In a typical week, how much time do you spend on a computer? _____ hours

In a typical week, how much time do you spend with CAS? _____ hours

Rate your experience with computer applications. novice expert

1 2 3 4 5 6 7

Briefly describe the sorts of tasks you perform on computers in general.

_____

_____

_____

SECTION 2: General Knowledge Level:

Please rate the series of questions *based on your perceived knowledge level of each category.* Please circle the numbers that most appropriately reflect your impressions about using AMST. Not Applicable = N/A

1. Novices can accomplish tasks knowing only a few commands. difficultly easily
   1 2 3 4 5 6 7 n/a
2. Time it takes AMST to respond during operations. slow fast
   1 2 3 4 5 6 7 n/a
3. Accessing help messages. difficult easy
   1 2 3 4 5 6 7 n/a
4. Task completion follows a logical sequence. rarely always
   1 2 3 4 5 6 7 n/a
5. How would you rate operating with AMST? frustrating satisfying
   1 2 3 4 5 6 7 n/a
6. Getting started with AMST. difficult easy
   1 2 3 4 5 6 7 n/a

7. Arrangement of information on screen.	illogical	1	2	3	4	5	6	logical 7	n/a
8. Messages that appear on the screen.	confusing	1	2	3	4	5	6	clear 7	n/a
9. Exploration of AMST features.	risky	1	2	3	4	5	6	safe 7	n/a
10. Are terms related to munitions operations?	unrelated	1	2	3	4	5	6	related 7	n/a
11. Speed of application.	slow	1	2	3	4	5	6	fast 7	n/a
12. Help messages.	confusing	1	2	3	4	5	6	clear 7	n/a
13. Is task performance straightforward?	never	1	2	3	4	5	6	always 7	n/a
14. Are needs of experienced and inexperienced users considered?	never	1	2	3	4	5	6	always 7	n/a
15. Overall, how would you characterize AMST?	difficult	1	2	3	4	5	6	easy 7	n/a
16. Learning to operate AMST.	difficult	1	2	3	4	5	6	easy 7	n/a
17. Exploration of WST features by trial and error.	discouraging	1	2	3	4	5	6	encouraging 7	n/a
18. Were the screen layouts helpful?	never	1	2	3	4	5	6	always 7	n/a
19. Time it takes WST to display information.	slow	1	2	3	4	5	6	fast 7	n/a
20. How would you rate the performance of AMST?	rigid	1	2	3	4	5	6	flexible 7	n/a
21. Going back to the previous screen.	impossible	1	2	3	4	5	6	easy 7	n/a
22. Discovering new features in AMST.	difficult	1	2	3	4	5	6	easy 7	n/a
23. Users can control amount of feedback	never	1	2	3	4	5	6	always 7	n/a
24. Completion of a sequence of steps.	unclear	1	2	3	4	5	6	clear 7	n/a

25. Time to learn AMST. slow fast
1 2 3 4 5 6 7 n/a

26. Quality of help messages. inadequate adequate
1 2 3 4 5 6 7 n/a

27. How important is the intransit feature? unimportant important
1 2 3 4 5 6 7 n/a

28. Rate the performance of the intransit feature. marginal outstanding
1 2 3 4 5 6 7 n/a

29. How important is the asset balance feature? unimportant important
1 2 3 4 5 6 7 n/a

30. Rate the performance of the asset balance feature. marginal outstanding
1 2 3 4 5 6 7 n/a

31. How important is the expenditure feature? unimportant important
1 2 3 4 5 6 7 n/a

32. Rate the performance of the expenditure feature. marginal outstanding
1 2 3 4 5 6 7 n/a

33. How important is the requisition history feature? unimportant important
1 2 3 4 5 6 7 n/a

34. Rate the performance of the requisition history feature. marginal outstanding
1 2 3 4 5 6 7 n/a

35. How important is the ISIR information feature? unimportant important
1 2 3 4 5 6 7 n/a

36. Rate the performance of the ISIR information feature. marginal outstanding
1 2 3 4 5 6 7 n/a

37. Identify any features that you feel should be incorporated in the AMST application.

_____

_____

_____

38. Overall, how would you rate your experience with AMST?

_____

_____

_____

APPENDIX B

WST Factors

	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7	WQ8	WQ9	WQ10	WQ11	WQ12	WQ13	WQ14	WQ15	WQ16	WQ17	WQ18
WQ1	1.000	0.755	0.776	0.754	0.681	0.632	0.727	0.681	0.794	0.808	0.783	0.678	0.731	0.717	0.699	0.751	0.700	0.655
WQ2	0.755	1.000	0.854	0.655	0.716	0.835	0.568	0.837	0.829	0.851	0.833	0.789	0.816	0.889	0.827	0.806	0.712	0.807
WQ3	0.776	0.854	1.000	0.707	0.596	0.728	0.588	0.743	0.817	0.798	0.811	0.731	0.778	0.812	0.807	0.791	0.687	0.759
WQ4	0.754	0.655	0.707	1.000	0.742	0.644	0.765	0.698	0.675	0.674	0.651	0.693	0.680	0.657	0.767	0.769	0.732	0.706
WQ5	0.681	0.716	0.596	0.742	1.000	0.723	0.665	0.799	0.601	0.655	0.643	0.714	0.645	0.645	0.675	0.744	0.848	0.797
WQ6	0.632	0.835	0.728	0.644	0.723	1.000	0.378	0.806	0.747	0.757	0.804	0.710	0.746	0.784	0.755	0.699	0.631	0.726
WQ7	0.727	0.568	0.588	0.765	0.665	0.378	1.000	0.561	0.588	0.555	0.533	0.570	0.543	0.528	0.568	0.705	0.720	0.650
WQ8	0.681	0.837	0.743	0.698	0.799	0.806	0.561	1.000	0.739	0.718	0.726	0.801	0.779	0.742	0.725	0.806	0.793	0.859
WQ9	0.794	0.829	0.817	0.675	0.601	0.747	0.588	0.739	1.000	0.837	0.857	0.689	0.727	0.813	0.824	0.735	0.603	0.733
WQ10	0.808	0.851	0.798	0.674	0.655	0.757	0.555	0.718	0.837	1.000	0.946	0.718	0.821	0.858	0.806	0.800	0.693	0.705
WQ11	0.783	0.833	0.811	0.651	0.643	0.804	0.533	0.726	0.857	0.946	1.000	0.722	0.844	0.873	0.814	0.831	0.679	0.747
WQ12	0.678	0.789	0.731	0.693	0.714	0.710	0.570	0.801	0.689	0.718	0.722	1.000	0.845	0.826	0.813	0.832	0.776	0.853
WQ13	0.731	0.816	0.778	0.680	0.645	0.746	0.543	0.779	0.727	0.821	0.844	0.845	1.000	0.871	0.875	0.876	0.714	0.810
WQ14	0.717	0.889	0.812	0.657	0.645	0.784	0.528	0.742	0.813	0.858	0.873	0.826	0.871	1.000	0.865	0.819	0.669	0.797
WQ15	0.699	0.827	0.807	0.767	0.675	0.755	0.568	0.725	0.824	0.806	0.814	0.813	0.875	0.865	1.000	0.848	0.652	0.841
WQ16	0.751	0.806	0.791	0.769	0.744	0.699	0.705	0.806	0.735	0.800	0.831	0.832	0.876	0.819	0.848	1.000	0.822	0.847
WQ17	0.700	0.712	0.687	0.732	0.848	0.631	0.720	0.793	0.603	0.693	0.679	0.776	0.714	0.669	0.652	0.822	1.000	0.820
WQ18	0.655	0.807	0.759	0.706	0.797	0.726	0.650	0.859	0.733	0.705	0.747	0.853	0.810	0.797	0.841	0.847	0.820	1.000
WQ19	0.528	0.727	0.635	0.540	0.547	0.526	0.495	0.674	0.599	0.629	0.634	0.726	0.635	0.751	0.623	0.598	0.657	0.785
WQ20	0.695	0.831	0.699	0.571	0.605	0.634	0.496	0.696	0.689	0.739	0.744	0.717	0.664	0.734	0.621	0.645	0.652	0.699
WQ21	0.523	0.748	0.578	0.659	0.678	0.688	0.517	0.784	0.577	0.670	0.686	0.781	0.788	0.731	0.733	0.729	0.749	0.807
WQ22	0.563	0.751	0.620	0.519	0.652	0.596	0.527	0.719	0.627	0.665	0.670	0.679	0.532	0.672	0.602	0.622	0.655	0.718
WQ23	0.573	0.739	0.664	0.549	0.659	0.655	0.564	0.793	0.677	0.689	0.716	0.747	0.610	0.674	0.626	0.682	0.690	0.761
WQ24	0.400	0.614	0.579	0.433	0.333	0.695	0.306	0.511	0.592	0.613	0.654	0.389	0.583	0.722	0.566	0.555	0.339	0.457
WQ25	0.558	0.650	0.598	0.518	0.429	0.505	0.524	0.480	0.585	0.639	0.658	0.558	0.641	0.696	0.566	0.734	0.607	0.465
WQ26	0.626	0.590	0.661	0.650	0.480	0.576	0.531	0.428	0.606	0.663	0.698	0.605	0.678	0.750	0.697	0.688	0.614	0.586
WQ27	0.712	0.410	0.501	0.568	0.544	0.199	0.741	0.482	0.455	0.430	0.356	0.474	0.412	0.380	0.349	0.517	0.664	0.428
WQ28	0.787	0.686	0.718	0.599	0.667	0.464	0.648	0.616	0.593	0.607	0.566	0.619	0.637	0.650	0.594	0.722	0.743	0.633
WQ29	0.717	0.471	0.516	0.521	0.585	0.303	0.599	0.483	0.505	0.474	0.426	0.501	0.422	0.455	0.374	0.430	0.695	0.452
WQ30	0.656	0.480	0.531	0.569	0.591	0.315	0.600	0.485	0.466	0.452	0.426	0.514	0.519	0.464	0.457	0.504	0.728	0.538
WQ31	0.714	0.592	0.523	0.584	0.684	0.381	0.714	0.555	0.523	0.515	0.457	0.564	0.520	0.569	0.514	0.614	0.716	0.540
WQ32	0.663	0.535	0.466	0.558	0.750	0.373	0.706	0.531	0.461	0.504	0.495	0.634	0.568	0.554	0.548	0.725	0.771	0.636
WQ33	0.668	0.532	0.473	0.575	0.635	0.300	0.696	0.533	0.489	0.477	0.371	0.484	0.471	0.470	0.470	0.521	0.674	0.471
WQ34	0.671	0.526	0.485	0.544	0.666	0.390	0.639	0.486	0.509	0.523	0.510	0.540	0.604	0.573	0.568	0.641	0.700	0.584
WQ35	0.696	0.483	0.538	0.475	0.585	0.259	0.611	0.518	0.490	0.430	0.358	0.481	0.403	0.432	0.402	0.507	0.628	0.480
WQ36	0.747	0.501	0.530	0.524	0.673	0.349	0.630	0.456	0.515	0.442	0.468	0.515	0.474	0.466	0.484	0.575	0.632	0.537

	WQ19	WQ20	WQ21	WQ22	WQ23	WQ24	WQ25	WQ26	WQ27	WQ28	WQ29	WQ30	WQ31	WQ32	WQ33	WQ34	WQ35	WQ36
WQ1	0.528	0.695	0.523	0.563	0.573	0.400	0.558	0.626	0.712	0.787	0.717	0.656	0.714	0.663	0.668	0.671	0.696	0.747
WQ2	0.727	0.831	0.748	0.751	0.739	0.614	0.650	0.590	0.410	0.686	0.471	0.480	0.592	0.535	0.532	0.526	0.483	0.501
WQ3	0.635	0.699	0.578	0.620	0.664	0.579	0.598	0.661	0.501	0.718	0.516	0.531	0.523	0.466	0.473	0.485	0.538	0.530
WQ4	0.540	0.571	0.659	0.519	0.549	0.433	0.518	0.650	0.568	0.599	0.521	0.569	0.584	0.558	0.575	0.544	0.475	0.524
WQ5	0.547	0.605	0.678	0.652	0.659	0.333	0.429	0.480	0.544	0.667	0.585	0.591	0.684	0.750	0.635	0.666	0.585	0.673
WQ6	0.526	0.634	0.688	0.596	0.655	0.695	0.505	0.576	**0.199**	0.464	0.303	0.315	0.381	0.373	0.300	0.390	**0.259**	0.349
WQ7	0.495	0.496	0.517	0.527	0.564	0.306	0.524	0.531	0.741	0.648	0.599	0.600	0.714	0.706	0.696	0.639	0.611	0.630
WQ8	0.674	0.696	0.784	0.719	0.793	0.511	0.480	0.428	0.482	0.616	0.483	0.485	0.555	0.531	0.533	0.486	0.518	0.456
WQ9	0.599	0.689	0.577	0.627	0.677	0.592	0.585	0.606	0.455	0.593	0.505	0.466	0.523	0.461	0.489	0.509	0.490	0.515
WQ10	0.629	0.739	0.670	0.665	0.689	0.613	0.639	0.663	0.430	0.607	0.474	0.452	0.515	0.504	0.477	0.523	0.430	0.442
WQ11	0.634	0.744	0.686	0.670	0.716	0.654	0.658	0.698	0.356	0.566	0.426	0.426	0.457	0.495	0.371	0.510	0.358	0.468
WQ12	0.726	0.717	0.781	0.679	0.747	0.389	0.558	0.605	0.474	0.619	0.501	0.514	0.564	0.634	0.484	0.540	0.481	0.515
WQ13	0.635	0.664	0.788	0.532	0.610	0.583	0.641	0.678	0.412	0.637	0.422	0.519	0.520	0.568	0.471	0.604	0.403	0.474
WQ14	0.751	0.734	0.731	0.672	0.674	0.722	0.696	0.750	0.380	0.650	0.455	0.464	0.569	0.554	0.470	0.573	0.432	0.466
WQ15	0.623	0.621	0.733	0.602	0.626	0.566	0.566	0.697	0.349	0.594	0.374	0.457	0.514	0.548	0.470	0.568	0.402	0.484
WQ16	0.598	0.645	0.729	0.622	0.682	0.555	0.734	0.688	0.517	0.722	0.430	0.504	0.614	0.725	0.521	0.641	0.507	0.575
WQ17	0.657	0.652	0.749	0.655	0.690	0.339	0.607	0.614	0.664	0.743	0.695	0.728	0.716	0.771	0.674	0.700	0.628	0.632
WQ18	0.785	0.699	0.807	0.718	0.761	0.457	0.465	0.586	0.428	0.633	0.452	0.538	0.540	0.636	0.471	0.584	0.480	0.537
WQ19	1.000	0.853	0.770	0.731	0.716	0.346	0.446	0.504	0.419	0.507	0.523	0.522	0.506	0.455	0.441	0.432	0.421	0.350
WQ20	0.853	1.000	0.703	0.734	0.695	0.341	0.534	0.524	0.430	0.593	0.540	0.505	0.538	0.488	0.457	0.443	0.464	0.517
WQ21	0.770	0.703	1.000	0.622	0.683	0.418	0.565	0.517	0.339	0.444	0.411	0.467	0.478	0.495	0.463	0.473	**0.289**	0.314
WQ22	0.731	0.734	0.622	1.000	0.889	0.386	0.368	0.391	0.339	0.458	0.438	0.410	0.455	0.443	0.386	0.337	0.361	0.393
WQ23	0.716	0.695	0.683	0.889	1.000	0.416	0.421	0.376	0.428	0.515	0.454	0.460	0.458	0.471	0.451	0.415	0.365	0.377
WQ24	0.346	0.341	0.418	0.386	0.416	1.000	0.601	0.633	**0.034**	0.342	**0.023**	**0.119**	**0.203**	**0.153**	**0.140**	0.300	**0.073**	**0.101**
WQ25	0.446	0.534	0.565	0.368	0.421	0.601	1.000	0.765	0.459	0.622	0.419	0.440	0.569	0.589	0.475	0.583	0.395	0.431
WQ26	0.504	0.524	0.517	0.391	0.376	0.633	0.765	1.000	0.372	0.598	0.440	0.505	0.530	0.580	0.385	0.614	0.416	0.513
WQ27	0.419	0.430	0.339	0.339	0.428	0.034	0.459	0.372	1.000	0.774	0.891	0.737	0.872	0.747	0.892	0.709	0.872	0.704
WQ28	0.507	0.593	0.444	0.458	0.515	0.342	0.622	0.598	0.774	1.000	0.738	0.763	0.831	0.824	0.807	0.832	0.797	0.816
WQ29	0.523	0.540	0.411	0.438	0.454	0.023	0.419	0.440	0.891	0.738	1.000	0.841	0.860	0.706	0.852	0.720	0.848	0.745
WQ30	0.522	0.505	0.467	0.410	0.460	0.119	0.440	0.505	0.737	0.763	0.841	1.000	0.726	0.700	0.756	0.845	0.679	0.739
WQ31	0.506	0.538	0.478	0.455	0.458	0.203	0.569	0.530	0.872	0.831	0.860	0.726	1.000	0.879	0.931	0.815	0.886	0.769
WQ32	0.455	0.488	0.495	0.443	0.471	0.153	0.589	0.580	0.747	0.824	0.706	0.700	0.879	1.000	0.767	0.879	0.775	0.839
WQ33	0.441	0.457	0.463	0.386	0.451	0.140	0.475	0.385	0.892	0.807	0.852	0.756	0.931	0.767	1.000	0.794	0.839	0.698
WQ34	0.432	0.443	0.473	0.337	0.415	0.300	0.583	0.614	0.709	0.832	0.720	0.845	0.815	0.879	0.794	1.000	0.724	0.835
WQ35	0.421	0.464	0.289	0.361	0.365	0.073	0.395	0.416	0.872	0.797	0.848	0.679	0.886	0.775	0.839	0.724	1.000	0.811
WQ36	0.350	0.517	0.314	0.393	0.377	0.101	0.431	0.513	0.704	0.816	0.745	0.739	0.769	0.839	0.698	0.835	0.811	1.000

APPENDIX C

AMST Factors

	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8	AQ9	AQ10	AQ11	AQ12	AQ13	AQ14	AQ15	AQ16	AQ17	AQ18
AQ1	1.000	0.798	0.790	0.883	0.799	0.783	0.663	0.842	0.739	0.925	0.809	0.839	0.883	0.830	0.840	0.864	0.867	0.872
AQ2	0.798	1.000	0.783	0.719	0.722	0.640	0.688	0.669	0.657	0.791	0.648	0.747	0.693	0.739	0.762	0.778	0.755	0.760
AQ3	0.790	0.783	1.000	0.733	0.719	0.707	0.674	0.712	0.775	0.761	0.640	0.788	0.758	0.755	0.863	0.774	0.766	0.809
AQ4	0.883	0.719	0.733	1.000	0.836	0.754	0.680	0.853	0.780	0.900	0.823	0.761	0.878	0.869	0.869	0.856	0.920	0.840
AQ5	0.799	0.722	0.719	0.836	1.000	0.799	0.879	0.860	0.775	0.845	0.860	0.754	0.780	0.870	0.861	0.848	0.875	0.872
AQ6	0.783	0.640	0.707	0.754	0.799	1.000	0.728	0.848	0.749	0.827	0.845	0.745	0.788	0.784	0.762	0.814	0.835	0.827
AQ7	0.663	0.688	0.674	0.680	0.879	0.728	1.000	0.757	0.712	0.717	0.750	0.716	0.631	0.718	0.793	0.712	0.784	0.791
AQ8	0.842	0.669	0.712	0.853	0.860	0.848	0.757	1.000	0.822	0.879	0.883	0.812	0.883	0.864	0.800	0.883	0.899	0.836
AQ9	0.739	0.657	0.775	0.780	0.775	0.749	0.712	0.822	1.000	0.770	0.807	0.792	0.778	0.762	0.827	0.755	0.816	0.830
AQ10	0.925	0.791	0.761	0.900	0.845	0.827	0.717	0.879	0.770	1.000	0.886	0.848	0.851	0.871	0.862	0.905	0.893	0.874
AQ11	0.809	0.648	0.640	0.823	0.860	0.845	0.750	0.883	0.807	0.886	1.000	0.805	0.817	0.777	0.799	0.833	0.848	0.861
AQ12	0.839	0.747	0.788	0.761	0.754	0.745	0.716	0.812	0.792	0.848	0.805	1.000	0.776	0.803	0.790	0.841	0.815	0.868
AQ13	0.883	0.693	0.758	0.878	0.780	0.788	0.631	0.883	0.778	0.851	0.817	0.776	1.000	0.809	0.801	0.896	0.887	0.851
AQ14	0.830	0.739	0.755	0.869	0.870	0.784	0.718	0.864	0.762	0.871	0.777	0.803	0.809	1.000	0.805	0.890	0.887	0.828
AQ15	0.840	0.762	0.863	0.869	0.861	0.762	0.793	0.800	0.827	0.862	0.799	0.790	0.801	0.805	1.000	0.846	0.861	0.852
AQ16	0.864	0.778	0.774	0.856	0.848	0.814	0.712	0.883	0.755	0.905	0.833	0.841	0.896	0.890	0.846	1.000	0.915	0.849
AQ17	0.867	0.755	0.766	0.920	0.875	0.835	0.784	0.899	0.816	0.893	0.848	0.815	0.887	0.887	0.861	0.915	1.000	0.893
AQ18	0.872	0.760	0.809	0.840	0.872	0.827	0.791	0.836	0.830	0.874	0.861	0.868	0.851	0.828	0.852	0.849	0.893	1.000
AQ19	0.719	0.551	0.639	0.744	0.779	0.772	0.632	0.737	0.652	0.699	0.723	0.703	0.755	0.816	0.663	0.725	0.753	0.828
AQ20	0.696	0.630	0.675	0.701	0.775	0.651	0.697	0.737	0.747	0.750	0.702	0.722	0.605	0.845	0.733	0.724	0.723	0.773
AQ21	0.790	0.736	0.750	0.828	0.919	0.798	0.854	0.822	0.723	0.851	0.815	0.730	0.746	0.848	0.865	0.823	0.845	0.830
AQ22	0.727	0.512	0.626	0.820	0.811	0.790	0.701	0.809	0.738	0.794	0.788	0.640	0.754	0.820	0.733	0.756	0.853	0.804
AQ23	0.776	0.694	0.728	0.816	0.840	0.749	0.743	0.779	0.730	0.801	0.749	0.687	0.730	0.784	0.818	0.799	0.853	0.823
AQ24	0.610	0.652	0.603	0.562	0.546	0.585	0.554	0.525	0.541	0.649	0.548	0.556	0.482	0.524	0.655	0.626	0.629	0.589
AQ25	0.785	0.815	0.756	0.752	0.767	0.673	0.731	0.698	0.660	0.811	0.668	0.734	0.714	0.706	0.820	0.791	0.817	0.792
AQ26	0.757	0.772	0.692	0.709	0.712	0.699	0.730	0.674	0.664	0.791	0.717	0.754	0.687	0.597	0.778	0.748	0.790	0.783
AQ27	0.617	0.667	0.523	0.660	0.661	0.600	0.710	0.628	0.587	0.588	0.653	0.565	0.652	0.603	0.581	0.593	0.711	0.660
AQ28	0.645	0.779	0.683	0.682	0.757	0.674	0.817	0.707	0.740	0.653	0.680	0.705	0.702	0.687	0.770	0.763	0.794	0.762
AQ29	0.446	0.542	0.515	0.507	0.611	0.467	0.682	0.543	0.631	0.457	0.601	0.505	0.578	0.490	0.552	0.528	0.584	0.632
AQ30	0.655	0.716	0.646	0.670	0.807	0.758	0.905	0.751	0.773	0.713	0.784	0.690	0.665	0.628	0.824	0.714	0.769	0.761
AQ31	0.499	0.606	0.537	0.490	0.624	0.600	0.727	0.525	0.631	0.505	0.606	0.548	0.574	0.513	0.586	0.568	0.592	0.652
AQ32	0.555	0.669	0.686	0.606	0.775	0.649	0.862	0.695	0.729	0.609	0.641	0.581	0.619	0.614	0.771	0.696	0.739	0.705
AQ33	0.464	0.542	0.539	0.502	0.561	0.486	0.664	0.469	0.642	0.435	0.547	0.472	0.554	0.474	0.520	0.480	0.574	0.581
AQ34	0.717	0.778	0.679	0.727	0.778	0.783	0.871	0.704	0.724	0.759	0.749	0.690	0.659	0.673	0.781	0.749	0.816	0.783
AQ35	0.438	0.506	0.508	0.459	0.532	0.509	0.636	0.547	0.629	0.462	0.560	0.477	0.505	0.526	0.437	0.456	0.571	0.564
AQ36	0.676	0.752	0.752	0.714	0.812	0.759	0.871	0.758	0.785	0.746	0.738	0.703	0.741	0.742	0.807	0.792	0.841	0.832

	AQ19	AQ20	AQ21	AQ22	AQ23	AQ24	AQ25	AQ26	AQ27	AQ28	AQ29	AQ30	AQ31	AQ32	AQ33	AQ34	AQ35	AQ36
AQ1	0.719	0.696	0.790	0.727	0.776	0.610	0.785	0.757	0.617	0.645	0.446	0.655	0.499	0.555	0.464	0.717	0.438	0.676
AQ2	0.551	0.630	0.736	0.512	0.694	0.652	0.815	0.772	0.667	0.779	0.542	0.716	0.606	0.669	0.542	0.778	0.506	0.752
AQ3	0.639	0.675	0.750	0.626	0.728	0.603	0.756	0.692	0.523	0.683	0.515	0.646	0.537	0.686	0.539	0.679	0.508	0.752
AQ4	0.744	0.701	0.828	0.820	0.816	0.562	0.752	0.709	0.660	0.682	0.507	0.670	0.490	0.606	0.502	0.727	0.459	0.714
AQ5	0.779	0.775	0.919	0.811	0.840	0.546	0.767	0.712	0.661	0.757	0.611	0.807	0.624	0.775	0.561	0.778	0.532	0.812
AQ6	0.772	0.651	0.798	0.790	0.749	0.585	0.673	0.699	0.600	0.674	0.467	0.758	0.600	0.649	0.486	0.783	0.509	0.759
AQ7	0.632	0.697	0.854	0.701	0.743	0.554	0.731	0.730	0.710	0.817	0.682	0.905	0.727	0.862	0.664	0.871	0.636	0.871
AQ8	0.737	0.737	0.822	0.809	0.779	0.525	0.698	0.674	0.628	0.707	0.543	0.751	0.525	0.695	0.469	0.704	0.547	0.758
AQ9	0.652	0.747	0.723	0.738	0.730	0.541	0.660	0.664	0.587	0.740	0.631	0.773	0.631	0.729	0.642	0.724	0.629	0.785
AQ10	0.699	0.750	0.851	0.794	0.801	0.649	0.811	0.791	0.588	0.653	0.457	0.713	0.505	0.609	0.435	0.759	0.462	0.746
AQ11	0.723	0.702	0.815	0.788	0.749	0.548	0.668	0.717	0.653	0.680	0.601	0.784	0.606	0.641	0.547	0.749	0.560	0.738
AQ12	0.703	0.722	0.730	0.640	0.687	0.556	0.734	0.754	0.565	0.705	0.505	0.690	0.548	0.581	0.472	0.690	0.477	0.703
AQ13	0.755	0.605	0.746	0.754	0.730	0.482	0.714	0.687	0.652	0.702	0.578	0.665	0.574	0.619	0.554	0.659	0.505	0.741
AQ14	0.816	0.845	0.848	0.820	0.784	0.524	0.706	0.597	0.603	0.687	0.490	0.628	0.513	0.614	0.474	0.673	0.526	0.742
AQ15	0.663	0.733	0.865	0.733	0.818	0.655	0.820	0.778	0.581	0.770	0.552	0.824	0.586	0.771	0.520	0.781	0.437	0.807
AQ16	0.725	0.724	0.823	0.756	0.799	0.626	0.791	0.748	0.593	0.763	0.528	0.714	0.568	0.696	0.480	0.749	0.456	0.792
AQ17	0.753	0.723	0.845	0.853	0.853	0.629	0.817	0.790	0.711	0.794	0.584	0.769	0.592	0.739	0.574	0.816	0.571	0.841
AQ18	0.828	0.773	0.830	0.804	0.823	0.589	0.792	0.783	0.660	0.762	0.632	0.761	0.652	0.705	0.581	0.783	0.564	0.832
AQ19	1.000	0.714	0.764	0.791	0.678	0.323	0.565	0.488	0.560	0.633	0.502	0.558	0.531	0.545	0.473	0.581	0.497	0.691
AQ20	0.714	1.000	0.791	0.719	0.660	0.531	0.667	0.567	0.407	0.652	0.442	0.598	0.446	0.642	0.372	0.622	0.498	0.723
AQ21	0.764	0.791	1.000	0.825	0.877	0.636	0.805	0.722	0.569	0.742	0.486	0.776	0.509	0.763	0.471	0.783	0.453	0.796
AQ22	0.791	0.719	0.825	1.000	0.862	0.511	0.619	0.579	0.555	0.584	0.486	0.626	0.501	0.624	0.468	0.676	0.569	0.740
AQ23	0.678	0.660	0.877	0.862	1.000	0.707	0.725	0.690	0.583	0.677	0.491	0.696	0.503	0.707	0.473	0.744	0.465	0.730
AQ24	0.323	0.531	0.636	0.511	0.707	1.000	0.745	0.806	0.388	0.566	**0.255**	0.591	0.361	0.521	**0.252**	0.675	**0.283**	0.573
AQ25	0.565	0.667	0.805	0.619	0.725	0.745	1.000	0.913	0.520	0.744	0.383	0.727	0.459	0.667	0.383	0.763	0.339	0.739
AQ26	0.488	0.567	0.722	0.579	0.690	0.806	0.913	1.000	0.573	0.722	0.457	0.782	0.543	0.676	0.452	0.827	0.386	0.742
AQ27	0.560	0.407	0.569	0.555	0.583	0.388	0.520	0.573	1.000	0.718	0.847	0.713	0.857	0.627	0.839	0.754	0.806	0.693
AQ28	0.633	0.652	0.742	0.584	0.677	0.566	0.744	0.722	0.718	1.000	0.681	0.863	0.738	0.872	0.654	0.795	0.617	0.903
AQ29	0.502	0.442	0.486	0.486	0.491	0.255	0.383	0.457	0.847	0.681	1.000	0.700	0.914	0.717	0.892	0.679	0.840	0.743
AQ30	0.558	0.598	0.776	0.626	0.696	0.591	0.727	0.782	0.713	0.863	0.700	1.000	0.768	0.880	0.650	0.901	0.589	0.870
AQ31	0.531	0.446	0.509	0.501	0.503	0.361	0.459	0.543	0.857	0.738	0.914	0.768	1.000	0.724	0.872	0.764	0.822	0.779
AQ32	0.545	0.642	0.763	0.624	0.707	0.521	0.667	0.676	0.627	0.872	0.717	0.880	0.724	1.000	0.664	0.826	0.634	0.918
AQ33	0.473	0.372	0.471	0.468	0.473	0.252	0.383	0.452	0.839	0.654	0.892	0.650	0.872	0.664	1.000	0.706	0.859	0.706
AQ34	0.581	0.622	0.783	0.676	0.744	0.675	0.763	0.827	0.754	0.795	0.679	0.901	0.764	0.826	0.706	1.000	0.632	0.860
AQ35	0.497	0.498	0.453	0.569	0.465	0.283	0.339	0.386	0.806	0.617	0.840	0.589	0.822	0.634	0.859	0.632	1.000	0.728
AQ36	0.691	0.723	0.796	0.740	0.730	0.573	0.739	0.742	0.693	0.903	0.743	0.870	0.779	0.918	0.706	0.860	0.728	1.000

APPENDIX D

ANOVA Results

Question	Group	Mean	Sig.
AQ1	Jr./Sr.	4.75/4.08	.102
AQ2	Jr./Sr.	4.53/4.11	.388
AQ3	Jr./Sr.	5.03/4.04	.015
AQ4	Jr./Sr.	5.34/4.11	.002
AQ5	Jr./Sr.	5.53/4.63	.034
AQ6	Jr./Sr.	5.66/5.11	.183
AQ7	Jr./Sr.	5.67/5.08	.110
AQ8	Jr./Sr.	5.23/4.13	.006
AQ9	Jr./Sr.	4.64/3.67	.012
AQ10	Jr./Sr.	4.85/3.70	.010
AQ11	Jr./Sr.	5.22/4.11	.017
AQ12	Jr./Sr.	4.47/3.54	.022
AQ13	Jr./Sr.	5.00/3.81	.004
AQ14	Jr./Sr.	4.97/4.36	.133
AQ15	Jr./Sr.	5.17/4.15	.012
AQ16	Jr./Sr.	4.88/4.19	.089
AQ17	Jr./Sr.	4.86/4.24	.136
AQ18	Jr./Sr.	4.69/3.93	.074
AQ25	Jr./Sr.	4.11/4.62	.287
AQ26	Jr./Sr.	4.28/4.44	.743
AQ19	Jr./Sr.	4.77/3.62	.006
AQ20	Jr./Sr.	4.57/3.93	.093
AQ21	Jr./Sr.	5.19/4.29	.043
AQ22	Jr./Sr.	5.44/5.16	.513
AQ23	Jr./Sr.	4.88/4.27	.124
AQ24	Jr./Sr.	4.43/4.59	.734
AQ27	Jr./Sr.	5.23/5.33	.787
AQ28	Jr./Sr.	4.83/4.35	.244
AQ29	Jr./Sr.	5.57/5.48	.790
AQ30	Jr./Sr.	5.09/4.61	.223
AQ31	Jr./Sr.	5.25/5.39	.699
AQ32	Jr./Sr.	4.94/4.48	.262
AQ33	Jr./Sr.	5.33/5.14	.633
AQ34	Jr./Sr.	4.96/4.55	.300
AQ35	Jr./Sr.	5.31/4.95	.363
AQ36	Jr./Sr.	4.89/4.41	.242

Question	Group	Mean	Sig.
WQ1	Jr./Sr.	5.03/4.50	.080
WQ2	Jr./Sr.	5.11/4.12	.007
WQ3	Jr./Sr.	4.89/4.00	.012
WQ4	Jr./Sr.	5.11/4.42	.039
WQ5	Jr./Sr.	5.11/4.58	.151
WQ6	Jr./Sr.	5.11/4.44	.093
WQ7	Jr./Sr.	5.31/5.31	.984
WQ8	Jr./Sr.	5.03/4.52	.176
WQ9	Jr./Sr.	4.75/3.91	.020
WQ10	Jr./Sr.	5.00/4.08	.011
WQ11	Jr./Sr.	5.23/4.35	.018
WQ12	Jr./Sr.	5.00/4.00	.010
WQ13	Jr./Sr.	5.14/4.00	.003
WQ14	Jr./Sr.	5.17/4.33	.026
WQ15	Jr./Sr.	5.15/3.80	.000
WQ16	Jr./Sr.	5.03/4.30	.042
WQ17	Jr./Sr.	5.06/4.35	.047
WQ18	Jr./Sr.	4.91/3.88	.004
WQ25	Jr./Sr.	4.91/4.15	.051
WQ26	Jr./Sr.	4.97/3.96	.011
WQ19	Jr./Sr.	4.67/3.73	.015
WQ20	Jr./Sr.	4.51/3.81	.093
WQ21	Jr./Sr.	5.00/4.00	.027
WQ22	Jr./Sr.	4.74/4.21	.244
WQ23	Jr./Sr.	4.46/4.34	.799
WQ24	Jr./Sr.	5.25/4.52	.028
WQ27	Jr./Sr.	5.03/5.46	.286
WQ28	Jr./Sr.	5.29/4.81	.191
WQ29	Jr./Sr.	5.27/5.43	.698
WQ30	Jr./Sr.	5.21/4.86	.370
WQ31	Jr./Sr.	5.50/5.50	1.000
WQ32	Jr./Sr.	5.38/4.80	.173
WQ33	Jr./Sr.	5.29/5.55	.550
WQ34	Jr./Sr.	5.13/4.79	.330
WQ35	Jr./Sr.	5.36/5.27	.830
WQ36	Jr./Sr.	5.09/4.65	.265

APPENDIX E

Survey Comments

WST Needed Features	WST Comments	AMST Needed Features	AMST Comments
Simpler web site	Good information	Simpler Web site	CPU problems
Pop-up box on screen instead of bottom of screen	Excellent system, easy to use.	Map, expenses, and asset lot number information	Frustrating. Need expert guidance, not very fast
A more user friendly screen and hard copy of help manual.	Mostly good, a tutorial would definitely help novice users	Condensed help feature, too in-depth. Less information input more point and click	Excellent! Inform all Bases of systems ASAP as a first time user, it was relatively easy to use and helpful
JHCS, ERRC, ADR, RDO, CRD, and RIMF	Had problems with aircraft compatibility feature	Additional security features	Easy to navigate. In transit option is great
Need training class (1 day) and print capabilities	Great system, Good source of munitions information	Fed Log information and AMMO catalog	Good resource tool. Concerned with security.
COTS Approval, Forecasting, and allocation breakdown	Excellent! Novice use! Help messages great and easy to use	Weapons profile and definition of terms.	Great tool but concerned with security of quantities, could be a threat to OPSEC
Indicative Data, Expenditure, and requisitions information	Good product; however, some of the pop-up menu descriptions hide behind the toolbar. Hard to read.	Quick help like in Fed Log and blow up of states in Asset Map for easier use.	Would make everything easier if we could get everything
Incorporate with AMST	Not as good as AMST	Master NSN Listings	Difficult
Clear titles, NSNs and reference to applicable TOs	Enjoyable, very user friendly system but very mission specific	Acronym explanation and help in query	Good System for depot assets. Need to know what you are looking for.
Attention to Security	Good fast information		Hard to use for first timers
Better layout of features	Informative		Overall good program
	Excellent user interface but lacks depth of information. No information pertaining to Fed Log/HAZDEC		Older CPU caused frustrating experience. Unable to get information fast if at all.
	Weapon diagrams nice feature. Term breakdown helpful. Difficult to find specific munitions without the specific number.		Interesting with a lot of potential but information may be dangerous. Can be helpful to a manager in the field.
	Frustrating due to old computer, menu navigation not friendly		Frustrating, have to enter NSNs etc. to get information
	Difficult to move around. Numerous problems with navigating system. Need more time to learn system		Very easy to navigate however, a manual should be included for beginners and non-munitions users.

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Vita

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14. ABSTRACT
The purpose of this research is to ascertain if the United States Air Force (USAF) is duplicating effort with the development of the two IT applications, or if one will effectively meet requirements. Specifically, this thesis sought to answer four research questions addressing customer needs for a munitions IT application, identifying the capabilities of the two research IT applications, determining how well each application met the needs of the customer, and determining how supportable each application was in terms of information needs versus existing munitions systems. A mixed qualitative and quantitative paradigm was used to conduct a gap analysis and verification occurred through the use of surveys. Sixty-five munitions users participated in a surveying session to identify differences between the two systems as well as the relative merits of each. Overall, munitions users chose WST as the more favorable application. All but two construct measures supported the overall rating of the application. Munitions personnel liked the screen layout of AMST better than that of WST even though WST seemed to be the application that better used terminology familiar to munitions personnel. WST was also the easier of the two applications to manipulate although the AMST help features were identified as the better of the two. The Warrior Support Tool provided information in a timelier manner than did the Agile Munitions Support Tool.

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