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Experimentation in a collaborative planning environment

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THESIS

EXPERIMENTATION IN A COLLABORATIVE PLANNING ENVIRONMENT

by

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June 2006

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13. ABSTRACT (maximum 200 words) Research details the Oracle Database and Collaboration software technologies, the Trident Warrior (TW) planning and experimentation process, and how the utilization of those software technologies, coupled with the Knowledge Management (KM) methodologies, affect large scale military experimentation processes. Of specific focus is how the FORCEnet Innovation & Research Enterprise (FIRE) system at NPS has facilitated rapid advancement of TW scope and capabilities as well as delivered a significantly improved final product to NETWARCOM.			
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EXPERIMENTATION IN A COLLABORATIVE PLANNING ENVIRONMENT

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ABSTRACT

Large-scale military experimentation has been an increasingly complex endeavor throughout the Naval Postgraduate School's (NPS) years of involvement in such efforts. NPS started with supporting the Fleet Battle Experiments (FBEs), the Sea Trial events that were replaced by Trident Warrior (TW) in 2003, and has continued on through the development of the Navy's FORCEnet concept into the current TW experiments which support the development of FORCEnet. During the FBEs, the planning process was very ad hoc and there was little development of experimental initiatives and objectives. This caused many problems in the execution, data collection and analysis of the experiments. As the Navy transitioned from FBEs to Trident Warrior, NPS instituted for the first time a process for doing pre-experiment planning, data collection, initiative and objective development, experiment execution and post experiment analysis. In the past, during FBEs, the analysis was all done post-experiment, which led to huge amounts of work involving sifting through millions of lines of chat data, survey data, electronic data and observation data. This was very much a manual process using large file cabinets, huge binders of paper data and a highlighter to go through it all. There were some tools used, such as Ethnograph Qualitative analysis system to help with this process. But the complexity of the experiment data required a much more robust enterprise system in order to collect and analyze the data from these experiments to produce a high quality final report and data reduction for the experiments. Once NPS moved into supporting TW experiments, the technology for accomplishing this important task was ramped up by using an Oracle enterprise data management system to plan the experimental objectives. This system developed by the Knowledge Management (KM) Lab at NPS is called the FORCEnet Innovation & Research Enterprise (FIRE). As the TW process moved from TW03 through TW05, this system was improved to include experiment execution planning, data collection planning, data analysis and collaboration for key experiment participants. The leap in technology, and the process of experiment planning and management, significantly improved the final product when compared to the final reports generated from the FBEs; however, measuring this benefit has proven to be uncharted

territory. This paper will discuss and attempt to measure the contribution and improvements in processes and technologies provided by an enterprise system using the Naval Postgraduate School's FIRE as its source.

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I. INTRODUCTION

A. BACKGROUND

The goal of FORCEnet is to enable the U.S. Navy to maximize its potential in the new information age by means of a fully netted force in which they operate with increased power, command, awareness and speed as an integral part of the joint team.

FORCEnet attempts to enhance dramatically how the Navy acquires, shares, and capitalizes on information superiority to generate transformational combat effectiveness. It has its roots in the visionary work of the Chief of Naval Operations' Strategic Studies Group based in Newport, Rhode Island. After years of research and concept generation, the Strategic Studies Group defined FORCEnet as "the operational construct and architectural framework for naval warfare in the information age that integrates warriors, sensors, networks, command and control, platforms, and weapons into a networked, distributed combat force that is scalable across all levels of conflict from seabed to space and sea to land." FORCEnet implements the theory of network-centric warfare.

Developing FORCEnet involves designing and implementing a network architecture that includes standard joint protocols, common data packaging, seamless interoperability, and strengthened security. It requires identifying and prioritizing capability investments within and across joint, interagency, and international programs. Most importantly, it will emphasize people as the center of FORCEnet development, so that technological advances support increasingly rapid and accurate decision making.

The goal of FORCEnet is to arm U.S. Joint and Coalition forces with superior knowledge, leading to increased combat power. In pursuit of this goal, FORCEnet will provide a comprehensive network of sensors, analysis tools, and decision aids to support the full array of naval activities, from combat operations to logistics and personnel development. The focused, timely, and accurate data delivered by FORCEnet will help leaders at every level by allowing them to draw on vast amounts of information and share the resultant understanding. This will increase the joint force's ability to synchronize activities throughout the battle space to achieve the greatest impact.

Since its inception, FORCEnet has improved the coordination and consolidation of command, control, communications, computers and intelligence, surveillance and reconnaissance (C4ISR) efforts throughout the naval services. By providing this single point focus for technology and systems development, FORCEnet is allowing designers and war fighters to work in a collaborative environment to affect both the level of connectivity for individual units, and also the flow of information throughout the organization. Furthermore, FORCEnet is the backbone upon which the former Chief of Naval Operations Adm. Vern Clark's Sea Power 21 vision is built, providing the communication network through which Sea Strike, Sea Shield, and Sea Basing enhance the warfighters' effectiveness in the battlespace.

FORCEnet is more than just putting bombs on target; it is the framework for the integration of weapons, sensors, systems, platforms, people, and electronic knowledge management. Sailors will also see benefits in staying connected to their families, accessing training and education programs, and maintaining a broad picture view of their own career development--all online while forward deployed.

To test the current capabilities of the FORCEnet integration efforts, NETWARCOM and Space and Naval Warfare Systems Command (SPAWAR) sponsored Programs of Record co-sponsor the Trident Warrior experiment series. Trident Warrior is the annual major FORCEnet Sea Trial event which provides a venue for testing of capabilities, communications, networks, technologies and Tactics Techniques & Procedures (TTPs.)

A core team of Professors, faculty and staff at the Naval Postgraduate School play the role of planning and analysis lead for TW experiments. One of the many key processes that this team oversees and facilitates is the development of TW experiment objectives. A typical TW experiment will have approximately ten experimental initiatives. An initiative is the high level description of an area of experimentation, i.e. Networks, Information Management, or Fires. Each of the TW initiatives is headed up by an initiative lead who is typically a subject matter expert. The initiative lead is required to develop experimental objectives that address specific goals and or questions within their initiative area. In order to accomplish this, the initiative leads must identify the objective,

the specific question or goal being addressed, the operational conditions, the system conditions, the information conditions and the data collection source. This process is iterative and requires collaboration of up to ten people depending on complexity of the objective.

In the past, the objective development process was done though an ad-hoc method of emailing planning documents back and forth between initiative leads and other crucial planning members. Over the last three years, the Knowledge Management Lab at the Naval Postgraduate School has been developing collaborative tools and environments to support many aspects of the TW planning and analysis process. This thesis focuses on the aforementioned processes and the development of collaborative tools for use in Trident Warrior experiments. These methodologies and tools can also be utilized in other large scale military experiments.

B. OBJECTIVE

The objective of this thesis is to discuss and attempt to measure the contribution and improvements in processes and technologies provided by an enterprise system using the Naval Postgraduate School's FIRE as its example.

C. SCOPE AND METHODOLOGY

1. Scope

This thesis will investigate collaborative enterprise systems and the effects they have on Planning and Analysis environments such as that of the FORCEnet Innovation and Research Enterprise (FIRE). We will focus our research on two collaboration suites successful on the market; Oracle's Collaborative Suite (which is used as a backbone to FIRE) and the competing IBM's Software Solution for the On Demand Workplace. We plan to analyze the planning processes used for Trident Warrior 05 which relies heavily on collaboration of many users through the FIRE system.

We will explore the underlying database and collaborative technology used in the development of the system and how the features of the system are being utilized by the TW planning and analysis team. Oracle Portal capabilities will be examined along with the Oracle Real-Time Collaboration suite of tools such as "files" "workspace" "conference" and "discussion."

We will look at the planning and analysis methodologies currently used in TW and compare them to previous experiments such as Fleet Battle Experiments, TW03 and TW04. We will investigate how the NPS KM Lab has enhanced the ability to test FORCEnet Trident Warrior objectives efficiently through the robust planning and analysis techniques provided by FIRE and the current planning and analysis taxonomy.

We will research TW05 and how FIRE was used in support of this experiment. Raw experiment data and subjective survey and interview data will be collected and analyzed for the purpose of determining the extent to which FIRE and the NPS KM team's methodologies have improved and enhanced the TW planning and analysis process.

2. Methodology

The methodology used in this thesis will consist of the following steps (applied to previous and current TW experiments):

1. Examination of Literature and Research: Research experimentation processes outside of the TW realm. Also research and sort through previous (TW03-TW05) reports, data, and documentation. Observing:
    a. Initial state of planning process
    b. Advancements each iteration
    c. Complications and advantages to the shared environment
2. Examination of applications used in each iteration of the TW experimentation.
3. Questionnaires and Surveys: Based on our findings, we will create questionnaires or conduct short interviews with key TW players in order to get different responses from a personal perspective that cannot be captured in a written final report. We will see feedback from both players who have been involved in only one TW experiment and those who have been in multiple experiments. Our goal will be to find answers (per each TW experiment) to such questions as:
    a. What were the problems in the planning process?

b. What could have been done or was done to resolve problems and what were the effects?

c. Has the collaborative effort increased productivity?

d. What is your overall assessment of the procedures and improvements made to the system and collaborative features?

e. Further recommendations that would be of importance?

4. Knowledge Value Added assessment of the TW Objective Development process.

5. Observe TW Experimentation: On-site, TW04.

6. Note our own experiences interacting with key players in the planning process and during the experimentation phase.

7. Distribute Surveys

8. Measures: The measures will be based on the KVA results as well as survey responses, facts and technological advancements between the experiments. Measures noted will be such things as:

a. Number of people travels for that year

b. Percent reduction in emailing of reference and planning documents

c. Initiative data versioning TW03 through TW05

d. Survey processes (creation, distribution, and results compilation)

3. Primary Research Question

How does employment of a collaborative enterprise system, such as FORCEnet Innovation and Resource Enterprise (FIRE), effect large-scale military experimentation.

4. Subsidiary Research Questions

5. Benefits of Study

The research will give an assessment of the value added to TW experimentation by the FIRE system. The research will also provide a venue for possible

recommendations for improvements to the TW processes including: development of experimental initiatives, furthering of collaborative tools and environment, automating processes and analysis, and implementation of new data collection tools and technology.

6. Organization of Thesis

Chapter I is the background and organization of the thesis.

Chapter II is an introduction to the concepts of collaboration and Knowledge Management.

Chapter III discusses two current opposing software suites.

Chapter IV gives background on FORCEnet and discuses the evolution of Trident Warrior.

Chapter V discusses the FORCEnet Innovations and Research Enterprise (FIRE).

Chapter VI discusses the theory of Knowledge Value added and how it applies to the FIRE system.

Chapter VII discusses conclusions, recommendations and possible areas for further research.

II. COLLABORATION AND KNOWLEDGE MANAGEMENT

A. COLLABORATION

1. Collaboration Suites

"People are the most forgotten part of the organization" [Ambuj Goyal, General Manager of Lotus Software]. According to Ambuj, the untapped resources in organizations are human responsiveness, awareness, and ingenuity. In today's business world, it's necessary to integrate the people working in an organization and to help them collaborate with one another. When this collaboration works, it saves time and money, and it provides new value to customers and shareholders. Industry has long focused on customer needs to maintain return on investment, but the focus has changed recently in the sense that businesses are now looking at how they can help employees help customers. "The pendulum has returned from the obsessive focus on externally facing e-business to a renewed focus on the individual worker, often in the form of business-to-employee initiatives. These trends acknowledge that many workers are overloaded with an incoherent mix of tools and systems all purporting to support their work activities, but designed and delivered without any composite perspective of the work process." (Gartner Research, February 3, 2003) A new realization has come that by helping employees, customers' needs are served more quickly and more efficiently. In order to do this, businesses are supplying tools to employees to increase productivity. In addition, businesses are harnessing web content to provide true global connectivity. This eliminates the regional and physical boundaries that "bricks" businesses encounter. Lastly, organizations are using web sources and portals to integrate intranets, internets, and extranets, connecting all of their business data in a way that helps not only employees, but partners and customers as well.

A collaborative workspace or shared workspace is an inter-connected environment in which all the participants, in dispersed locations, can access and interact with each other just as inside a single entity. The environment is generally supported by electronic communications and application software which enable participants to

overcome space and time differentials, enhance productivity and reduce costs. These are typically enabled by a shared understanding and common information by all of the participants regardless of physical location.

Collaboration suites are an important tool that is being used today to fulfill the above objectives. According to the Lotus glossary, collaboration software increases human productivity, bringing people together with messaging, calendaring, scheduling, and other applications. Some benefits of collaborative suites are real-time web conferencing, files at your fingertips, and a single in-box for your voice mail, e-mail, and fax. All of the components are optionally wireless, and all save the business organization time and money. Two collaboration suites successful on the market today are Oracle's Collaborative Suite and IBM's Software Solution for the On Demand Workplace. This paper will explain the different features of each suite, and give a comparison between the two suites.

B. KNOWLEDGE MANANGEMENT

1. Described

Historically, there have been a number of technologies enabling or facilitating Knowledge Management (KM) practices in the organization, including expert systems, knowledge bases, software help desk tools, document management systems and other IT systems supporting organizational knowledge flows.

The advent of the internet brought with it further enabling technologies, including e-learning, web conferencing, collaborative software, content management systems, corporate directories, email lists, wikis, blogs, and other technologies. Each enabling technology can expand the level of inquiry available to a user, while providing a platform to achieve specific goals or actions. The practice of KM will continue to evolve with the growth of collaboration applications available by IT and through the Internet. Since its adoption by the mainstream population and business community, the Internet has led to an increase in creative collaboration, learning and research, e-commerce, and instant information.

Knowledge management refers to the ways organizations gather, manage, and use the knowledge that they acquire. It is an approach to improving organizational outcomes

and organizational learning by introducing into an organization a range of specific processes and practices for identifying and capturing knowledge, know-how, expertise and other intellectual capital, and for making such knowledge assets available for transfer and reuse across the organization.

Knowledge management programs are typically tied to specific organizational objectives and are intended to lead to the achievement of specific targeted results such as improved performance, competitive advantage, or higher levels of innovation.

While knowledge transfer (an aspect of KM) has always existed in one form or another (for example through on-the-job discussions with peers, formally through apprenticeship, professional training and mentoring programs, and — since the late twentieth century — technologically through knowledge bases, expert systems, and other knowledge repositories), KM programs seek to consciously evaluate and manage the process of accumulation and application of intellectual capital. KM has, therefore, brought together various strands of thought and practice relating to intellectual capital and the knowledge worker in the knowledge economy: the idea of the learning organization; various enabling organizational practices, such as Communities of Practice and corporate directories for accessing key personnel and expertise; and various enabling technologies, such as knowledge bases and expert systems, help desks, corporate intranets and extranets, content management, wikis, and document management.

While Knowledge Management programs are closely related to organizational learning initiatives, Knowledge Management may be differentiated from organizational learning by its greater focus on the management of specific knowledge assets.

The rise of KM has seen an increasing understanding of the relevance of the distinction between tacit vs. explicit knowledge, sophisticated perspectives on the management, assessment and use of intellectual capital, and the emergence of new organizational roles and responsibilities such as the position of Chief Knowledge Officer (CKO).

2. Tacit Versus Explicit Knowledge

There is a key distinction between tacit and explicit knowledge. The former is often subconscious and internalized. The individual may or may not be aware of what he

or she knows and how he or she accomplishes particular results. At the opposite end of the spectrum is explicit knowledge — knowledge that the individual holds explicitly and consciously in mental focus, and may communicate to others.

Nonaka and Takeuchi (1995) argued that a successful KM program needs to convert internalized tacit knowledge into explicit codified knowledge in order to share it, but also for individuals and groups to internalize and make personally meaningful codified knowledge once it is retrieved from the KM system.

3. Knowledge Capture Stages

Knowledge may be accessed, or captured, at three stages: before, during, or after knowledge-related activities. For example, individuals undertaking a new project for an organization might access KM resources to learn best practices and lessons learned for similar projects undertaken previously, access the KM network again during the project implementation to seek advice on issues encountered, and access the system afterwards for advice on after-project actions and review activities.

Knowledge may be captured and recorded into the system before the project implementation, for example as the project team learns information and lessons during the initial project analysis. Similarly, lessons learned during the project operation may be entered into the KM system, and after-action reviews may lead to further insights and lessons being recorded in the KM system for future access.

4. Ad-hoc Knowledge Access

One alternative strategy to encoding knowledge into and retrieving knowledge from a knowledge repository such as a database is for individuals to instead access expert individuals on an ad hoc basis, as needed, with their knowledge requests. Key benefits of this strategy are that the response from the expert individual is rich in content, contextualized to the particular problem being addressed and personalized to the particular person or people addressing it. On the downside this strategy is tied to the availability of specific individuals in the organization, does not capture their insights and experience for future use should they leave or become unavailable, and the expert's memories of particular technical issues or problems previously faced may change with time.

5. KM Drivers

There are a number of drivers, or motivations, leading to organizations undertaking a Knowledge Management program.

Perhaps first among these is to gain the competitive advantage that comes with improved or faster learning and new knowledge creation. KM programs may lead to greater innovation, better customer experiences, consistency in best practices and knowledge access across a global organization, as well as many other benefits; and KM programs may be driven with these goals in mind.

Considerations driving a knowledge management program might include: making available increased knowledge content in the development and provision of services; achieving shorter new product development cycles; facilitating and managing organizational innovation; leverage the expertise of people across the organization; benefiting from network effects as the number of productive connections between employees in the organization increases and the quality of information shared increases; managing the proliferation of data and information in complex business environments and allowing employees to rapidly access useful and relevant knowledge resources and best practice guidelines; facilitate organizational learning; managing intellectual capital and intellectual assets in the workforce (such as the expertise and know-how possessed by key individuals) as individuals retire - in larger numbers than they have in a long time — and new workers are hired.

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III. SOFTWARE

A. ORACLE

1. Oracle Collaboration Suite

When decisions have to be made, it's important to have complete and accurate information at your fingertips. Oracle Collaboration Suite (OCS) allows real-time Web conferencing, files at your fingertips, federated search, a single inbox for your email, voicemail, and fax, and all with wireless access.

OCS has integrated collaborative applications based on a relational database and built on open standards. The information is consolidated into a single secure, reliable, and scalable database — contrasts solutions that fragment information. The architecture supports knowledge reuse and a platform for compliance. It has ability to manage unstructured data in the database, which supports compliance needs.

OCS consists of many components integrated together and sells the software as a suite or with the possibility to just purchase certain components. The components Oracle chose to offer as separate solutions are Files, Web Conferencing, and Email and Calendar.

A feature of OCS is Oracle Files. It leverages the power of the database to provide a reliable, scalable, and secure place to store content. You can consolidate all file servers into one repository and log in and access files from any computer using any of the popular protocols such as HTTP, WebDAV, FTP and SMB. Once logged in, there is full access to both personal and shared workspaces. The security model is folder-based which allows full control over the level of access to the files chosen to share. Managing the life-cycle of files is done with file categories, versioning, and locking, as well as workflow.

Oracle Ultra Search is used to search across other OCS components, corporate Web servers, databases, mail servers, fileservers and Oracle Portal instances. It's based on Oracle Text technology and does not require SQL coding. It uses a crawler to index documents. The documents stay in their own repositories and the crawled information is used to build an index that stays within a firewall in a database.

Oracle Web Conferencing integrates with other business applications for low cost and can be managed in-house. It provides real-time online collaboration to any e-business, enabling you to conduct meetings online in a common and flexible environment.

Some features of this component allow users to create, join and participate in a meeting and present meeting content in one of four ways: cobrowse which is used to present Web pages, document presentation which is used to present documents and images, whiteboard which allows the user to draw on the whiteboard using a variety of drawing tools and the attendees see those drawings on the in real time, and desktop sharing which allows the user to share an application, part of the desktop and entire desktop. Hosts can publish meeting archives for participants to view after meeting and that access to the archives can correspond to access rights to the meeting. The user can control delegation, do polling, have chat sessions, save screenshots. The voice streaming is seamless and uses voice from any telephone or teleconference in a Web conferencing recording for on-demand playback. It allows Web conferencing attendees to listen through their PC speakers, rather than having to dial into a teleconference.

Oracle Wireless and Voice provides anytime-anywhere access to email, voice mail, calendar, address book, tasks, files, corporate directories, and instant messaging from any device with wireless or voice access. The user can use their cellular phone or other wireless device to receive and answer email or look up the phone numbers in a corporate directory. In addition, users can be notified when events are added in their calendar, when they receive a specific e/voice mail, when documents are updated in their folder, or general reminders.

Oracle Email uses the Oracle Database to store email, voice mail and fax messages in the same database. This allows the user to send and receive voice mail and faxes through email via an attachment. The files are stored as a .wav for voicemail and a .tif for fax. The user can send and receive messages from any client, browser or wireless device. The Email web client provides Internet access to all aspects of their account through a standard web browser.

Oracle Calendar combines real-time architecture with different methods of access, seamlessly integrating with other components of OCS to provide a unified source for all time management information. Users have access via their desktop or the Web. The desktop client is available for Windows, Mac, Linux and Solaris and offers functionality not found in the Web client such as designate rights and other end-users customization options. There is a connector for Outlook, which offers access via the standard Outlook interface. Other features include synchronization tools, real-time access to information and a free and busy lookup.

B. COMPETING SOFTWARE SUITE

1. IBM On Demand Workplace

The On Demand Workplace by IBM is a powerful collaboration and portal software designed to meet the needs of business organizations today through innovation of technology, increasing business value, and lowering the total cost of ownership. The collaboration solution combines the IBM WebSphere Portal for Multiplatforms 5.0 with Lotus Workplace to provide an easy-to-use one-cost integrated business package. The package fee is per-license, and includes one common user interface with a single sign-on. The package uses open standards (J2EE) so that businesses can integrate the package with existing business applications, databases, and directories. Different packages can be constructed based on the needs of the business if the On Demand Workplace package is lacking something or needs more specialization. For instance, there are packages of the On Demand Workplace for Banking, Consumer Products, Electronics, Government, Retail, Telecommunications, and Travel and Transportation.

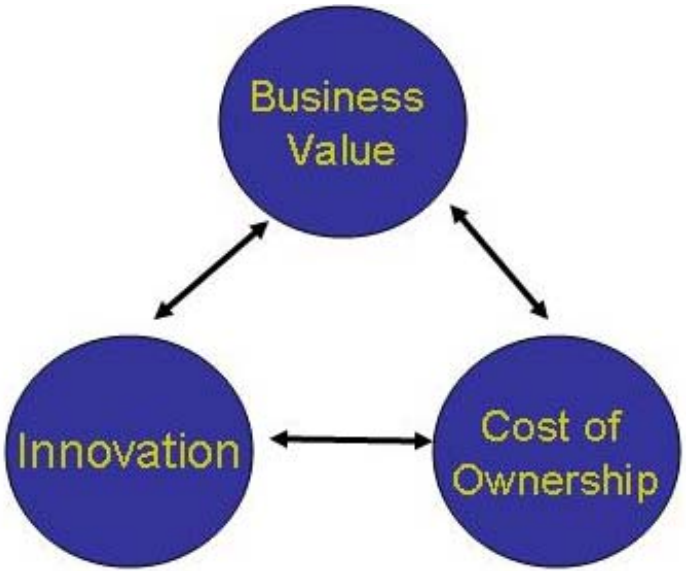

Figure 1. On Demand Workplace Summary

The On Demand Workplace attempts to personalize the workplace for every employee, simplifying every task an employee may have while working. The simplification of tasks enables employees to concentrate on more difficult tasks, therefore saving the business time and money. With the on-demand workplace, employee-to-employee and employee-to-partner communication can respond more quickly when changes occur within the workplace. Businesses also become more competitive as their processes improve, which always benefits the customer. IBM strives to envision every situation an employee may encounter while working, as seen in the following On Demand Workplace Model.

Three key messages that IBM wants users to take away regarding the Workplace environment are: provides ‘Collaboration on demand’, provides ‘Flexibility’, and is ‘An Open platform’’.

The On Demand Operating Environment concentrates on four main points: integration, automation, virtualization, and infrastructure management. The caveat behind all of these is the use of standards within the operating environment. Without standards, no integration can occur. IBM chooses to use open standards, such as J2EE, because they are most effective to connect disparate resources of a business into seamless and flexible infrastructures, especially for businesses using old and sometimes outdated systems.

Integration of applications within the business is critical in order to provide flexibility within the business. Integration allows the business to channel not only data, but knowledge and experience of employees across the organization. With automation, the Information Technology management becomes simpler. Routine tasks, such as load-balancing, and day-to-day system maintenance, are set up to reflect business policies and strategic goals of the organization, and this allows Information Technology personnel more time to deal with critical and time-dependent issues. Virtualization combined with systems integration reduces the barriers caused by geography and standards incompatibilities, and allows users to access resources that may be outside of their specific location. The resources are used, and then freed up for others to use when tasks are completed. This makes application resources much more valuable because they are able to be accessed across the globe. Lastly, virtualization and automation both contribute to improving infrastructure management because resource management is easier and not so costly. All of these together enhance the operating environment of the company, which lowers costs

The applications included in the On Demand Workplace package are: Workplace Messaging, Workplace Team Collaboration, Workplace Web Content Management, Workplace Collaborative Learning, and IBM WebSphere Portal v5.0.

The Lotus Workplace Messaging application is a portal-based application that is designed for the “deskless worker”, or those who spend much of their time outside of an office environment. It includes e-mail, personal address book, scheduling, and calendar through web portal and web browser access. The application supports Linux, and relies on the WebSphere Application Server, DB2 data storage, SMTP routing, and the J2EE Application Framework. The Workplace Messaging system provides a way for employees to keep close contact with other employees, their clients and their appointment schedules even though they may not have a dedicated workstation. The messaging system is automated, because it relies on a Lightweight Directory Access Protocol which automatically sets up new users and updates the messaging system when changes are made. This simplifies installation tasks for information technology workers. The cost is low for the messaging system and decreases with high volume in an organization. Many large organizations pay less than $1.00 per month per employee for a three-year license.

The Lotus Workplace Team Collaboration application is designed for employees who need to collaborate with one another while working on tasks and projects together. Each team workspace has a "membership" which is defined by a moderator who controls member access. The application includes instant messaging tools, and team members can see who is and is not available at any given moment. There is a Document Manager that provides a centralized location for project documents. The Document Manager allows employees to track changes on all documents including comments. There is a Discussion Forum within the team workspace that enables employees to have web-based threaded discussions, and a Web Conference area where employees can share presentations with one another, or download meeting materials. A search tool is included so employees can search across teams, web conference areas, etc. The Team Collaboration applications reduced travel costs because employees are able to work with one another even if they are not in the same location. It also improves responsiveness to customers because employees can capitalize on the knowledge of other team members, and make faster decisions.

The Lotus Workplace Web Content Management system supplies a simple system to use for Internet, intranet, extranet, and portal sites. It was purchased from Presence Online and Aptrix, and supports WebSphere, WebSphere Portal, Lotus Domino, and the DB2 Content Manager. The system is scalable for mid-sized to large businesses. It helps businesses manage their content both for internal processes, and to meet critical government requirements. The goal of the web content management system is to "author once, publish everywhere". It provides companies with a place to store data, documents, video, audio, and other forms of content. Templates to place content on the web and automated services are included so that content creators without technical skills can build content and access the content of others. Through the web content management system, it is simple to update web content, locate content owners, meet the content needs of a diverse audience, and reuse and publish content on multiple sites. The system also reduces the cost of content development and management, since unskilled end users are able to develop content and publish it. The content management process is streamlined, saving time and money.

The Lotus Workplace Collaborative Learning application is an easy-to-use authoring tool for those who may be technically challenged. It relies on a portal-based user interface that integrates online learning on the desktop. Multiple employee groups can be set up with specific profiles in the application, and users can set their personal preferences, enhancing the customization and usefulness of the product. Each user has the ability to manage and track their own learning program, as well as find courses and resources throughout the organization. Users can also take courses offline and upload information to the system when they have a connection. This learning environment benefits organizations because employees are encouraged to improve their skills which benefit the company in the long run.

The IBM WebSphere Portal 5.0 is the portal application that enables all of the other applications to work together. It includes a document manager that employees can use to share, view, and organize files. Productivity components are used to view, create, convert, and edit documents, spreadsheets, and presentation files. The portal application integrator allows employees to create portlets that interact with relational databases or enterprise applications from business like Oracle, SAP, Siebel, or PeopleSoft. Lotus Extended Search is part of the WebSphere environment and makes searches across content areas possible for employees. The Portal also includes a WebSphere Translation server that can translate languages for those who are working in a global environment.

There are many On Demand Workplace specializations for those companies who want specific pieces that suit their business needs, including the following: banking, consumer packaged goods, electronics, government, retail, telecommunications, travel and transportation.

In addition, those businesses who do not need all of the components of Lotus Workplace can purchase stand-alone applications.

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IV. FORCENET AND TRIDENT WARRIOR

A. FORCENET CONCEPT

1. Described

FORCEnet is defined as "the operational construct and architectural framework for naval warfare in the Information Age, integrating warriors, sensors, command and control, platforms, and weapons into a networked, distributed combat force."

Experimentation requires theoretical grounding. FORCEnet, at the conceptual level includes an overarching hypothesis: "when all forces and organizations down to the level of individuals are interconnected in a networked, collaborative command and control environment, then all operations and activities will enjoy the benefits of decentralization….and commanders will make and implement better decisions faster than any enemy can endure." Trident Warrior experimentation takes this conceptual hypothesis as a truism, one which cannot be fully tested at this level until the necessary requirement, a fully networked-centric capability is in place and used in Fleet operations. Indeed, it is possible that this condition can never be met; only approximated. Therefore, Trident Warrior is grounded theoretically, at a lower level of testable conditions. At this level, the overarching hypothesis is that increased complexities of maritime environments require a similar complexity of information and decision-making that can only be achieved through the attributes described in the fifteen FORCEnet requirements. This set of requirements then become the system capabilities that lead directly to development of higher conceptual capabilities such as the "1000 ship navy," and Effects Based Operations.

In the Global War on Terror (GWOT), Coalition organizations are a likely consequence, and therefore development of FORCEnet capabilities are intended to encompass the ability of a JFMCC to act in a Coalition Forces Maritime Component Commander (CFMCC) environment, adjusting the physical, information and cognitive domains as required.

2. Capabilities

Below are presented the FORCEnet Capabilities necessary to implement the FORCEnet concept.[1]

- Fn1. Provide robust, reliable communication to all nodes, based on the varying information requirements and capabilities of those nodes.

  The foundation of FORCEnet is a fully integrated, self-healing, self-organizing, communications system or infrastructure. This will consist of an interoperable worldwide network of information hardware and software and management services that produce and move information. It is this infrastructure that connects all nodes into an interactive system that generates network effects. It is this information network that will allow, for example, direct feeds from non-organic sensors to tactical commanders, the formation of virtual teams from among distributed elements, collaborative planning within these teams, and shared visual representations. This information infrastructure must be compatible with the requirements of the Global Information Grid. This capability will include a combination of permanent information infrastructure and expeditionary capabilities that exploit the full range of transmission technologies (radio, infrared, microwave, fiber, cable, etc.) and communications modes (voice, text, graphical, geo-spatial, etc.).

- Fn2. Provide reliable, accurate and timely location, identity and status information on all friendly forces, units, activities and entities.

  Information will be gathered from self-reporting elements. Self-reporting elements will generate the information that will serve as the first step in gaining situational awareness. Friendly units, equipment and supplies will automatically provide a steady stream of location and status information in real time. The information will depend on the type of asset that is reporting, and might include location, logistical or personnel status, operational readiness, current activity or mission, disposition, and plans. Weapon systems could report location, speed, azimuth, area of coverage, on-board ammunition

[1] FORCEnet: A Functional Concept for the 21st Century

supply, engagement criteria, or current activity. Automation should aggregate entity-level information to provide unit-level summaries at any echelon desired.

- Fn3. Provide reliable, accurate and timely location, identification, tracking and engagement information on environmental, neutral and hostile elements, activities, events, sites, platforms, and individuals.

  Information will be gathered on any elements that are not self-reporting-including meteorology, geography and oceanography. This concept envisions more comprehensive and higher-quality information available about the enemy than ever before, due to emerging advances in sensor technology that will pursue the aim of continuous and pervasive surveillance. The goal is not only to detect, locate, identify and target, but also to infer capabilities and intentions-although it is important to keep in mind that no amount of surveillance will ever provide complete understanding of enemy plans and intentions.

- Fn4. Store, catalogue and retrieve all information produced by any node on the network in a comprehensive, standard repository so that the information is readily accessible to all nodes and compatible with the forms required by any nodes, within security restrictions.

  Information that has been collected or created must be stored so that it is available for use when needed. Information collected or generated by any node will be captured and stored in shared space where it is available for use. This applies to any form of information, including, e.g., imagery, plans, graphics, position reports, battle damage assessments, logistical status, intelligence analysis, command guidance, and audio and text communications. It must be stored in a structured way that makes it readily accessible to any node with the necessary permissions and have continuous and assured access that is not subject to systemic shutdown. All nodes must produce information

in a standard format that is compatible with the network repository and all information in the repository must be in a format that can be recognized and retrieved by all nodes.

- Fn5. Process, sort, analyze, evaluate, and synthesize large amounts of disparate information while still providing direct access to raw data as required.

  Information that is made available in a shared space must be examined and processed to make it more valuable to decision makers. Information management generally should occur as a service provided on the network. Information can become more valuable when formatted into a more useful form, combined or compared with other information, and analyzed and evaluated for meaning and implications. In this way, data are turned into knowledge and knowledge transforms into understanding. Information systems should be designed to provide commanders with higher levels of information rather than huge amounts of data, but without preventing commanders from directly and readily accessing key data elements as needed. In the collaborative environment envisioned in this concept, the aim should be to make it easy for others to add value to any piece of information.

- Fn6. Provide each decision maker the ability to depict situational information in a tailorable, user-defined, shareable, primarily visual representation.

  Information is to be presented in ways that help commanders understand situations more intuitively and convey that understanding to others quickly and effectively. Information should be presented in whatever form is most useful. It could be represented geo-spatially on a map, temporally on a time line, substantively as text or an image, graphically as part of a table or chart. Development of new visualization media, such as systems or influence diagrams to represent situational dynamics, may be required. Decision makers should be able to cut through a reservoir of information in any number of flexible ways, combining and recombining elements as desired to tailor a user-

defined representation of the situation as it pertains to them. Because these visualizations would all be networked, they would be shareable with all other nodes.

- Fn7. Provide distributed groups of decision makers the ability to cooperate in the performance of common command and control activities by means of a collaborative work environment.

  Multiple decision makers must have the ability to work with information together on a common enterprise. Spatially dispersed decision makers must collaborate with the same or more directness and richness of interaction as when collocated. The goal is that decision makers will interact much more informally and achieve greater mutual understanding. Commanders will create virtual teams of any composition desired to collaborate on a mission. The collaboration would occur within the medium provided by the user-defined visualizations. Within this primarily visual work environment, decision makers would employ a suite of command tools, allowing them to create overlays, graphics, orders or other products. The tools in this environment should interface with other mission planning systems in a seamlessly interoperable way. Plans would develop as collective efforts, with each team member contributing based on authority and ability. The plan would update in real time across the network as the cumulative effort of synchronous or asynchronous contributions.

- Fn8. Automate lower-order command and control sub-processes and use intelligent agents and automated decision aids to assist people in performing higher-order sub-processes, such as gaining situational awareness and devising concepts of operations.

  Some command and control activities must happen so quickly, routinely and consistently that machines best perform them. Other activities require the judgment and creativity that only experienced and trained people can bring. Automation can support both. Intelligently applied automation should result in higher-quality decisions made more quickly in both cases. Automation should

perform lower-level functions with greater speed and accuracy than people could. In cases in which people rely primarily on intuition, automation may assist with mechanical aspects of the activity, allowing humans to concentrate on the higher-level parts of the process, facilitating faster decision-making. Wisely used automation should result in a greater proportion of the organization dedicating itself to working on the problem at hand rather than administration and other overhead activities. A corollary is that automation should make it possible to perform effective command and control with fewer people. Required is a complex combination of machine-to-machine, human-to-machine, and human-to-human interactions, which will have doctrinal implications.

- Fn9. Provide information assurance (IA).

  Protecting and defending information and information systems includes proactive and reactive, layered defense-in-depth, computer network defenses. Required is capability to protect command and control activities against efforts to deceive, exploit or otherwise attack them. This capability should include the abilities to detect, locate, and identify hostile information operations, defeat or counter those efforts, and mitigate the effects of successful hostile efforts. Information assurance also applies to accidental corruption of information. It should include the ability to recover to an earlier information state from any kind of information corruption. This protection capability should be largely automatic and autonomous. It should routinely report hostile efforts according to conditions set by users, automatically handle those efforts within its means, and alert commanders to threats beyond its means. This capability should be adaptive and learning, meaning that it should adjust in response to changes in the conduct of hostile information operations.

- Fn10. Function in multiple security domains and multiple security levels within a domain, and manage access dynamically.

The logic of the network effect argues for few security restrictions because information generally is more valuable the more nodes have access to it. However, protecting intelligence sources remains a valid concern and included must be the ability to control access to information through the use of permissions. As a result, there are potentially significant implications for security classification. As a principle, information should be withheld only by exception rather than shared only by exception. This capability requires keeping track of the classification of all information and the clearance of all nodes, and reconciling the two in an environment in which information is continuously moving through the communications network in numerous directions at once. The fact that collaboration will take place in groups consisting of changing joint, coalition and interagency membership with varying security clearances will complicate this. This concept envisions that information will routinely be sanitized or downgraded to lower security classifications using information management services resident on the network.

- Fn11. Interoperate with command and control systems of very different type and level of sophistication.

  Because most future operations will be joint, FORCEnet elements must be fully and routinely interoperable with the systems of other services, creating a seamlessly joint command and control system. Because operations will also often be coalition and interagency operations, FORCEnet must be able to interface with the systems of nonmilitary agencies and other nations' militaries. Often these systems will be less sophisticated than U.S. systems, although some elements may be more sophisticated than elements of U.S. systems. Nonmilitary and foreign systems will likely have very different standards and conventions, so FORCEnet requires the ability to translate automatically as needed. Because command and control systems are ultimately human systems, joint, interagency, and coalition operations will invariably involve varying degrees of cultural differences, including differences in language and doctrine.

- Fn12. Allow individual nodes to function while temporarily disconnected from the network.

  Although intense, networked communications is the preferred state, individual nodes should also have the ability to function, at least temporarily, while disconnected from the network or with limited throughput. Bandwidth is a limited resource. Throughput will usually be constrained, whether due to environmental factors or hostile efforts. Some nodes may choose to disconnect from the network temporarily for security reasons. This capability has two aspects. The first is functioning based on periodic network communications, which has different implications for information management and situational awareness. The second aspect is retaining the self-contained or autonomic ability to perform certain core functions that would otherwise be transacted as services on the network.

- Fn13. Automatically and adaptively monitor and manage the functioning of the command and control system to ensure effective and efficient operation and to diagnose problems and make repairs as needed.

  FORCEnet requires its own command and control capability for making decisions about managing and optimizing system performance. Required is a capability that monitors transactions of information, products, and services on the network and generally making use of the same principles and interfaces as the command and control applications it manages. This capability should be automatic and adaptive, providing for the rapid and efficient reallocation of resources, bandwidth, services, communication links, equipment, memory, personnel, etc., and reconfiguring of system parameters in response to latencies, damage, overload or congestion, environmental interference, etc. Because FORCEnet will be an open system interacting with external nodes and systems, this capability requires the ability to interoperate with the trouble-shooting and command and control capabilities of other systems.

- Fn14. Incorporate new capabilities into the system quickly without causing undue disruption to the performance of the system.

FORCEnet will never reach a final state. It will continually evolve as new advancements appear. Technology is advancing at an accelerating rate, and FORCEnet must keep pace with industry standards. Maximizing the effectiveness of FORCEnet over time requires incorporating new capabilities-technological or other-without disrupting the system. The incorporation of new capabilities should be rapid and orderly, suggesting a modular structure, which minimizes the systemic repercussions of introducing a new element, other than a fully integrated structure that tightly couples all elements.

- Fn15. Provide decision makers the ability to make and implement good decisions quickly under conditions of uncertainty, friction, time, pressure, and other stresses.

  The primary reason for FORCEnet is to provide decision makers the ability to make and implement good decisions quickly. This capability is treated separately because of its importance and significant implications for nonmaterial solutions, especially education and training.

B. TRIDENT WARRIOR

1. Concept

Trident Warrior (TW) is the annual major FORCEnet Sea Trial event sponsored by NETWARCOM. TW is intended to provide "Speed to Capability" - a rapid fielding of improved FORCEnet Command and Control warfighting capability to the fleet, with full supportability and maintainability, and supporting Tactics, Techniques & Procedures (TTPs) to best use this new capability to optimize execution of Naval operations.

C. TW EVOLUTION

1. TW 03

Trident Warrior 03 (TW03) was planned as an Integrated Prototype Demonstration (IPD) to demonstrate an integrated prototype capability for fleet refinement and evaluation, piggybacking on the USPACOM command and control exercise (C2X) and the JTF WARNET Pre-Deployment Exercise (PDX). The IPD was expanded to include fielding a supportable incremental delivery of FORCEnet capability

and adding the Expeditionary Strike Group (ESG) Limited Objective Experiment (LOE) that would focus on command and control issues for the forward deployed naval forces (FDNF) ESG.

There were three ESG LOE initiatives:

- ESG command and control (C2)
- ESG fires CONOPS and TTP
- Information and Knowledge Management (IMKM)

There were three IPD initiatives:

- Human-System Interaction
- Technology
- METOC

TW 03 was conducted 25-30 September 2003 with the ESSEX Expeditionary Strike Group (ESG). The ESSEX ESG included elements of Amphibious Squadron Eleven, the 31st Marine Expeditionary Unit (MEU), USS ESSEX and USS CHANCELLORSVILLE as live forces, USS JOHN S. MCCAIN and USNS GUARDIAN as live but limited players, and USS HOUSTON and USS FLETCHER as simulated forces. TW03 consisted of PACOM C2X-08, JTF-WARNET Pre-Deployment Exercise (PDX) and FORCEnet Integrated Prototype Demonstration (IPD).

Operational objectives of the ESG LOE were to refine the Concept of Operations (CONOPS) and the Tactics Techniques & Procedures (TTPs) for the strike group in the following areas:

- Common Operational Picture management
- Bandwidth management and Quality of Service (QOS)
- Distributed collaborative planning
- Joint fires for the ESG as required to integrate JTF WARNET and FORCEnet capabilities to improve Joint Fires networks

Technical objectives in TW03 included assessment of the Advanced Digital Networking System (ADNS) enhancements in a joint and Naval Fires environment, analyze the implications of ship to ship networking on IP-based applications, CONOPS to maximize use of available bandwidth, assess the afloat bandwidth usage impact over Challenge Athena (CA) and Super High Frequency (SHF) equipment, assess the impact of web-enabled services to the ESG via the Navy's enterprise portal, and the implications of webCOP and COP synch tools.

COMPACFLT IPD objectives included assessment of bandwidth requirements in joint operations and recommendations on how to use bandwidth more efficiently, demonstration of the ability to reach high throughput on CA & SHF and assess the combat survivability of networks

- Major experimental initiatives of TW03 were the following:
- Command and Control (C2)
- Fires – Fires automation
- Information Management
- Knowledge Management
- Human Systems Integration (HSI)
- Technology Enhancements
- Situational Awareness
- Communications Capabilities
- Wideband SATCOM
- Collaboration Tools
- METOC[2]

2. TW 04

Trident Warrior 2004 (TW04) was conducted in October 2004. Conceptually, TW04 included new technologies for networks, processes to enable ESG operations,

[2] Naval Postgraduate School. (2004) *Trident Warrior 03 Analysis Report*

operational procedures that extended to shore-based capabilities, quality of life, and information services for career maintenance. TW04 also explored the means by which human-systems interactions with systems could be better defined and studied—making HSI a veritable component of what FORCEnet systems are intended to become. The ten major initiative areas also included specific research opportunities in knowledge management, demonstrating new techniques for defining the abstract term, knowledge, in metrics that may be used in the future as part of systems design. In short, TW04 cut across nearly all aspects of ESG operations; from internal war-fighting processes, to networked solutions for tactical planning (in the case of ISR and reach-back/reach-in to the Fleet Intelligence Support Team), and "day in the life" of the men and women embarked. This "total system" view of FORCEnet helps to understand from a much higher vantage point, the vectors along which FORCEnet is moving towards the future, and at its deck-plate vantage point, specific requirements for change. An effort of this immense scale cannot cover every aspect of every component included. Instead, TW04 sought to move the methodology and science of large-scale, complex systems experimentation forward, and in the process study some very specific FORCEnet concepts.

Moving from the conceptual to the specific, TW04 had to goals: to create an environment to examine FORCEnet systems, obtaining quantitative and qualitative data with regard to tactics, techniques, and procedures (TTP) and provide insights for use in procurement and development decisions; and to provide "speed to capability" (S2C). S2C is the rapid fielding of improved FORCEnet command and control warfighting capabilities to the fleet with full supportability and maintainability. It also includes the development of supporting TTP.

TW04 took place October 4-15, 2004 onboard the TARAWA Expeditionary Strike Group (ESG) (USS Tarawa, USS Pearl Harbor, USS John Paul Jones, USS Chosin) off the California coast; at nodes ashore in Ft. Hood, Texas; Fleet Imaging Support Team (FIST), in Maryland; and at locations on San Clemente Island.

TW04 was organized around the FORCEnet impact in the following ten areas, with important objectives in each listed:

- Intelligence, Surveillance, and Reconnaissance (ISR) – improve collaboration and support in a networked environment by "reach-in" to other networked nodes.
- Fires – assess the ESG architecture for fires and develop appropriate changes to TTP.
- Blue Force Tracking (BFT) – demonstrate the capability to use service-oriented architecture (SOA) to successfully ingest other-service tracking information and determine issues needing resolution.
- Web-Enabled Warrior (WEW) – assess the effectiveness of the Navy-Marine Corps Portal (NMCP) and a distributed server architecture, among other new systems, in supporting tactical forces.
- Sea Warrior (SW) – assess the accessibility of the Navy Knowledge On-Line (NKO) portal and the 5 Vector Model for career management.
- Networks, Information Management (IM)/Information Management Plan ((IMP) – increase data throughput by improving bandwidth management and provide multi-path, multi-tiered network architecture.
- Information Management (IM)/IM Plan (IMP) – improve collaboration and coordination by improving information flow and documenting the process.
- Knowledge Management (KM)/Knowledge Flow (KF) – explore the treatment of knowledge gaps with resources brought by FORCEnet capabilities; measure knowledge inventory of watchstanders and propose relationships to other performance metrics.
- Human Systems Integration (HSI) – assess efficiency in utilization of FORCEnet systems by the warfighter, shared situational awareness of collaborative teams, and speed of command in using multi-tiered sensor and weapon information.

- Information Operations (IO) – evaluate the preparation and distribution of psychological operations (PSYOP) products, management of the electro-magnetic spectrum in an ESG, and other new tools.[3]

3. TW 05

The TW05 focus was on demonstrating capabilities that lead to all elements of the Coalition being "robustly networked and achieving secure and seamless connectivity." These attributes were addressed principally through application of new and program of record technologies with a potential for being rapidly advanced through the acquisition process. Attributes of concern to TW05 included the "ability to collect, share, access and protect information," and "provide collaborative capabilities to improve a force's information position through correlation, fusion and analyses." TW05 included considerable Human Systems Integration (HSI), human factors related to technology usability, and knowledge assessment techniques in order to further the FORCEnet character of NCW in which a force "is able to share high quality situational awareness," and "develop a shared knowledge of a Commander's Intent."

TW05 explored the need to bring units of the AUSCANNZUKUS (Coalition included units from Australia, New Zealand, United Kingdom, Canada and the U.S. Navies) together within a Coalition Forces Maritime Component Commander (CFMCC) environment, potentially for GWOT or humanitarian assistance and disaster relief (HADR) operations. TW05 was also the opportunity for U.S. only and Coalition enclaves to conduct experiments aimed at C2 improvements to battle group operations. These experiment objectives were intentionally primarily technical, with limited operational interaction for decision making.

U.S. and Coalition enclaves were then bridged via technical capabilities such as the Coalition Naval Forces, or CNF network (CENTRIXS) as a transport layer via satellite communications, a subnet relay (SNR) and extended line of sight HF IP communications between Australian, New Zealand, U.S., and Canadian ships.[4]

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[3] Naval Postgraduate School. (2005) *Trident Warrior 04 Analysis Report*

[4] Naval Postgraduate School. (2005) *TW 05 Analysis Report*

V. FIRE

A. CONCEPT

The FORCEnet Innovation & Research Engine was developed to facilitate the TW planning, execution and analysis processes and streamline the development of the aforementioned processes while providing an enhanced collaborative environment to accomplish this. FIRE was designed to provide enterprise level features including a repository of documents associated with the various experiments that NPS has supported starting with the FBEs through current iterations of TW. FIRE also includes applications attached to a database in which the taxonomies for initiative and objective development are housed. These applications are forms and reports which the key experiment planners and initiative leads interact with to develop their experimental objectives. This initiative development area also serves as a single point of information where any and all experiment participants can go to see the most current versions of the development teams work in planning the experiment.

B. EVOLUTION

FIRE started out in TW03 strictly as a document repository and an initiative taxonomy development area. The document repository proved a very useful area to keep everyone up to date on the most current versions of experiment related documentation. Whenever documents were updated they were uploaded into the FIRE repository so that experiment personnel could access the current versions without having to pass documents around via email. The initiative development taxonomy was introduced in TW03 and served as a common structure for the initiative leads to describe their experimental objectives. This enabled experiment analysts to do much more thorough data collection planning than had occurred in the past.

For TW04 there were some added featured including a detailed data planning area in which the initiative leads could specify details about their objectives and how the critical data could be captured. For example leads could specify if the data capture for a particular objective would be captured by chat data, observation data, electronic data logs or from surveys. Another new feature added for TW04 was the introduction of a MSEL (Master Scenario Event List). The MSEL served as a script, or a list of dates times and

scenario events, upon which data collection was centered around and allowed participants access to see the upcoming scenario events of the day. Experiment personnel could sort the MSEL by platform, date, time or initiative to show the information in a manor that would most benefit their execution and data collection, organize data collectors and assign people to be at the right place and the right time to collect the data needed to support the objective at stake.

In TW05, the features used in TW03 and TW04 were improved based upon previous experience. The initiative and objective development areas were modified to create a more efficient structure to plan the objectives. The data planning taxonomy was also improved and broken out visually to show an easily read description of the various kinds of data to be collected. The MSEL was swapped out for what is now called the Master Event List (MEL). The MEL was a much simpler format than its scenario-based predecessor. Another key feature of FIRE introduced in TW05 was the Oracle Collaboration Suite (OCS). OCS was released by oracle the previous year and was in testing during TW04 and finally integrated into FIRE for TW05. The OCS included a Web Conferencing tool which greatly improved communication and effectiveness of the weekly planning meetings which facilitate the collaboration of the key experiment leads and planners.

VI. KNOWLEDGE VALUE ADDED

A. CONCEPT

Knowledge Value Added (KVA) is an Information Age methodology which is based on Thermodynamics - Complexity Theory. It views an organization as a portfolio of knowledge assets deployed to create value and assesses the value of intellectual capital and information technology. It is a way to allocate value or revenue inside organizational boundaries based on knowledge. It provides a common unit of output and performance ratios for all core processes: return on knowledge (ROK). KVA allows for the use of traditional financial analysis internally.

The assumptions of KVA are found in the underlying model; change, knowledge, and value are proportionate. ROK is an organizational performance ratio where the numerator equals the amount of knowledge (K) required to reproduce process outputs and the denominator equals the cost to use K to produce the output.

B. THE MEASUREMENT

We applied the KVA theory to measure and examines the changes made in the Trident Warrior initiative and data planning (IDP) process that have been implemented in FIRE during the last several years by the NPS FORCEnet KM lab. Since the TW IDP process has been undergoing incremental changes over the past three years of research and development, this report will start out examining the “As-Was” scenario first. This allows an opportunity to look at several years’ worth of changes in process from a Business Process Re-engineering (BPR) perspective, in hopes of presenting a method for determining value added from the intellectual research and Information Technologies that have been applied to TW. The “As-Was” and “As-Is” each look at one complete instance of an experiment; TW03 and TW04 respectively. See Appendix B for Excel printouts of data.

C. KVA AS-WAS

1. Process

The “As-Was” process of development was highly ad hoc and consumed lots of time in meetings, conferences, travel, document generation, document sharing via email and phone conversations. The amount of technology used was minimal, the initiative

lead, their designees and other experiment planning personnel used no more than Microsoft Office tools to aid in the process of initiative and data planning. This meant collaboration efforts were difficult for several reasons. In cases where several people needed to work together on an objective they had no means of doing this remotely other than for to pass MS Word documents back and forth via email or to actually meet in the same physical workspace to collaborate. Another difficulty was that the aforementioned issue of collaboration required planning personnel to travel frequently so they could collaborate in person through meetings and conferences. When passing planning documents via email only one planning team member could be editing their document at a time without creating versioning issues. If several people were working on developing an objective together and all three were working on their individual PCs in remote locations on the same day, then at the end of the day someone would have to concatenate their new work which was a time consuming and error prone method of collaborating.

The results of the above limitations were most notable in the amount of time taken to complete experiment design and quality of the data planning documents. In the "As-Was" paradigm, the experiment timeframe would be approximately eighteen months, the majority of which was spent in objective development and data collection planning. If the data planning is not completed accurately and with the appropriate amount of relevance to the Sea Trial or FORCEnet experimental objectives then the ability to do quality analysis on the experiment data was lessened. If the experiment data is not planned properly or collected properly then the analysis becomes more difficult to accomplish and the final product, TW Final Report, will be of less value to the customer (NAVNETWARCOM.)

2. Flowchart

When the IDP process is broken down into its sub process components the core parts of the process are defining experiment objectives, experiment data collection planning and experiment management planning. The first part of the process includes defining high level goals and questions, identifying attributes and measures and identifying data sources which culminate in an initial objective design document. The experiment data planning includes defining data collection processes, data capture systems, data capture locations, data requirements (survey, chat, electronic or

observation) and data capture personnel. The experiment data planning portion of objective development produces a Data Capture Plan (DCAP) document. The final phase is experiment management planning in which the initiative lead and the related planners must assign personnel to data capture locations and create, manage and assign surveys, should they be included in the data requirements. The total work of the above sub processes and their outputs is put together in the TW Experiment Plan document and the Master Event List.

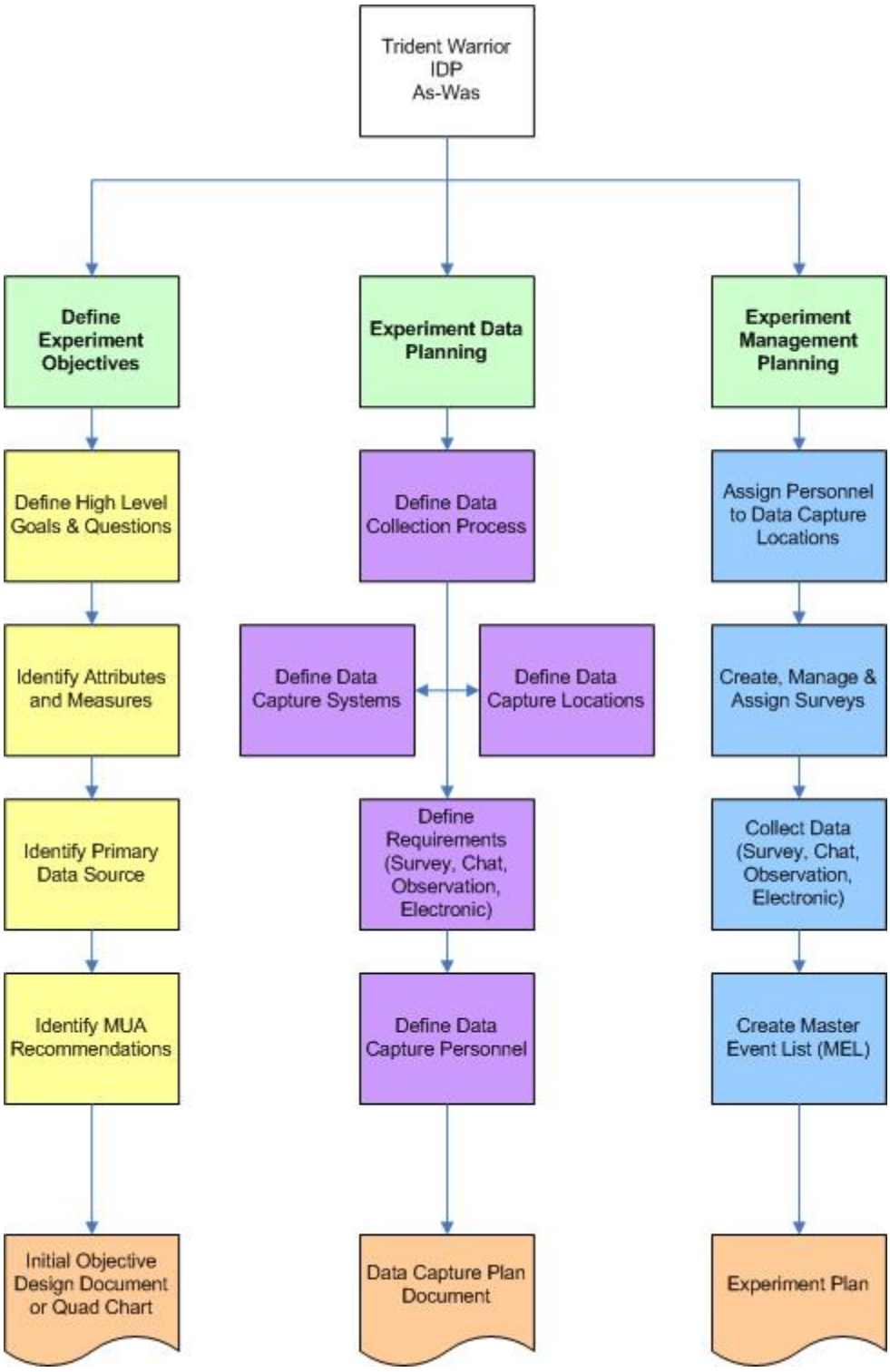

Figure 2. As-Was Flowchart

D. KVA AS-IS

1. Process

Over the past several years of development and research the NPS FORCEnet analysis team has generated many new features and methodologies for enhancing the process of planning large scale military experiments. The first issue that was addressed from the "As-Was" approach was the need for a common database and repository for the development of TW objectives. The FORCEnet analysis team created the Knowledge Management Lab to build this functionality. The result was the FORCEnet Innovation and Research Enterprise (FIRE) database web portal. The FIRE site is built on Oracle Portal technology and allows its developers at the Naval Postgraduate School to manage and facilitate the IDP process among many others. The FIRE site also provides collaborative tools for virtual meetings, and remote collaboration between TW planners all over the world including coalition forces.

The initiative input area of FIRE allows initiative leads and their designees to collaborate on the objectives and goals for their particular area of experimental ownership. There are a series of applications provided which allow the users to input their objectives into the FIRE database where all authorized users can collaborate on the work in a structured input form geared to keep fitness and relevance to the FORCEnet objectives. The ontology developed and implemented in the initiative input applications ensures a level of rigidity and consistency throughout the many initiatives and goals included in a TW experiment. This method also eliminates the versioning inconsistencies that were common and troublesome in the previous method of planning collaboration. The paradigm used in FIRE also facilitates parallel processing in the sense that multiple users can work on an objective within one initiative at the same time, and furthermore multiple initiatives leads can do their work at the same time via the database for exponential growth in efficiency.

Another process enhancing feature supplied by the NPS FORCEnet KM Lab is the Oracle Real Time Collaboration tool. Through the FIRE web portal users can join and start virtual meetings all done over the internet. In these meetings users can pass and share presenter role, share documents, share desktops, share web browsers, have access to

shared whiteboards and chat features. This capability has decreased the amount of travel, emails and face time required for TW planning personnel to accomplish their work.

A couple resounding examples of the success of these changes lie in the timeline and the quality of the final reporting documents generated. The NPS FORCEnet analysis team is currently supporting 3 TW experiments at once, each with approximately a six month time frame. When compared to the "As-Was" paradigm this shows a boost in efficiency by a multiple of three. Using the FIRE site and the methodologies captured therein the FORCEnet analysis team can, for example, concurrently run reporting phases on TW05, final planning and execution management on TW06 as well as support planning for TW07. Another example of the increase in efficiency is the final result, the TW Final Analysis Report generated by NPS. The TW05 final report is of very high quality when compared to the TW03 final report. A large part of this is due to the extensive and accurate objective planning now done within the FIRE site.

2. Flowchart

Note that the "As-Is" flow looks very similar to the "As-Was" flow chart. The fundamental processes have not changed, nor have the outputs. It is the ways in which these processes happen that is drastically different. The boxes outlined in red illustrate the areas of the process where Information Technology (IT) has been added in order to streamline the process, reuse data or methods and where the FIRE web portal has added automation, structure, collaboration or other enhancements.

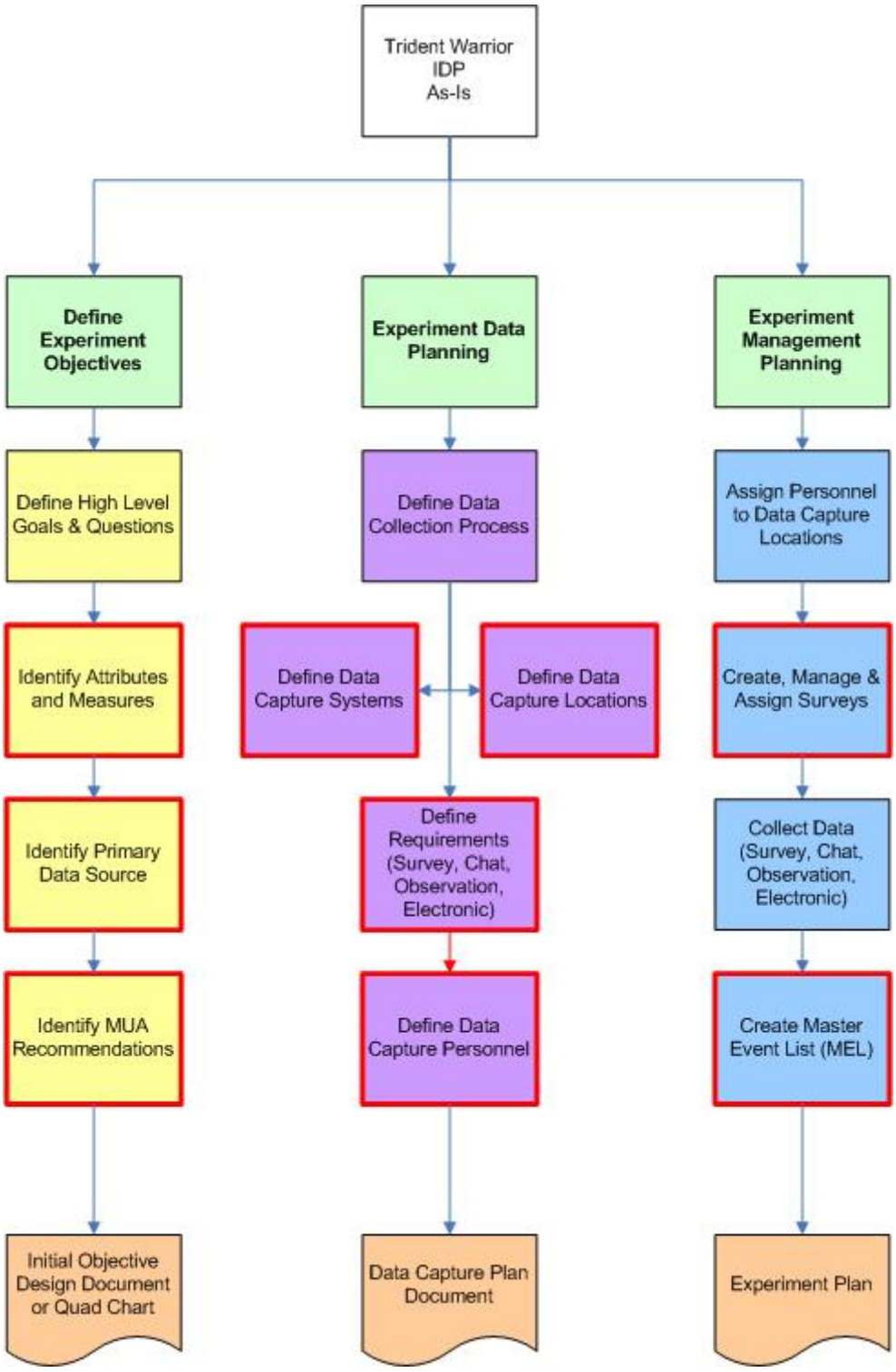

Figure 3. As-Is Flowchart

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VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS AND RECOMMENDATIONS

1. Survey Analysis

A survey was administered to FIRE users in effort to determine how the users felt about their experiences with FIRE. Questions about benefits and advantages of using the FIRE site to do their TW planning and development were asked. It is, however, difficult to get a large response group with regards to the IDP process because there are no more than twelve initiative leads per TW experiment, and the majority of the questions asked in the survey to support the research in this thesis needed to be focused towards initiative leads and the other primary planning staff. For the full survey output report see Appendix A. A brief summary of survey results follows:

When users were asked if they preferred using FIRE to do the IDP process compared to the previous system of emailing documents 77.8% of respondents agreed or strongly agreed. Only one respondent marked strongly disagreed.

When asked if users had difficulties or obstacles with the IDP process while using FIRE, 26.3% agreed or strongly agreed and 26.3% disagreed or strongly disagreed, leaving 37.5% of responses in the neutral category. Comments of note from users who agreed with the statement indicated that issues included data input fields were too small, formatting the text was not easy without knowledge of HTML, rich text was not supported (i.e. the ability to use features like bold, italic, bullets, font colors, etc.) and the inability to post documents without going to the FIRE administrators for uploading.

75% of respondents agreed or strongly agreed that the initiative planning area in FIRE improved the TW planning process. Three respondents were neutral, and one respondent strongly disagreed. Some additional comments added by respondents included:

- “FIRE is a single source to manage and execute the experiment.”
- “Developers of the site listened to feedback and responded positively”

- “It gave Initiative Leads a place to put what they were planning in writing so we could all "understand" what they were planning.”
- “Kept everyone following the same general template. helped me stay in sequence.”
- “Gradual simplifications in what had to be entered and in the arrangement of planning items (better association between items). Significant improvements in the reporting sections.”
- “Realtime view into what was happening with experiment planning.”
- “The ability to get information into one place and be able to cross reference with other initiatives.”
- “Common format and structure, detailed oversight and coordination by NPS analysis team, entries (approaches, concepts, terms) differed widely between Initiatives”
- “FIRE helps to organize and clarify the initiative areas, goals, and objectives.”
- “The information in FIRE is not organized along any line that makes it quick and easy to find information. The opening page is like reading the Wall Street Journal. Lots of small text, lots of disjointed information, requirement to scroll around to even look for information; Once one gets into the various tabbed areas, FIRE limits you to text entry only - very limited amounts - and does not allow charts, graphs and other images to be imbedded with the text to facilitate Knowledge Transfer. Linking to such images or other amplifying documents remains a mystery. The amount of text is quite limited. One has to go through a single individual to get documents posted for Knowledge Sharing... not my idea of KM.”

When asked if the capabilities offered by FIRE lessened the time planners would have spent traveling to attend meetings and do face to face collaboration with other experiment planning staff 81.3% of survey takers agreed or strongly agreed to the

statement. 12.5% disagreed. One user added the following comment: “It's more than just the travel time saved; it's the time plus the quality of the work done!”

88.2% of FIRE users responded with agree or strongly agree with the statement that the evolution of the FIRE site and its collaborative capabilities increased the productivity and/or quality of their work. One respondent was neutral and one strongly disagreed.

46.7% of users surveyed found the value of the procedures and capabilities of the FIRE site valuable to highly valuable. 17.6% were neutral and one respondent marked low value to this question. Comments of note to the question are as follows:

- “Saves lots of time and money”
- “Collaborate suite is difficult to access and use.”
- “Would be higher if more people used it”
- “Results in defensible experiment results”
- “especially saves time bringing new (or curious) people up to speed about what's happening in exercise planning”
- “The concept is good. The way to get there is not something I find beneficial.”

When users were asked to state what improvements or features they felt would benefit the FIRE system the following comments were collected:

- “Operational systems should be on unclassified and classified networks. All must be backed-up! Separate developmental systems should be used for developmental work.”
- “Speed of the site (response time) is too slow. Information is hard to find, unless you know exactly where it is. Need a 'search' function. Retaining personal preferences between visits, i.e., site knows where you last were and when you revisit, you start where you left.”

- “I believe FIRE is critical; however I also believe we need to streamline some of the process. In future iterations, fields should be able to populate other sections of the database, so that clicking back and forth is not necessary.”
- “Better visibility on what the other initiatives might do that affects me. That's all manual now.
- Figure out the routine information sharing requirements, and make the FIRE meet them. I'm really tired of filling out all the blocks in FIRE, only to find the requirement is yet another medium like a power point quad chart. Or re-writing OAA and MUA verbiage. Should be able to mouse click the required output, and the FIRE fields are already prepared to be transitioned.
- Still seems prone to burps. More than once, I've found things I worked on weren't saved.
- Needs more embedded templates so that a well written question, or objective, or whatever, is a matter of filling in the blocks.”
- “Video, VoIP. Difficult to navigate if you are not a power use. Need to integrate a wiki capability.”
- “The ability to input and hyperlink documents directly to the initiative. Saves the time of using support personnel.”
- “while the database structure of FIRE (with many fields) provides a useful structure for planning, it loses the temporal property of the data collection / analysis process - perhaps this is what the THREADEX helps accomplish”
- “Potential integration of the initiative spreadsheet with the data planning spreadsheet. 2) Area for collaboration regarding survey development, e.g., if appropriate, possibly the ability to link to the latest copy of the survey via the data source section. 3) Overhauling the data collection fields (row labels within FIRE tables) to meet user needs.”
- “More background information for each initiative area would be helpful.”

- “1. Better organization of information 2. One screen/page to minimize scrolling 3. Ability to enter unlimited rich text and graphics into planning and data reduction areas, allowing formatting of the text without having to code in HTML 4. Ability to post and manage own documents 5. Password expiration notices 6. Faster response by the web site. It is too slow in its responses to make me want to work there unless forced to. 7. General availability of the collaboration services without having to schedule meetings - ad hoc meeting ability 24/7 by any/all registered users. 9. Easier ability to link to stored documents and other data stores 10. Much more automated roll-up from stage to stage as initiatives are planned and executed. Right now it is inconsistent and painful. 11. Screens, forms, etc. need to remember where the user has been. It takes way too many keystrokes to do relatively simple tasks, simply because FIRE does not take us to the where we need to go, but rather takes us back several steps, requiring one to burrow back down to the appropriate level. When entering a lot of data or forms, this gets old very quickly and is not a good KM paradigm. 12. Make FIRE less NPS-centric and more user-centric”
- “Better interoperability with NMCI”

88.2% of surveyed users agreed that it would be helpful to include a library feature in which they could upload and manage their planning documents. Users added the following comments to this question:

- “Handy management device.”
- “Site is currently too restrictive in what you can upload. I understand that it is a relational database - not an object oriented database - and this makes it much harder to store and retrieve files such as video, ppt, etc.”
- “Would reduce the duplicate files I'm carrying around “
- “although it is wise to have a centralized control/oversight of what's posted”
- “Probably should offer some templates for this area depending on the [potential to standardize planning docs.”

- "The inability to upload and share documents quickly and easily (and I do not include emailing to a 3rd party a step in the right KM direction) is a must."

Overall, the results showed that people felt FIRE was beneficial and did save them time. It was reported from users that some reasons for travel time not decreasing, and in fact increasing, was because more meetings were held. This was due to rapid decrease in required planning time which in turn increased amount of experiments able to plan concurrently.

See Appendix A for further recommendation, complaints, or general comments about FIRE.

2. KVA Analysis

One thing of note is that KVA does not seem to take into consideration the increase or decrease in the quality of output; the quality of the final report and ability to collect critical data to support the final report have increased since the days of FBE when FIRE was not utilized. Another consideration that is not factored into the numbers that our KVA produced is that FIRE has allowed multiple iterations of TW to be running concurrently, which is of extreme value. A more in-depth and advanced KVA study should be structured in the timeframe of a year, vice that of a single instance of a TW experiment as was used, in order to correctly reflect the ROK FIRE provides.

The operations and services performed by the NPS KM Lab in support of TW experiments are always under development with the goal of reaching maximum potential in efficiency and quality. The results show that with each re-engineering iteration, the methodologies and applications developed by the NPS FORCEnet analysis team have greatly increased ability to plan, execute and analyze large scale military experiments in a reduced amount of time at a reduced cost, with a much higher ROK. The IDP process has come a long way since the days of the FBEs but there are extra layers of usability, features, collaboration and automation that can and will be added to future versions of the FIRE site. The road ahead, as far as the KVA goes, will show more IT injected into the process. The addition of updated collaboration features will be most notable in the next-generation FIRE site.

B. AREAS FOR FURTHER RESEARCH

The NPS KM Lab is always improving the capabilities of the FIRE site and the processes for developing and planning for the large-scale experiments which are supported by FIRE. One area requiring further research and development is the collaborative features of the enterprise system. As noted by several survey respondents, a place for planners to upload, manage and share their planning documents would be beneficial to users. This is currently already under testing for the TW06 experiment. Initiative leads have been granted a workspace area in the OCS where they can upload documents of any format and organize them in a folder structure of their design.

Another feature under testing currently is the "Discussion" area included in the OCS workspaces. The discussion area is specific to the initiatives involved in the TW06 experiment and functions much like a typical web based user forum in which users may start discussion topics and collaborators may respond and discuss the issues at hand in the various discussion threads.

Task lists are also included in the OCS that is being developed to support experiment design. This allows initiative leads and planners to assign tasks to members of the initiative workspace.

A meeting calendar will also be included in the new OCS integrated into FIRE. The meeting calendar can be used by leads and planners to coordinate and schedule web collaboration sessions.

When a user logs into their workspace they see an overview page which outlines any new activity in the discussion space, new tasks assigned to them, any new files that have been added to the workspace library and any upcoming web collaboration meetings that have been scheduled for them to be involved in. Furthermore, these areas of the workspace may be linked together. For example, if a user logs into the OCS workspace and notes that there is a web collaboration meeting scheduled for them they can click a link which will show them which documents in the workspace library are of interest for the upcoming meeting. They can also be linked to any topics in the discussion area that have been running which contribute to the meeting coming up.

Another area of further research is how to allow users to use more advanced rich text formatting within their initiative development areas. Currently Oracle does not support rich text within the input forms used to develop initiative planning data. This limits users to a block of text which can not be broken up by bullets, numbered lists and custom font changes which would make their work easier to read and organize.

FIRE users working behind the Navy Marine Corps Intranet (NMCI) have complained that the FIRE site is too slow moving from their workstations. This issue is important to research and find a solution to, so that usability can be maximized for all planners' leads and general users of FIRE. Network analysis research is currently underway to provide a solution to this issue. One possible solution that has been under consideration is physically moving the FIRE and OCS servers to a more robust Network Operating Center (NOC) such as FNMOC.

Research is also being conducted to create a FIRE system which will include more extensive enterprise level features like clustered redundancy among remote servers and automated back up and recovery methods. It is a desirable feature to have the FIRE site located on several servers operating in a cluster. Under this paradigm if one server loses power or has a physical hardware failure, the information would be seamlessly moved to the other servers in the remote cluster and operation of the database and all its connected applications would continue to function without interruption. Furthermore, once operability was restored to the troubled node it would automatically update itself to contain the most current versions of information that had been added to the rest of the servers in the cluster while it was down. Currently the backup and disaster recovery system of FIRE is not suitable and needs further development; this will be handled by the clustered server technology which will allow for recovery from most any system failure or power outages.

Other features that need further development include advanced security and user management. Currently, the security settings are allocated in a highly manual method, which requires lots of time and effort by the site administrators. Much the same are the operations of the user account creation and maintenance; several upgrades are required to take large amounts of manual overhead labor out of this process. Users currently are

required to fill out an Excel form, which has to be emailed to them by the FIRE administrator. The form needs to be filled out and returned via email to the administrator who, in turn, has to forward it to the approval authorities. Once approval authorities have emailed FIRE administrators, verifying that the user request has been approved, the administrator has to create the account manually and email the requestor their log in credentials. This process needs to me automated as much as possible; one solution currently under development is a web-based, new user request form that will automatically show the status of a user who is requesting access. This will eliminate a substantial amount of email traffic and manual entry of user attributes from the FIRE administrator, as well as cut down on the complexity and time taken to complete the task.

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APPENDIX A

Survey Results & Analysis

for

FIRE User Survey

Saturday, June 3, 2006

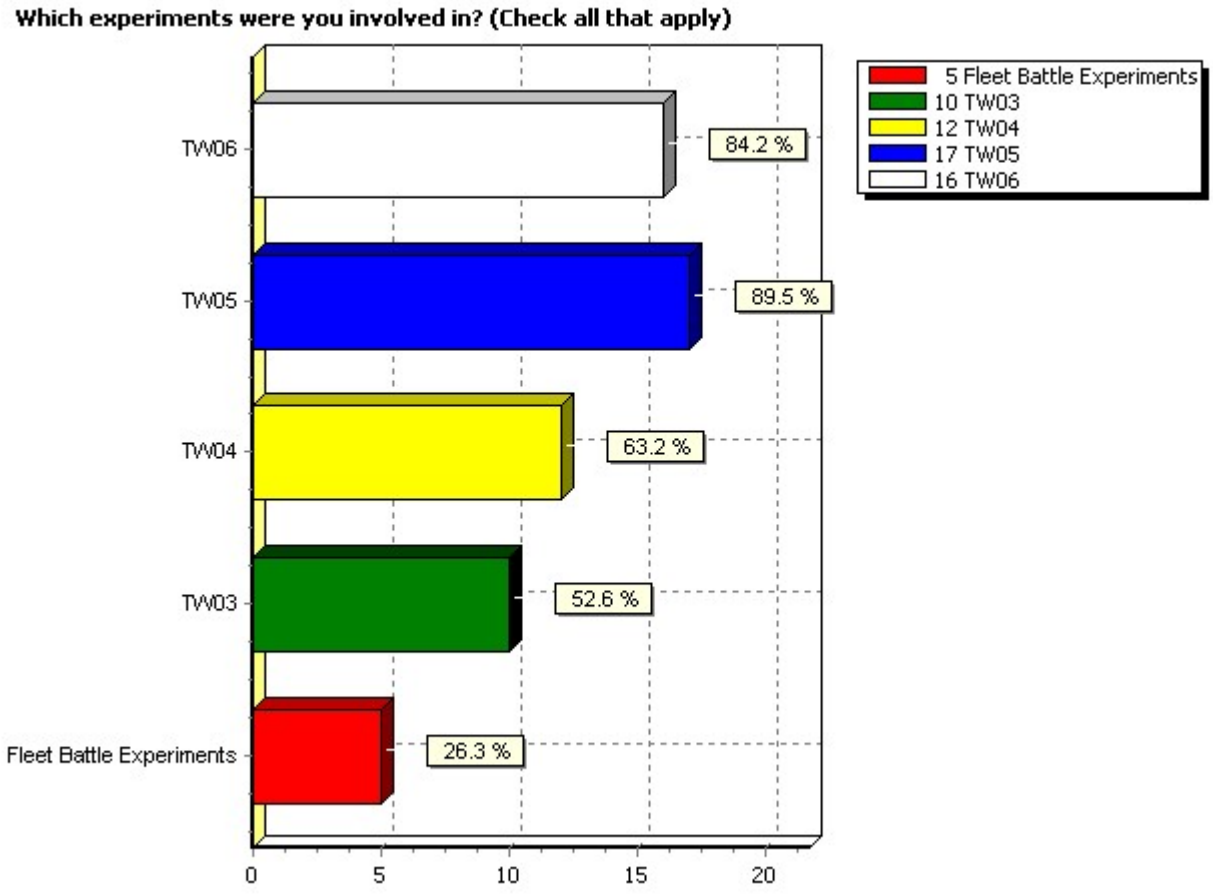
Executive Summary

This report contains a detailed statistical analysis of the results to the survey titled *FIRE User Survey*. The results analysis includes answers from all respondents who took the survey in the 20 day period from Thursday, May 11, 2006 to Tuesday, May 30, 2006. 19 completed responses were received to the survey during this time.

Survey Results & Analysis

Survey: FIRE User Survey
Author: McClain, Smith
Filter:
Responses Received: 19

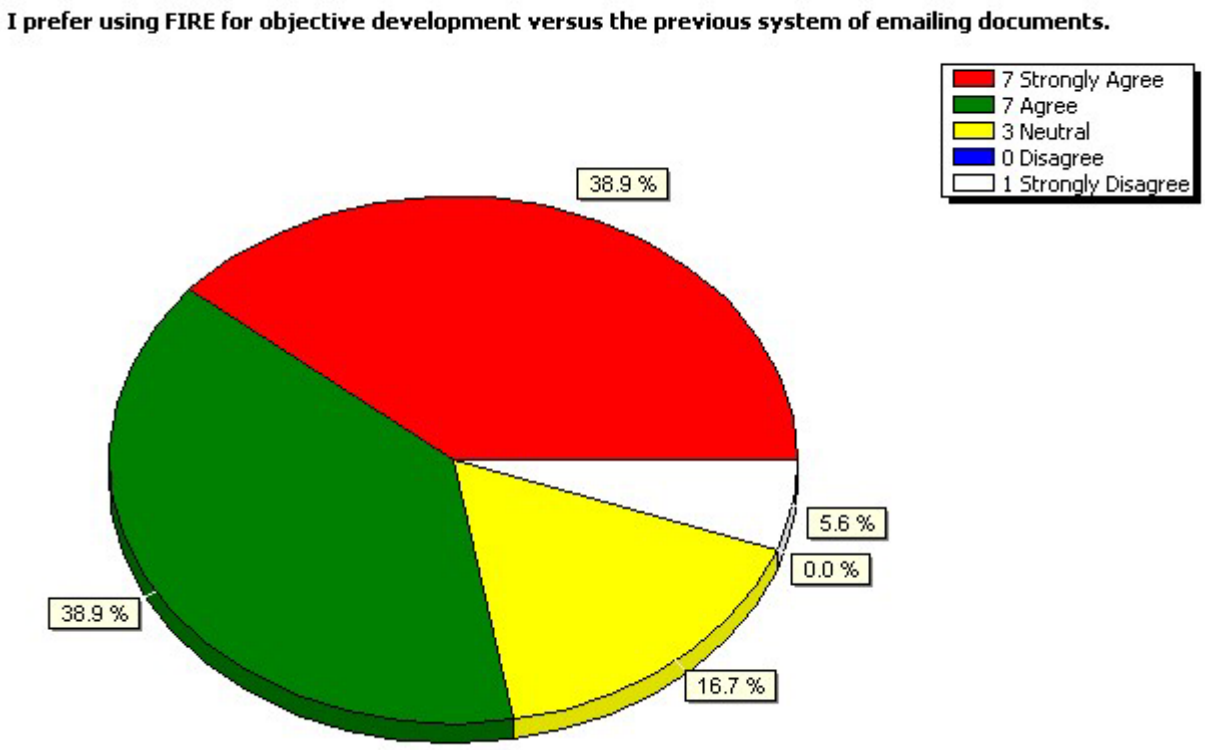
Which experiments were you involved in? (Check all that apply)



What was your role/function in the experiments?

planner, analyst, report writer
Deputy CHENG 04, Initiative lead in 05 and 06
Planning and execution
Initiative Lead
Network Architect/Engineer Data Collection Experiment Design LOE Build Data Planning
Initiative lead
Resource sponsor. (OPNAV)
Planning and analysis
Different roles different years. '03 I interviewed about 10 people on how they conduct various processes and wrote up the results of the interviews. '04 I reviewed surveys and made recommendations for improvements. '05 reviewed surveys and helped oversee survey implementation and reporting on results. '06 same role as '05
TW03 experiment planning. TW04 specific initiative planning
IO Lead
Officer in Charge of FBE Echo Information Management Lead TW03, TW04 Information Management and Collaboration Lead TW05 C2/MDA Lead TW06
HSI analysis
Data / surveys
survey development
Systems engineering and integration of initiatives; organizing and sharing information to accomplish this task across a broad spectrum of users with wide geographic and temporal separation
Technical Director

I prefer using FIRE for objective development versus the previous system of emailing documents.

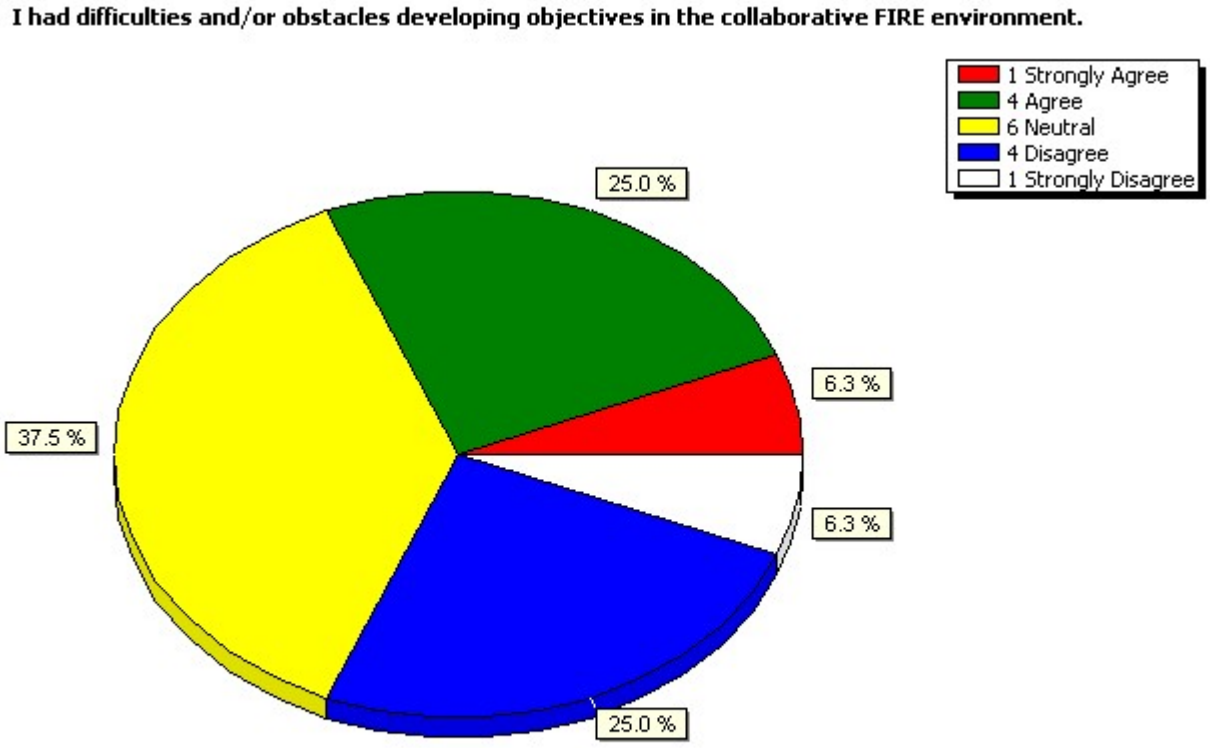


Comment Responses:

FIRE has allowed faster development of the experiments and faster and more accurate analyses. It has also permitted far more complex experimentation than could be effectively managed previously.
Helps with version control and passing info
Didn't experience any other method than FIRE
Email is not very collaborative when working with more than one person.
but....it still seems clumsy
lots better
I was not involved in inputting info into FIRE/ objective development
but it's useful to iterate among a small analysis team via Word docs prior to uploading to FIRE
FIRE is too static, not well organized and severely limits what a users can enter into data fields; I did not find it a useful planning tool or knowledge base
As technical director I do not develop objectives however utilization of a "single stop

shopping" venue for objective development only makes sense. It precludes all the issues associated with version control.

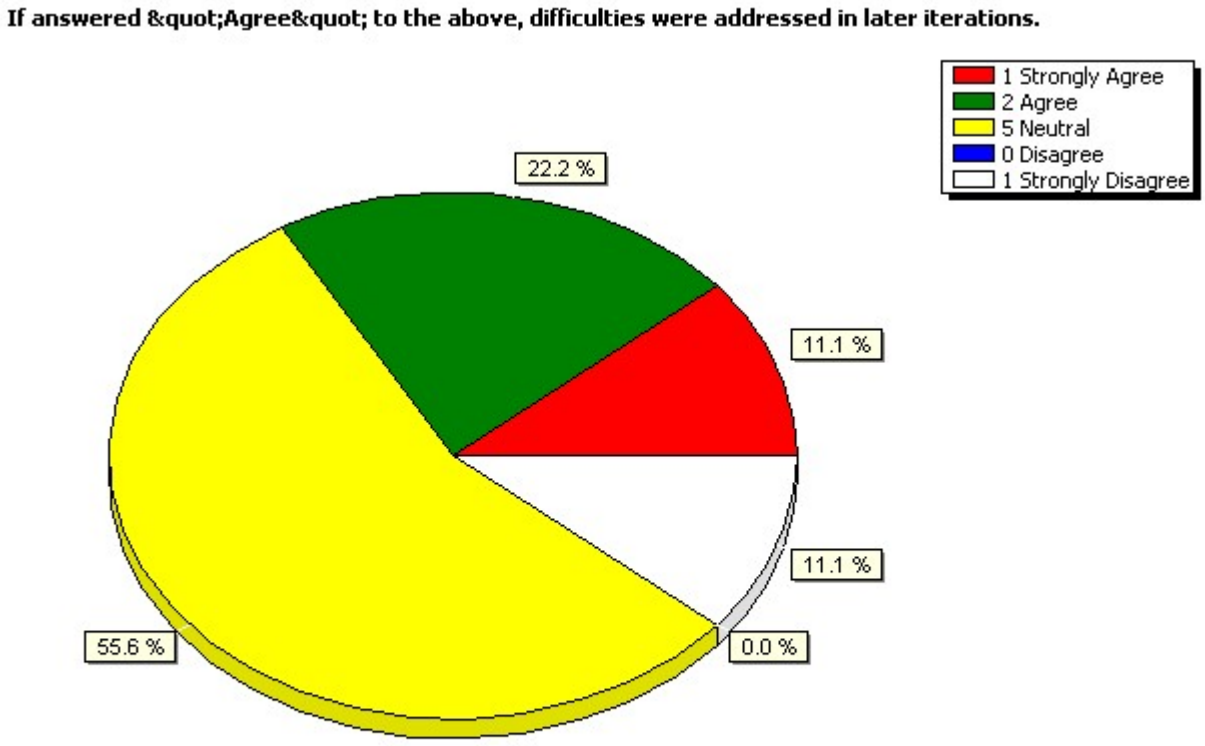
I had difficulties and/or obstacles developing objectives in the collaborative FIRE environment.



Comment Responses:

Some did, however.
I believe that it was based on website development issues. ie print page and attributes
NA
N/A for my role
Data fields were too small; unable to format text without knowing HTML; unable to include diagrams with text; no obvious rich text capability; unable to post documents of relevance; difficult to find and track information within FIRE

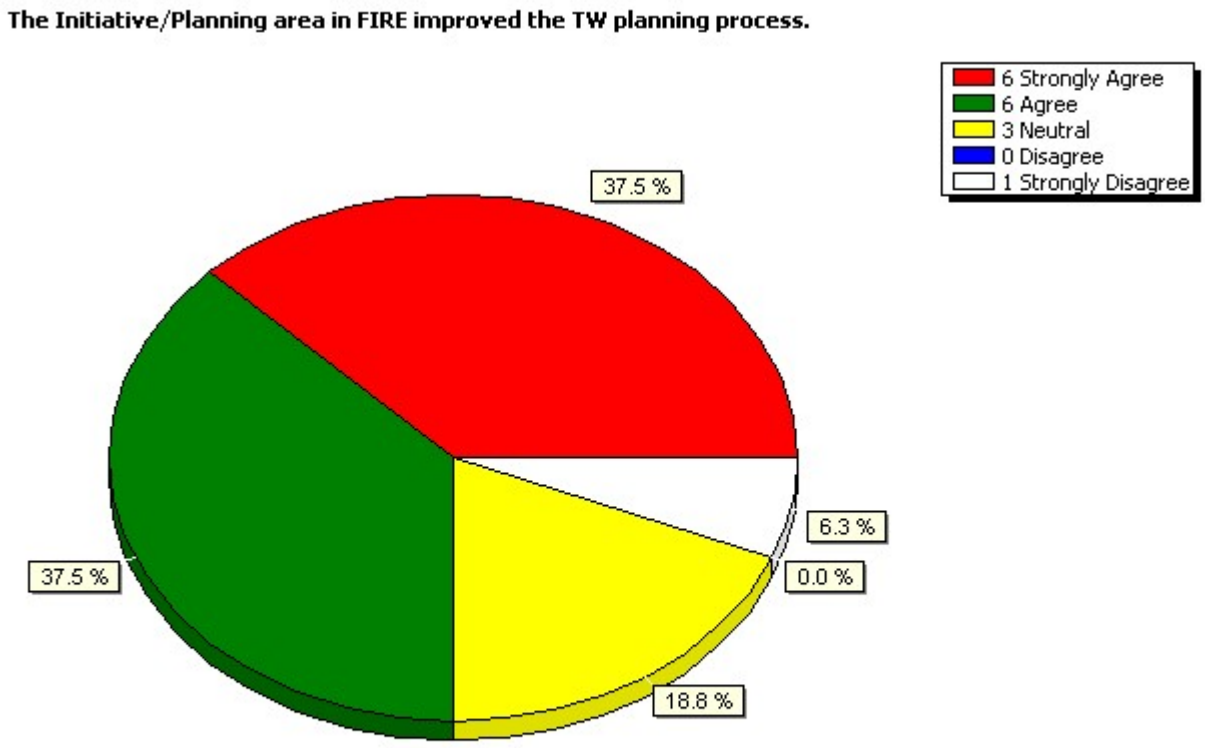
If answered "Agree" to the above, difficulties were addressed in later iterations.



Comment Responses:

Text limitations only marginally increased; plethora of excuses for the other obstacles

The Initiative/Planning area in FIRE improved the TW planning process.



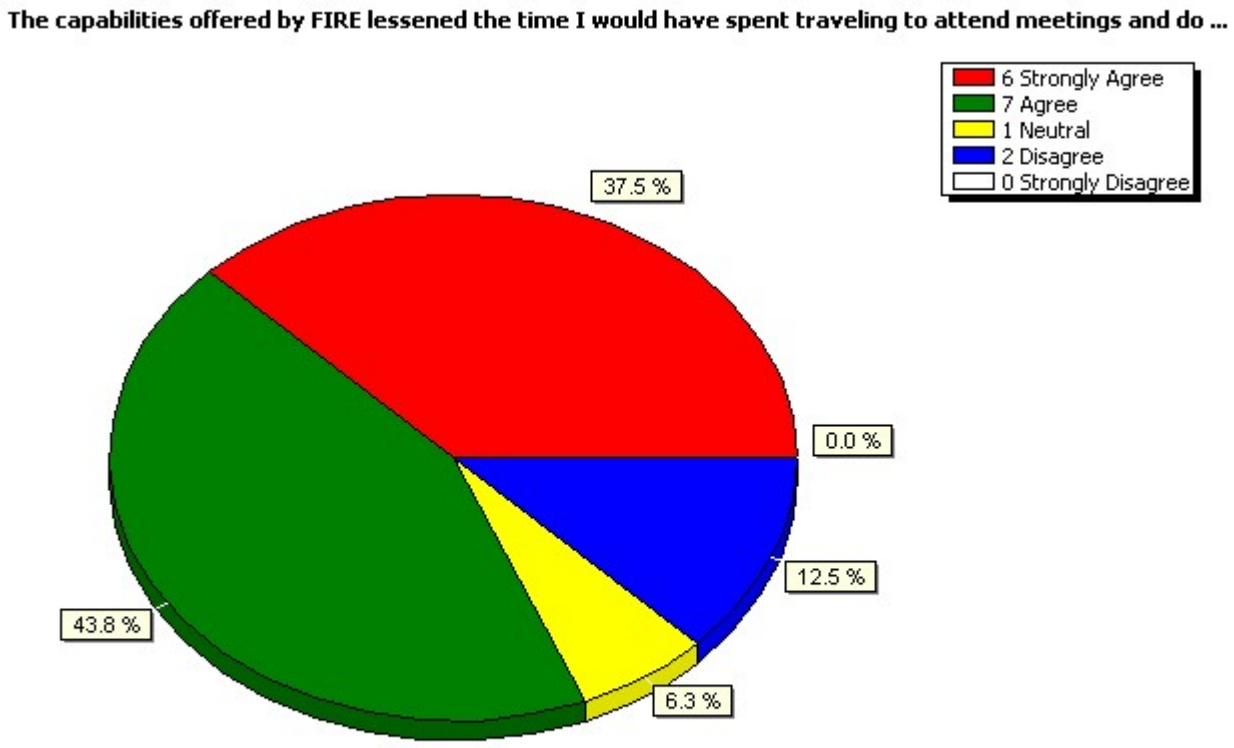
Comment Responses:

Improved efficiency and effectiveness of the process.
I felt that there is still redunancy in the data fields between the obj page and the data page.
I can't compare it to anything since I wasn't here prior to use of FIRE. I have no way of knowing if its an improvement.
See the comments above, FIRE is just not easy to use. It is not flexible. One cannot post documents. Input is limited to a minimal amount of text that has no organic formatting; the list goes on and on and on

To what would you attribute the previous rating?

See answer Number 4.
See above answer
Single source to manage and execute the experiment.
Developers of the site listened to feedback and responded positively
It gave Initiative Leads a place to put what they were planning in writing so we could all "understand" what they were planning.
Kept everyone following the same general template. helped me stay in sequence.
Observation.
Gradual simplifications in what had to be entered and in the arrangement of planning items (bettter association between items). Significant improvements in the reporting sections.
Realtime view into what was happening with experiment planning.
The ability to get information into one place and be able to cross reference with other initiatives.
1. common format / structure 2. detailed oversight and coordination by NPS analysis team 3. entries (approaches, concepts, terms) differed widely between Initiatives
N/A
FIRE helps to organize and clarify the initiative areas, goals, and objectives.
The information in FIRE is not organized along any line that makes it quick and easy to find information. The opening page is like reading the Wall Street Journal. Lots of small text,lots of disjointed information, requirement to scroll around to even look for information; Once one gets into the various tabbed areas, FIRE limits you to text entry only - very limited amounts - and does not allow charts, graphs and other images to be imbedded with the text to facilitate Knowledge Transfer. Linking to such images or other amplifying documents remains a mystery. The amount of text is quite limited. One has to go through a single individual to get documents posted for Knowledge Sharing... not my idea of KM.

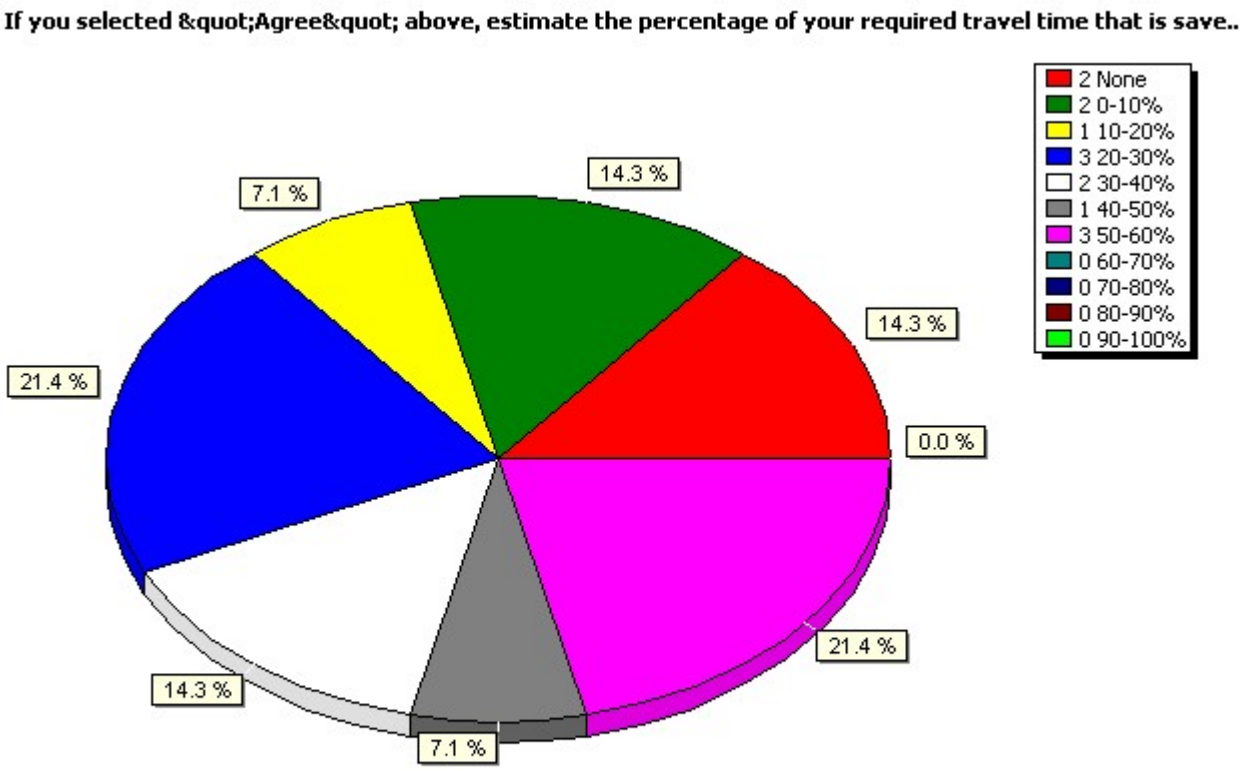
The capabilities offered by FIRE lessened the time I would have spent traveling to attend meetings and do face to face collaboration with other experiment planning staff.



Comment Responses:

Similar collaborative development would be impractical due to time and cost.
Still too many meetings.
N/A for my role
There are other tools that are more mature, more flexible and easier to use. Frankly, I am not sure FIRE actually saved any time. We still had to meet face to face to plan. The only real users of FIRE seemed to be NPS. Out of text room again.. NG

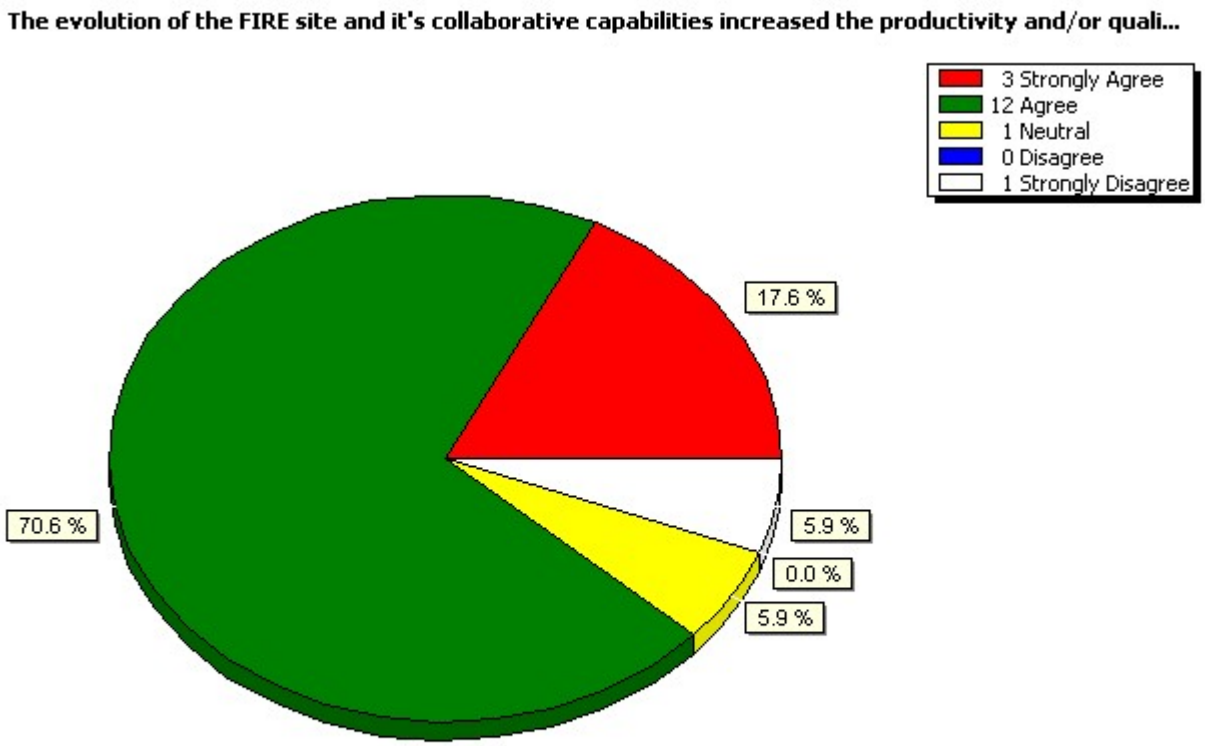
If you selected "Agree" above, estimate the percentage of your required travel time that is saved by using FIRE to collaboratively plan Trident Warrior Experiments.



Comment Responses:

It's more than just the travel time saved; it's the time plus the quality of the work done!
Would not oversell it. Could have made better use of some of the fcae to face time if objective development was a bigger part of the IPC/MPC/FPC
can't say for sure if any time was saved... I spent hours fighting FIRE to get what I needed into the database.

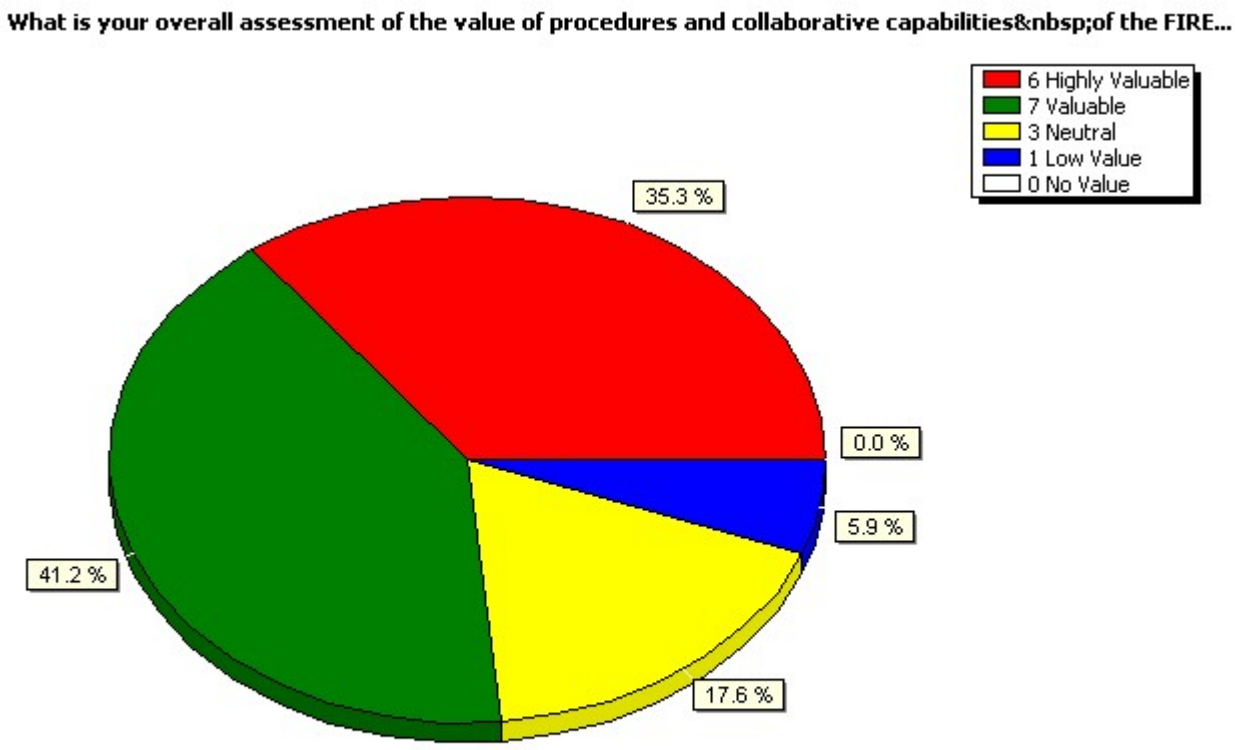
The evolution of the FIRE site and it's collaborative capabilities increased the productivity and/or quality of my work.



Comment Responses:

Same as my answer in Number 7 above.
The site has had down time problems that have made things difficult at times.
Again, wouldn't oversell it. The greatest weakness is the fact that many items still need to be handpoked, from spreadsheets to briefs.
Able to point interested parties.
FIRE's KM deficiencies have been articulated above. The Collaboration tool was not that useful as we spent most of our time in teleconference mode and fighting NMCI. NPS always "drove" so it was not collaboration in the true sense. Out of text r

What is your overall assessment of the value of procedures and collaborative capabilities of the FIRE system?



Comment Responses:

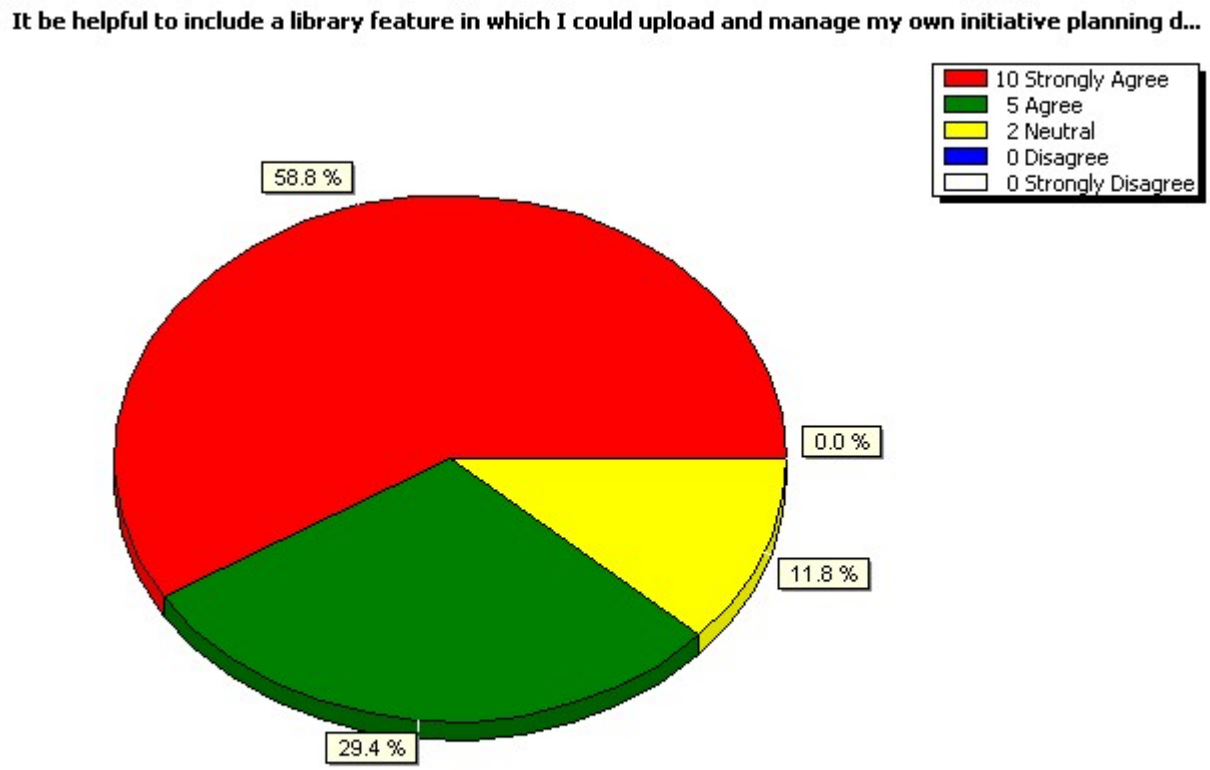
Saves lots of time and money
Collaborate suite is difficult to access and use.
Would be higher if more people used it
Results in defensible experiment results
especially saves time bringing new (or curious) people up to speed about what's happening in exercise planning
The concept is good. The way to get there is not something I find beneficial.

What improvements/features do you feel would be of benefit to the FIRE system?

Operational systems should be on unclas and classified networks. All must be backed-up! Separate developmental systems should be used for developmental work.
Speed of the site (response time) is too slow. Information is hard to find, unless you know exactly where it is. Need a 'search' function. Retaining personal preferences between visits. i.e. site knows where you last were and when you revisit, you start where you left.
I believe FIRE is critical, however I also believe we need to streamline some of the process. In future iterations, fields should be able to populate other sections of the database, so that clicking back and forth is not necessary.
--Better visibility on what the other intiatives might do that affects me. That's all manual now. --Figure out the routine information sharing requirements, and make the FIRE meet them. I'm really tired of filling out all the blocks in FIRE, only to find the requirement is yet another medai like a power point quad chart. Or re-writing OAA and MUA verbiage. Should be able to mouse click the required output, and the FIRE fields are already prepared to be transitioned. --Still seems prone to burps. More than once, I've found things I worked on weren't saved. --Needs more embedded templates so that a well written question, or objective, or whatever, is a matter of filling in the blaocks.
Video, VoIP. Difficult to navigate if you are not a power use. Need to integrate a wiki capability.
the ability to input and hyperlink documents directly to the initative. Saves the time of using support personnel.
while the database structure of FIRE (with many fields) provides a useful structure for planning, it loses the temporal property of the data collection / analysis process - perhaps this is what the THREADEX helps accomplish
1) Potential integration of the initiative spreadsheet with the data planning spreadsheet. 2) Area for collaboration regarding survey development. e.g.,if appropriate, possibly the ability to link to the latest copy of the survey via the data source section. 3) Overhauling the data collection fields (row labels within FIRE tables) to meet user needs.
More background information for each initiative area would be helpful.
1. Better organization of information 2. One screen/page to minimize scrolling 3. Ability to enter unlimited rich text and graphics into planning and data reduction areas, allowing formatting of the text without having to code in HTML 4. Ability to post and manage own documents 5. Password expiration notices 6. Faster response by the web site. It is too slow in its responses to make me want to work there unless forced to. 7. General availability of the collaboration services without having to schedule meetings - ad hoc meeting ability 24/7 by any/all registered users. 9. Easier ability to link to stored documents and other data stores 10. Much more automated roll-up from stage to stage as initiatives are planned and executed. Right now it is inconsistent and painful. 11. Screens, forms, etc. need to remember where the user has been. It takes way too many keystrokes to do relatively simple tasks, simply because FIRE does not take us to the where we need to go, but rather takes us back several steps, requiring one to burrow back down to the

appropriate level. When entering a lot of data or forms, this gets old very quickly and is not a good KM paradigm. 12. Make FIRE less NPS-centric and more user-centric
Better interoperability with NMCI

It be helpful to include a library feature in which I could upload and manage my own initiative planning documents.



Comment Responses:

Handy management device.
Site is currently too restrictive in what you can upload. I understand that it is a relational database - not an object oriented database - and this makes it much harder to store and retrieve files such as video, ppt, etc.
Would reduce the duplicate files I'm carrying around
although it is wise to have a centralized control / oversight of what's posted

Probably should offer some templates for this area depending on the [potential to standardize planning docs.
The inability to upload and share documents quickly and easily (and I do not include emailing to a 3rd party a step in the right KM direction) is a must.

Please provide any further recommendations, complaints, compliments or general comments about FIRE.

FIRE, and ultimately TACFIRE, are the leading edge of key systems in Enterprise architectures. The entire NPS FIRE team deserves accolades and honors...and some time off to relax.
I believe that you all are going in the correct direction. Most issues are a result of overlapping experiments coupled with the evolution of the website into what it is and will be.
Too many "clicks" to where you need to go for the collaboration suite. The system needs more "Word like" features, i.e., bolding, highlighting, underlining, carriage return, bulletizing, etc.
FIRE is an amazing tool. I think it needs to be further refined, become more user friendly (for both users and administrators), and it needs to be advertised as a necessity when doing experimentation.
If we keep having to build new things from scratch, like the quad charts to support the OAA, then it's not as effective as we think it is. It should be easier to gain viewing access. I don't think one should need the registration and password if you're hitting it from a .mil domain. Only if you're a vendor or Chinese agent. probably need more people to maintain "helpdesk" style presence. Too hard to expand and improve otherwise. There are other places to economize!
Need to integrate a wiki capability. What is the linkage to the NNWC Trident Warrior site ? What should it be ?
I have been advocating use of FIRE to the Open Architecture Engineering Team and to the Composeable FORCEnet LOE team. FIRE is well known in the community for it's value in orchestrating complex events. There is a high degree of administrative overhead for an initiative that may not be fully appreciated till the planning is underway. But the end result is worth the effort in my opinion.
It gets better every experiment. The technical issues of hosting/running and maintining a collaboration session will get figured out the more we use the system. The imeeting/collaboration tab has to get to the point where each initative lead can host a session without direct NPS support. Only then will FIRE become a truly effective collaboration suite.
FIRE has been very stable and reliable, which adds greatly to its utility. Support staff have been very responsive to changes and attachments.
Anything that is offered as a template or standardized document or entry mechanism (e.g., FIRE data planning webpage) would benefit from a process to ensure ease of use of

the template as well as ensuring that all the appropriate fields are in place (e.g., user needs analysis to account for the many different user groups such as experimentation planning folks, initiative leads, survey personnel , technical folks). If the document is either hard to use or doesn't meet the needs of all of these groups, the situation will be such that people will continue to make different versions of the same document because the document either (a) doesn't allow user to drill down to adequate detail (or goes into too much detail to the extent that the user can't view the high level and is overwhelmed in details) (b) has a format that is missing a one or more key fields and requires the user to then create his/her own version of the document to cover missing material (c) is not user friendly and therefore the user doesn't enter data accurately or in as much detail as s/he otherwise would with an easier system or when possible, opts for an easier alternative of his/her own choosing Consider integration of easily accessible attributes list complete with definitions (located in standardized location irregardless of which exercise. Users should be able to pick high level attributes and sub-attributes.
It would help if the fields in the data planning and intiative areas of FIRE were filled in more completely by the initiative leads. Also, it would be helpful if the Repository for Experiments was organized by initiative area (or some other means of organization).
1. In general, the KM thrust/theory/model behind FIRE is not well explained or well understood by the masses. Many of us do not understand the reason you implement things the way you do in FIRE. 2. Be ahead of the game. Many times we are requested to perform certain actions in FIRE, only to find that the web site functionality is significantly lagging the instructions from Trident Warrior leadership. e.g. We can't do what we are told as that feature has not yet been implemented.

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As-Was

Process	Subprocess	ALT (Weeks)	People Involved (Per Unit)	Times Fired (per Week/ person)	Time to Complete (weeks)	Cost per Week	IT	TLT (Weeks)	% Knowledge Allocatio	Numerator	Denominator	ROK (Revenue / Expense)
Define Experiment Objectives												
	Define High Level Goals & Questions	52	3	0.04	1.25	$3,250.00	5%	6.57	2%	$ 10,553.14	$390.00	**271%**
	Identify Attributes and Measures	5	3	0.04	0.38	$975.00	0%	0.60	0%	$ 963.99	$117.00	**82%**
	Identify MUA Recommendations	2	3	0.04	0.63	$1,625.00	0%	0.24	0%	$ 385.60	$195.00	**20%**
	Identify Primary Data Source	25	3	0.04	0.63	$1,625.00	0%	3.00	1%	$ 4,819.94	$195.00	**247%**
Experiment Data Planning												
	Define Data Collection Process	16	3	0.04	0.63	$1,625.00	5%	2.02	1%	$ 3,247.12	$195.00	**167%**
	Define Requirements (Survey, Chat, Obs., Electronic)	4	3	0.20	0.13	$325.00	0%	2.40	1%	$ 3,855.95	$195.00	**198%**
	Define Data Capture Locations	1	1	0.04	0.25	$650.00	0%	0.04	0%	$ 64.27	$26.00	**25%**
	Define Data Capture Personnel	1	1	0.04	0.25	$650.00	0%	0.04	0%	$ 64.27	$26.00	**25%**
	Define Data Capture Systems	10	3	0.12	0.17	$432.90	0%	3.60	1%	$ 5,783.93	$155.84	**371%**
Experiment Management												
	Create Master Event List (MEL)	5	3	0.04	1.38	$3,575.00	0%	0.60	0%	$ 963.99	$429.00	**22%**
	Create, Manage & Assign Surveys	52	3	0.04	2.50	$6,500.00	0%	6.24	2%	$ 10,025.48	$780.00	**129%**
	Assign Personnel to Data Capture Locations	1	2	0.04	0.13	$325.00	5%	0.08	0%	$ 135.30	$26.00	**52%**
	Collect Data (Survey, Chat, Observation, Electronic)	28	8	1.08	0.09	$240.70	5%	254.65	91%	$ 409,137.03	$2,079.60	**1967%**
	TOTALS							280.09		**$450,000.00**	**$4,809.45**	**936%**

Assumptions

1 week = 40 hours
1 experiment = 6 months = 25 weeks
1 year salary = 130,000.00

Reduction Factor

10%

Market Comparable

450,000.00 per experiment for 3 people

As-Is

Process	Subprocess	ALT (Weeks)	People Involved (Per Unit)	Times Fired (per Week/ person)	Time to Complete (weeks)	Cost per Week	IT	TLT (Weeks)	% Knowledge Allocatio	Numerator	Denominator	ROK (Revenue / Expense)
Define Experiment Objectives												
	Define High Level Goals & Questions	52	3	0.12	1.25	$3,250.00	40%	31.20	9%	$ 38,309.02	$1,170.00	**327%**
	Identify Attributes and Measures	5	2	0.08	0.25	$650.00	50%	1.60	0%	$ 1,964.57	$104.00	**189%**
	Identify MUA Recommendations	2	1	0.08	0.05	$130.00	20%	0.20	0%	$ 245.57	$10.40	**236%**
	Identify Primary Data Source	25	2	0.08	0.25	$650.00	40%	6.67	2%	$ 8,185.69	$104.00	**787%**
Experiment Data Planning												
	Define Data Collection Process	16	2	0.2	0.25	$650.00	50%	12.80	3%	$ 15,716.52	$260.00	**604%**
	Define Requirements (Survey, Chat, Obs., Electronic)	4	2	0.08	0.125	$325.00	50%	1.28	0%	$ 1,571.65	$52.00	**302%**
	Define Data Capture Locations	1	3	0.04	0.5	$1,300.00	50%	0.24	0%	$ 294.68	$156.00	**19%**
	Define Data Capture Personnel	1	2	0.08	0.5	$1,300.00	50%	0.32	0%	$ 392.91	$208.00	**19%**
	Define Data Capture Systems	10	3	0.12	0.15	$390.00	50%	7.20	2%	$ 8,840.54	$140.40	**630%**
Experiment Management												
	Create Master Event List (MEL)	5	2	0.04	1.25	$3,250.00	40%	0.67	0%	$ 818.57	$260.00	**31%**
	Create, Manage & Assign Surveys	52	3	0.4	0.5	$1,300.00	50%	124.80	34%	$ 153,236.08	$1,560.00	**982%**
	Assign Personnel to Data Capture Locations	1	2	0.08	0.125	$325.00	50%	0.32	0%	$ 392.91	$52.00	**76%**
	Collect Data (Survey, Chat, Observation, Electronic)	28	7	0.64	0.25	$650.00	30%	179.20	49%	$ 220,031.29	$2,912.00	**756%**
	TOTALS							366.49		**$450,000.00**	**$6,988.80**	**644%**

Assumptions

1 week = 40 hours
1 experiment = 6 months = 25 weeks
1 year salary = 130,000.00

Reduction Factor

10%

Market Comparable

450,000.00 per experiment for 3 people

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