Process Optimization Proposal

Fuel Reductions for Military Aircraft

NBS Enterprises Competition Sensitive

presented to:

(Draft)

submitted by:

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Committed to Our Clients, Our Customers, and Our Employees

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Fuel Reductions for Military Aircraft

FUEL SUPPLY, DISTRIBUTION, MANAGEMENT AND PLANNING

INTRODUCTION

The United States Army and other military units must reduce aircraft fuel consumption and its cost of operations while maintaining effective service. In order to stabilize efficiency, cost cutting in and by itself produces undesirable results. A more effective strategy is to employ all means of service optimization, which enhances performance even while operational costs are reduced.
An obvious target is the reduction of flight times through the use of optimal assignment planning tools. Other means of fuel cost reductions are proper selection of supplies, selection of aircraft and their locations for mission assignments, and minimization of time on station for missions such as surveillance and target localization. For all aircraft assignments, numerous variables and constraints must be considered and synthesized. Fuel depots are selected, delivery vehicles are identified, and aircraft are assigned. For logistics, supplies are loaded and distributed to drop locations. In some cases, multiple locations are visited. For surveillance, sensor suites that maximize mission results are placed aboard aircraft. Further, aircraft are to be maintained, asynchronous failures occur and pilots sometimes are not available. Another issue is command and control; questions exists as to the best means of allocating aircraft to missions, routing of deliveries and the response to asynchronous events, either from a central location or from numerous local sites.

Essentially, three segments of Air Tasking Orders (ATOs) are necessary: 1) initial planning for deliveries and stand-up meetings to consider recent changes in requests, personnel and flight operations; 2) a response to asynchronous events during execution; and 3) the debriefing of pilots. These ATO tasks further must be associated with all fueling and maintenance functions.

NBS Enterprises (NBS) is foremost in decision support and the integration of planning tools that provide a methodology for a seamless transition from receipt of fuel depot selections to mission completions and debriefings.
We are active in the representation, optimization and assessment of complex systems and the provision of exceptional system designs. We excel in the minimization of costs and response times. Further, NBS has developed methodologies for the transition of "as-is" to "to-be" systems, i.e., what exists to what is required. We have extensive experience in the derivation of optimal assignments of aircraft, both for the Department of Defense and the commercial world.

NBS proposes a three phase process to automate much of a decision support system:

a) Phase 1: Assess current Army procedures for fuel supply and assignments of aircraft, define transitions necessary for automation, and develop a rapid prototype for demonstration and proof-of concept purposes.
b) Phase 2: Incorporate Army desires and implement the decision support system (DSS), derived from the prototype, into an application for a specific location.
c) Phase 3: Expand the "to-be" automated DSS into all Army flight locations.

NBS also offers an option to associate scheduled and asynchronous maintenance with aircraft operations. In addition, we are adept in the analysis of command and control and the implementation of cloud architectures.
Using the three-phase approach, the Army will be able to make applications decisions in a well regulated manner.
NBS is confident that we will make a significant contribution to mission efficiencies and that the cost of our services will be more than offset with Army savings.

Measurable decreases in costs are the proposed outcome of applying our innovative techniques to integrate the NBS decision support system tools with existing databases, in concert with a comprehensive process model that delivers enhanced efficiencies.

STATEMENT OF WORK

The implementation of an automated fuel reduction planning tool requires not only integration and testing of components, but also an extensive amount of modeling and analysis. The NBS paradigm of transitioning qualitative descriptions to quantitative models produces systems designs that encapsulate optimal procedures. Further, the models guide the prototyping and implementation phases of development so that testing, changes and costs are minimized.

- *Phase 1* **...**

- Conduct architectural analysis and prepare an analytical model of the system
- Assess commercial-off-the-shelf (COTS) tools that might contribute to the NBS process
- Define a process model and a concept of operations for fuel reduction. The model will extend from fuel sources to flight operations,
- Describe all components of an integrated process,
- Represent a "to-be" top-level design for the planning tool.
- Prototype, test and demonstrate the automated tool

- *Phase 2* **...**
  - Revise all displays and algorithms in response to Army requirements
  - As a derivation of the prototype, develop a decision support system (DSS)
  - Select a location, as directed by Army, and integrate domain specific data with the NBS decision support system.
  - Apply the DSS and record all results and lessons learned.
- *Phase 3 ...*
  - Insert the DSS into all aircraft locations.

System Studies and Analysis

The initial objectives for the DSS/ planning tool development are:

- review and document the specifics of supply, distribution and air operations;
- conduct simulations, modeling and optimizations to provide performance statistics of current operations;
- assess new concepts and technologies and assist with the transition from the current process to a "to-be" environment; and
- develop a decision support system (DSS) that optimizes total systems operations.

Phase 1

Review Current Operations - Review enterprise documents, acquire information, review and evaluate total fuel processes, interview personnel and contractors to acquire an understanding of the current environment.

Model Current Operations - Using the information acquired in the previous task, develop analytical models that represent the current fuel environment. Demonstrate the model to USAF personnel.

Requirements Analysis - Populate the models with relevant variables and parameters. Exercise the model to compute overall mission performance, estimate the impact of new concepts and technologies, and provide requirements analysis and analytical forecasting.

Model of a "to-be" System - Using the information acquired during prior tasks, define a "to-be" DSS/ planning tool that will respond to evolving requirements.

Identification of Components - Define the data streams to be acquired from current databases, provide metadata (data about data) for the transition of data to model inputs, identify databases, select or develop metadata processors, structure a graphical user interface, a query capability, and a report generator.

Algorithm Development - Refine general algorithms for fuel operations.

Integration - Integrate and test all system components.

Prototyping – Design and demonstrate a prototype that automates operations and minimizes fuel consumption.

Phase 2

Implementation - After extensive prototype testing, implement an operational system for planning.

Phase 3

Operations - Maintain, manage and operate the DSS.

TECHNICAL APPROACH

The approach to the development of a planning tool involves the mapping of data to quantitative, analytical models. The models represent functions, assets and components of a system and act as a guide for an eventual system design.

System Processing and Data Flow

A flow diagram of our methodology is shown in Exhibit 1. Data streams exist in various forms such as voice, text, video, and digital formats. Each data source is transformed into a common representation scheme. Relevant data are extracted to form a separate, structured database operated on by unique metadata. A set of associations is developed for all disparate data structures. Dependencies with other associations are identified and are inserted into a representation of a computational model. The model is used to initiate a search routine that isolates and retrieves fuel depot descriptions with concurrent aircraft locations. Based upon the retrievals, algorithms are initiated which plan the delivery of fuel so that space limitations are observed while minimizing the travel distances of delivery vehicles. Thereafter, the best delivery routes are identified for each aircraft. The instantiation of the flow depicted in Exhibit 1, requires a description of all operational tasks and resources.

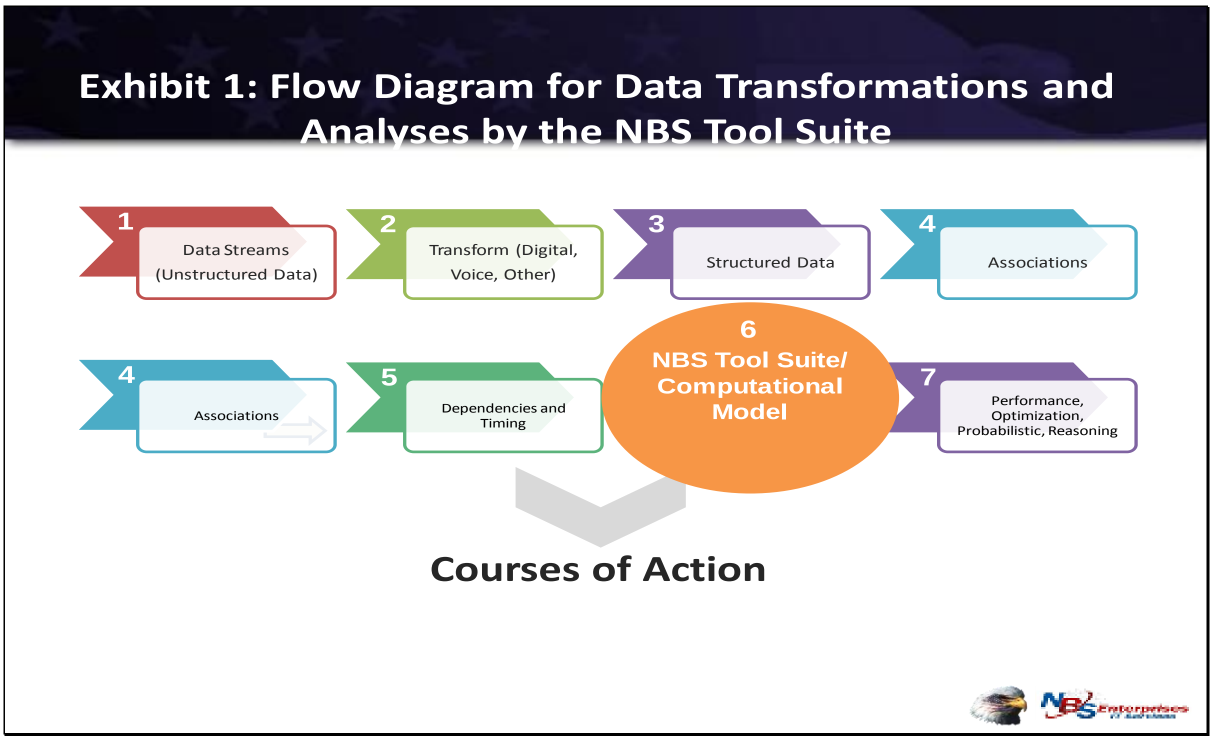

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Exhibit 1: Innovative techniques encompassing data transformation and integration of the NBS decision support system tools with USAF's existing databases, in concert with a comprehensive process model that delivers enhanced efficiencies**.**

Concept of Operations

The formation of a process of fuel minimization begins with a concept of operations and a subsequent definition of an architecture and design. The system functions encapsulate not only hardware and applications programs, but also decision support algorithms that guide the formation of courses of action from fuel requests to the selection of aircraft routes to mission completion.

Supply and Distribution Paradigm

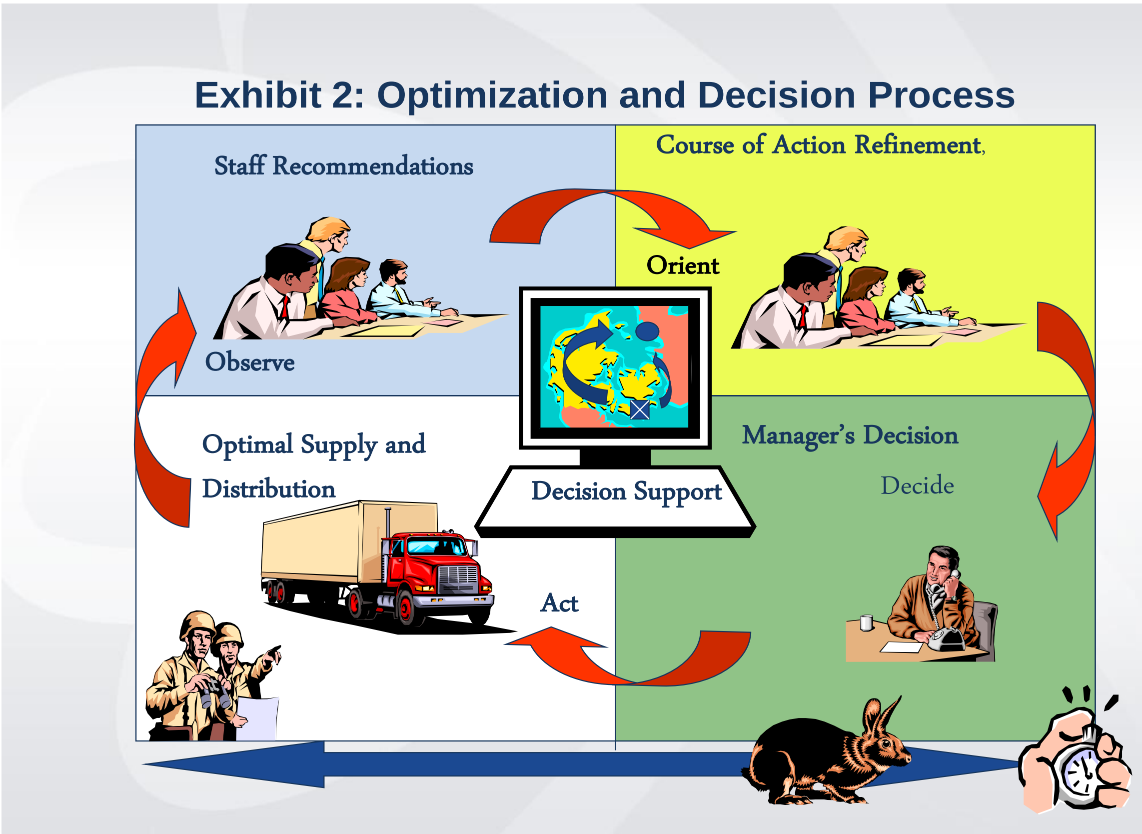
The savings of fuel, can be achieved throughout the entire cycle beginning with the requisition of fuel and ending with the completion of missions. Fuels are requisitioned, delivered to aircraft sites, and transferred to aircraft. Thereafter, missions are planned and executed. Several areas present themselves for optimization: 1) selection of fuel depots, selection of transportation vehicles and routes, selection of appropriate aircraft, optimal route assignments, and time on station for missions such as surveillance. Sensor suites that contribute to a reduction of time on station can also be selected optimally. Further, maintenance cycles also can be addressed so that appropriate aircraft are available for assignments.

Using supply chain management techniques, fuel depots are selected in response to availability, cost and required time of delivery. Many variables are addressed and input to the DSS algorithmic suite. After the receipt of fuel, aircraft are selected during mission planning. Selections are based upon performance and accomplishment at the least cost. Also during the planning stage, route assignments are optimized so that flight times are minimized. For example, sixteen areas of interest are to be visited and only four aircraft are available. What is the best way for the aircraft to be assigned so that all sites are visited while minimizing fuel consumption? A heuristic approach requires several hours of think time whereas once data are available, the DSS algorithms require less than one second of computational time. If time on station is an issue, the DSS is used to select transferable sensors for surveillance so that target detection probabilities are achieved expeditiously. Maintenance of aircraft often impacts upon aircraft availability. By optimizing procedures and integrating scheduled maintenance with asynchronous repairs, appropriate aircraft availability is increased dramatically. A significant value add is the response to asynchronous change during delivery operations. Vehicles might fail or a target structure might be modified. Given that reports are made to a central control site, a new solution is produced by the decision support system within minutes or perhaps seconds. The NBS tool suite does not make decisions. Rather it provides decision support. Exhibit 2 depicts the continual rotation of decision making tasks. The decision support system produces information that is digested by a planning staff allowing them to define courses of action within a time frame dramatically reduced relative to manual procedures.

Associations and Quantification

The chain of events from fuel requisitions to fuel requisitions to mission completions is not disjoint. Associations exists throughout the mission spectrum. Semantic nets are used to represent the associations, but in and by themselves, the nets are incomplete. A mapping is necessary from a qualitative to a quantitative representation. The associations are appended with parameters and variables so that a performance model is produced which exemplifies the association of events. Thereafter, the performance model is exercised and computes not only how well the current system performs, but also the optimization of technology selections and procedures, as well as analytical forecasting.

The NBS paradigm places disparate data into a system representation and produces a comprehensive set of results, as opposed to simply an identification of local enhancements.



An expanded description of the NBS decision support systems is available in the form of white papers, briefings and questionnaires.

DELIVERABLES

The following items will be delivered during the course of the effort:

- *Phase 1* **...**
  - Models of current and "to-be" fuel environments.
  - Analytical results of simulations, modeling and optimizations.
  - Performance and requirements analysis, as well as technology assessments
  - Design of an automated planning tool
  - Prototype of the automated tool
- *Phase 2* **...**
  - Tests and implementation of an operational system at a specified location

- *Phase 3* **...**
  - Management and maintenance of a comprehensive DSS applicable to all location environments

SCHEDULE

Phase 1 will require a three-month effort to develop and demonstrate a DSS prototype:

- Initial analysis and prototype design- first month
- Prototype development-second month.
- Test and evaluations-third month

The schedules for Phase 2 and Phase 3 will be defined after prototype acceptance by the USAF.

COST

The cost for Phase 1 is $.

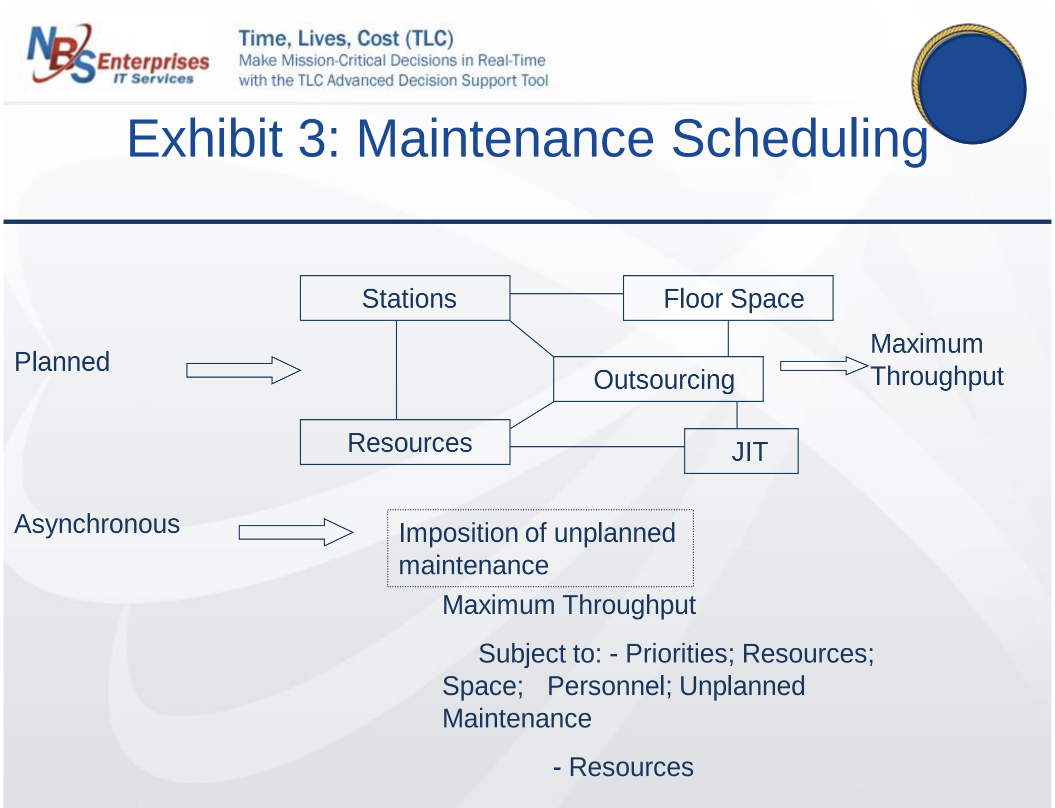
Costs for Phase 2 and Phase 3 will be defined after prototype acceptance by the USAF.

OPTIONS

Maintenance

The NBS decision support system contains algorithms which are able to optimize the integration of scheduled maintenance with asynchronous maintenance of aircraft and high-priority resources. Without decision support, asynchronous requirements can inject chaos into scheduled maintenance routines.

Further, maintenance procedures can be coordinated with aircraft assignments so that flight times are minimized.



Central Command and Control

NBS has extensive experience in command and control and the development of cloud designs. A cloud environment and a data protection system comprise two structured databases and a single server for access. The first database stores existing data relative to all Army resources. The second database captures fuel information as well as any forms of asynchronous change. The actual processing of fuel data and other forms of requested transmissions occurs within another single server. The applications portion of the second database stores a spectrum of programs that are called by an analyst to respond to calculations and queries. The second database also supports a report generator, visuals and other forms of applications. Simultaneous access to the cloud environment is possible by multiple users.

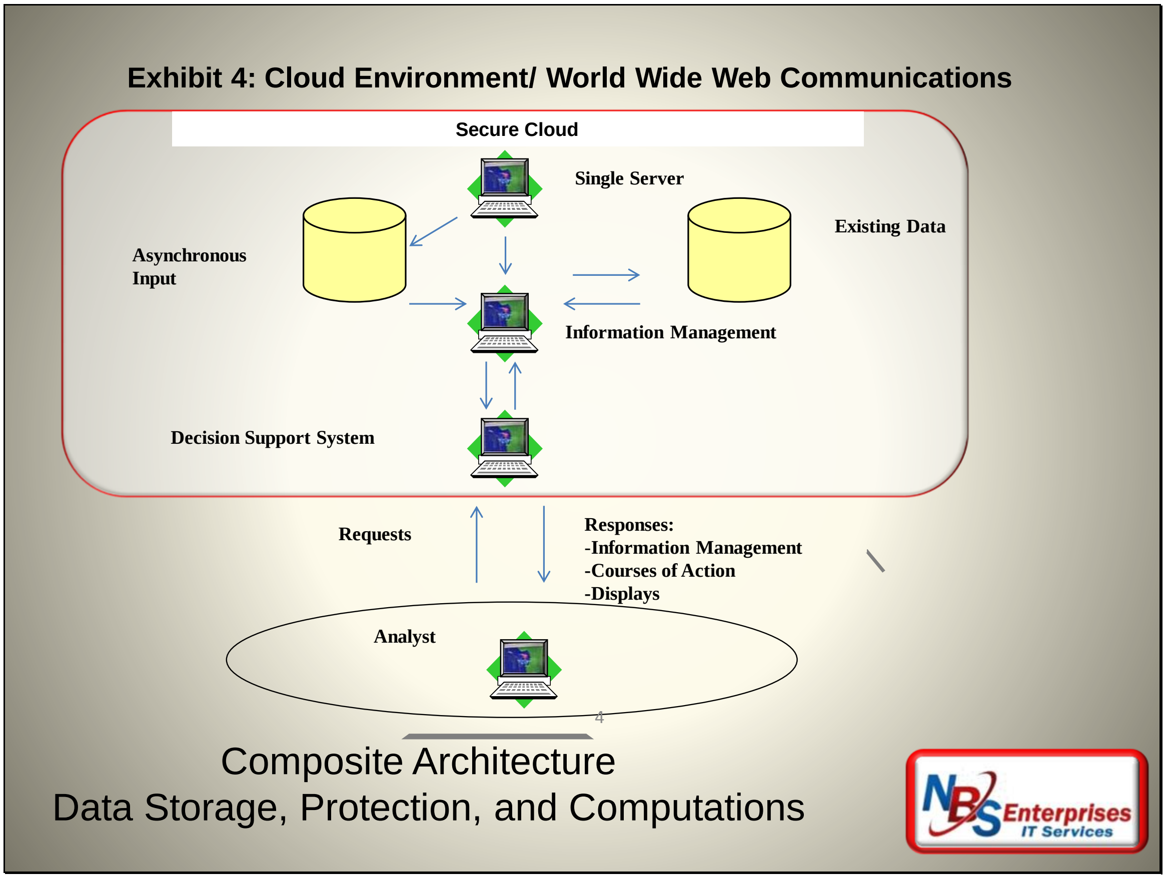


Exhibit 4: Cloud Environment/ World Wide Web Communications
Secure Cloud
Single Server
Existing Data
Asynchronous Input
Information Management
Decision Support System
Requests
Responses:
-Information Management
-Courses of Action
-Displays
Analyst
Composite Architecture
Data Storage, Protection, and Computations
NBS Enterprises
IT Services