

Decision Support for



Persistent Surveillance & Border Security

(An Automated Means of Aircraft Deconfliction)

NBS Enterprises, LLC Proprietary

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Decision Support for

PERSISTENT SURVEILLANCE & BORDER SECURITY

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INTRODUCTION

The Federal Aviation Administration (FAA) has been assigned the task of intermingling unattended air vehicles (drones) with commercial aircraft. Safety precautions and the lack of automated decision support tools have hindered the development of any implementation plans.

As an example, border patrols and persistent surveillance with the use of drones provides a cost saving and efficient means of detecting potential intruders. But flight interferences and the possibilities of drone collisions with commercial aircraft far outweigh the benefits of drone applications.



In response to these issues, NBS Enterprises (NBS) has developed a set of algorithms and a decision support system (DSS) that provide computations of courses of action (COA) in near real-time as opposed to several hours of manual efforts. The overall thrust is to produce actionable intelligence from multiple sources of information and provides optimal assignments of multiple vehicles to multiple areas of interest (AOI).

The purpose of the NBS planning tool is not to address the issues of physical control of drones, but rather to assist with the management of aircraft profiles within an extensive and dynamic environment.

Essentially, three segments of Air Tasking Orders (ATOs) are necessary:

- initial planning for flight paths and stand-up meetings to consider recent changes in requests, personnel and flight operations;
- a response to asynchronous events during execution; and
- the debriefing of pilots and drone controllers.

During mission planning, the NBS decision support system produces optimal drone assignments and routing which:

- do not interfere with commercial aircraft flight paths,
- fulfill all persistent surveillance requests, and

- conform to all mission and physical constraints.

During mission execution, the NBS decision support system responds to:

- changes in commercial aircraft flight paths,
- asynchronous events such as drone failures or changes in surveillance requests, and
- computations of revised drone assignments and routes in near real-time.

IMPLEMENTATION PROCESS

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 surveillance requests to mission completions.

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.

The implementation of an automated mission planning tool comprises three phases:

- Phase 1: Assess current FAA procedures for mission planning, define transitions necessary for automation, and develop a rapid prototype for demonstration and proof-of concept purposes.
- Phase 2: Incorporate FAA desires and enhancements into the prototype and provide a Beta site for the decision support system (DSS).
- Phase 3: Implement and insert the “to-be” automated DSS into all mission planning centers.

Using the three-phase approach, the FAA will be able to prevent collisions of drones with commercial aircraft in a well regulated manner.

NBS is confident that we will make a significant contribution to processing efficiencies resulting in dramatic improvement in safe operations..



The implementation of an automated aircraft deconfliction tool for FAA border patrols 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 persistent surveillance and deconfliction,
 - Assess commercial-off-the-shelf (COTS) tools that might contribute to the NBS process,
 - Define a process model and a concept of operations for a deconfliction system. The model will extend from mission planning to aircraft execution,
 - Describe all components of an integrated process,
 - Represent a “to-be” deconfliction planning tool.
 - Prototype, test and demonstrate the automated system
- *Phase 2 ...*
 - Revise all displays and algorithms in response to FAA requirements
 - Select a location, as directed by the FAA, and integrate domain specific data with the NBS decision support system (DSS).
 - Apply the DSS and record all results and lessons learned.
- *Phase 3 ...*
 - Implement the DSS at mission planning locations.

SYSTEM STUDIES AND ANALYSIS

Phase 1

Define/ Set the context and objectives of aircraft deconfliction - Review enterprise documents, acquire information, review and evaluate mission planning processes, interview personnel and contractors to acquire an understanding of the current FAA environment.

Measure/ Baseline performance - Using the information acquired in the previous task, develop analytical models that represent the current mission planning environment. Demonstrate the model to FAA personnel.

Analyze/ Use data and mathematical methods to understand causes and effects- 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.

Improve/ Develop modifications -1)-Using the information acquired during prior tasks, define a “to-be” DSS/ planning tool that responds to evolving requirements. 2) 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. 3) Refine general algorithms for mathematical analysis. 4) Integrate and test all system components. 5) Design and demonstrate a prototype that automates operations and enhances deconfliction planning.

Control/ Establish plans and procedures-Develop the courses of action from the results of mathematical analysis.

Phase 2

Implementation - After extensive prototype testing, implement a Beta site for further testing and evaluation.

Phase 3

Operations - Maintain, manage and operate the DSS.

SYSTEM PROCESSING AND DATA FLOW

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

A flow diagram of the NBS methodology is shown in Exhibit 1. Data streams might 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. Based upon the mapping from a qualitative to a quantitative model, algorithms are initiated. The algorithms produce drone trajectories which do not interfere with commercial aircraft while executing persistent surveillance. The instantiation of the flow depicted in Exhibit 1, requires a description of all operational tasks and resources.

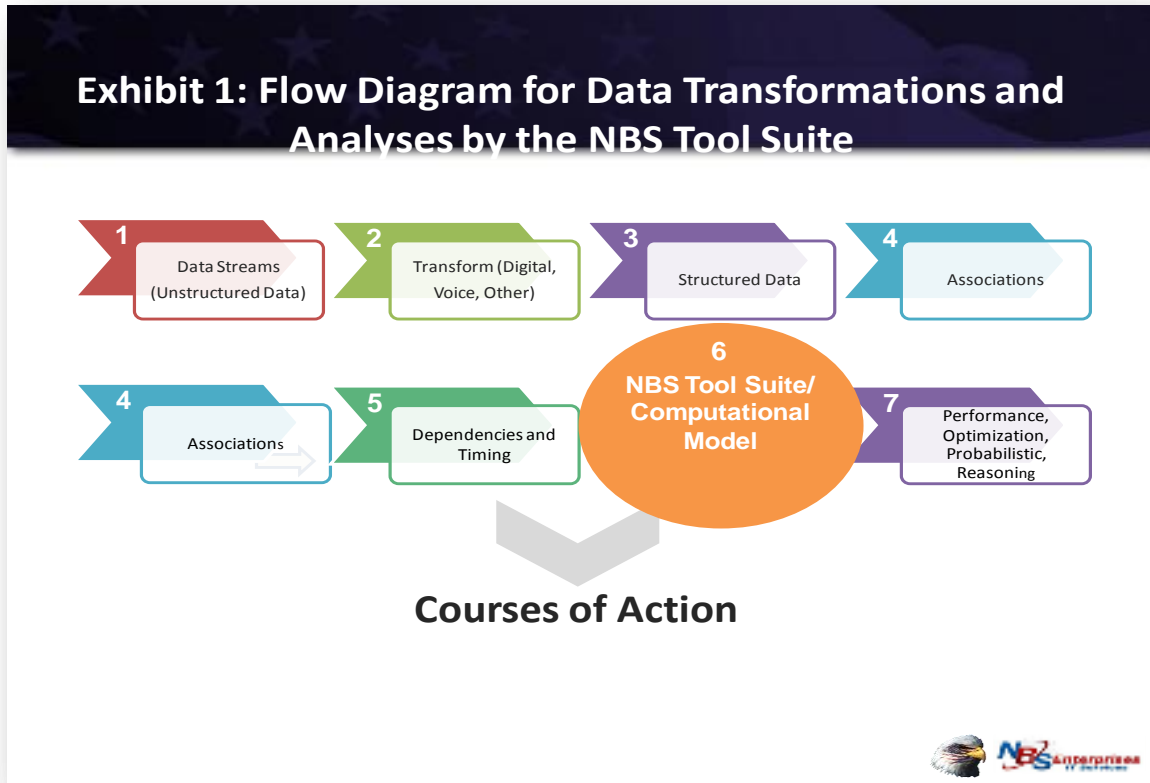


Exhibit 1: Innovative techniques encompassing data transformation and integration of the NBS decision support system tools with FAA’s existing databases, in concert with a comprehensive process model that delivers enhanced mission planning.

CONCEPT OF OPERATIONS

The formation of a process for mission planning begins with a concept of operations. The system functions encapsulate just not displays, requests and applications programs, but also decision support algorithms that guide the formation of courses of action from receipt of commercial airline flight paths and surveillance requests to recommendations of FAA courses of action.

Table 1
Concept of Operations

<ol style="list-style-type: none"> 1. During mission planning, a time frame and an area of interest (AOI) are established, 2. Commercial flight paths are obtained, annotated and displayed on a map of the AOI, 3. Ground rules are promulgated (e.g., minimum acceptable distance between commercial aircraft and drones), 4. Persistent surveillance requests are obtained, 5. An analytical context model is defined to represent all commercial aircraft and drones, including all drone and mission constraints,

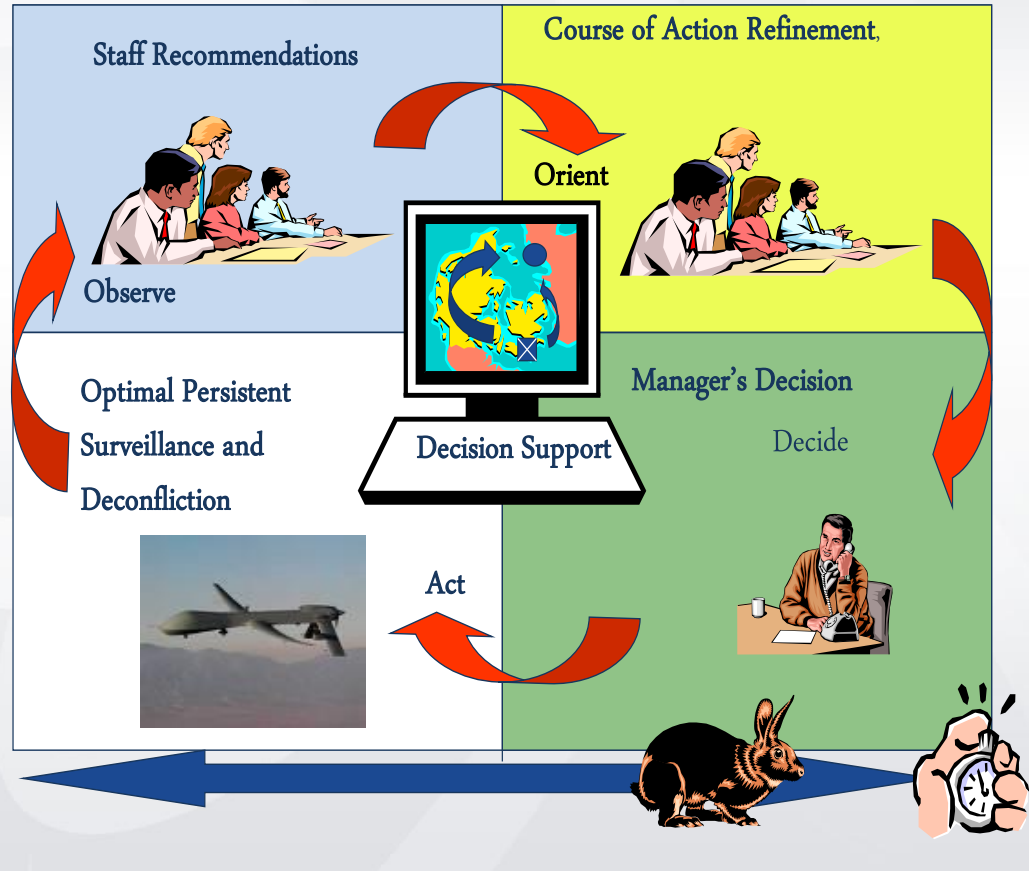
6. Impact, sensitivity and what-if analysis are conducted with the context model to provide analytical forecasting,
7. Optimal drone flight paths are computed so that mission constraints are met and surveillance objectives are achieved/ courses of action (COA),
8. During mission execution, occurrences of asynchronous events are monitored (e.g., changes in commercial flight plans, drone failures, new or modified surveillance requests),
9. The context model is exercised to provide reconfigured drone flight profiles
10. Monitoring is continuous and drone flight profiles are changed as necessary during the specified mission time frame.

Computations for the above scenario are accomplished within minutes as opposed to several hours of think time. In many cases, systems features, in and by themselves, are misconstrued. But, the products of the automated decision support system impact upon all personnel duties, by contributing to reporting, revisions to risk assessments, and a view of total system operations. Further, remedial actions are displayed automatically for view by mission planners.

PROCES MODEL FOR MISSION PLANNING

The NBS tool suite does not make decisions. Rather it provides decision support. A continual rotation occurs during decision making. The decision support system produces information that is digested by the mission planning staff, allowing them to understand the qualitative and quantitative rationale for decision making and subsequent recommended courses of action. The time frame for planning is dramatically reduced relative to manual procedures. Also, collision occurrences are essentially nullified.

Exhibit 2: Optimization and Decision Process



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

APPENDIX A: CORPORATE BACKGROUND

NBS PHILOSOPHY AND EXPERTISE

Political and positional success is directly tied to leadership's ability to lead their organizations, to identify and capture 'at hand' efficiencies, make sound/pragmatic resources optimization decisions, and then continually drive tangible 'continuous process improvements'. Both novel and noble objectives, which are absolutely essential in today's economic reality.

NBS Enterprises has the right Enterprise Resource Optimization (ERO) model and enabling algorithmic toolkit to empower senior executives with the insight necessary to identify and execute the best course of action for their organization. The NBS tool suite is known as Time-Lives-Cost (TLC). We are ready to help senior executives who are addressing a mandate to capture cost savings and efficiencies across their operations.

HISTORY

NBS Enterprises (NBS) is a woman owned small business founded in 2005 by Natasha Schebella.

We have capabilities and experience in three major areas: 1) Decision Support, 2) Information Technology (IT) Solutions and Services and 3) Staffing Services. NBS has personnel that routinely deliver in adverse environments both in the US and abroad, all focused on serving the same mission: the advancement and security of the United States.

NBS possesses exceptional talent in the management and technical administration of global requirements for the Department of Defense and numerous commercial businesses. The experience that NBS has gained through programs with customers include the Defense Threat Reduction Agency (DTRA), the Office of Naval Research (ONR), the Department of State and the Diplomatic Telecommunications Service – Program Office (DTS-PO), and the Washington Metro Transportation Services, which enables us to skillfully and efficiently coordinate and execute complex planning and decision support.

DECISION SUPPORT

NBS has developed logistics decision support algorithms for the Marine Corps, Navy and the Coast Guard. We have also developed optimal assignment for Hospice organizations, matching personnel and resources with patient requests. Based upon our understanding of logistics distribution and the routing of transportation vehicles, we have developed a full compendium of algorithms that provide courses of action for management, communications systems, and the design of sensor exploitation systems. We have also conducted studies and analysis of weapons of mass destruction and have devised exploitation systems that assist in the denial of terrorist threats.

IT SOLUTIONS AND SERVICES

NBS has been serving the Intelligence, DoD and Civilian Communities for 9 years. We have successfully delivered solutions in the areas of Information Assurance (IA), Enterprise Architecture, IT Transformation and Modernization, ITIL, Risk Management, Data Center transformation modernization, Security Assessments and Design, cloud environments, Human Resources, and Logistics and Mission support. We specialize in delivering exceptional results on projects with our trained, certified and cleared staff in the most widely used technologies.

STAFFING SERVICES

NBS provides direct staffing, temporary to permanent staffing, and temporary staffing in the intelligence, DoD and civilian communities, specializing in information technology and information assurance. The personnel include individuals with top-level clearances and experience. NBS also provides skilled individuals for accounting and financial services, as well as program and administrative support. We have a reputation for responding rapidly to meet our customer needs.