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Towards an Integrated Deployment and Crisis Response Planning System for C^2

C2 Concepts and Organizations

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Abstract

This paper presents the interim results of work by the Space and Naval Warfare Systems Center San Diego (SPAWAR) to increase the speed of Command and Control (C2) operations in the Naval Force Deployment Planning Process[1]. SPAWAR has fielded a Web-based employment scheduling and deployment planning system for the Navy called WebSked Distributed Services. The Chief of Naval Operations designated it the sole employment scheduling system for the Navy. Work is currently underway to integrate additional aspects of the deployment and crisis response planning processes into this automated architecture and thus increase speed of Command.

Deployment planning produces the Navy's Fleet Response Plan (FRP). The FRP helps meet quantitative readiness goals by focusing on finding the force allocation combinations that yield the optimal deployment dates for specific missions. The very nature of FRP production and its alteration during Crisis Response Planning is complex. Formulation of multiple options and analysis of alternatives is a tractable problem for an automated system to support, but only when the parameters from external systems and personnel are appropriately enumerated and brought together in a single data store. The plans for this work are discussed and the resulting C2 framework is presented.

1 Introduction

The Office of the Secretary of Defense issued the Quadrennial Defense Review in 2001 that gave the requirement for military forces to be able to swiftly defeat aggression in overlapping conflicts [OSD, 2001]. Part of the Navy's response to this challenge was to create a culture of readiness. Every aspect of operations is being optimized make the maximum number of units and force groups available for immediate forward deployment at any time. The Fleet Response Plan (FRP) concept was laid out by the Secretary of the Navy [SECNAV, 2003] and

[1] This work was sponsored by the Program Executive Office, C4I and Space, PMW-150

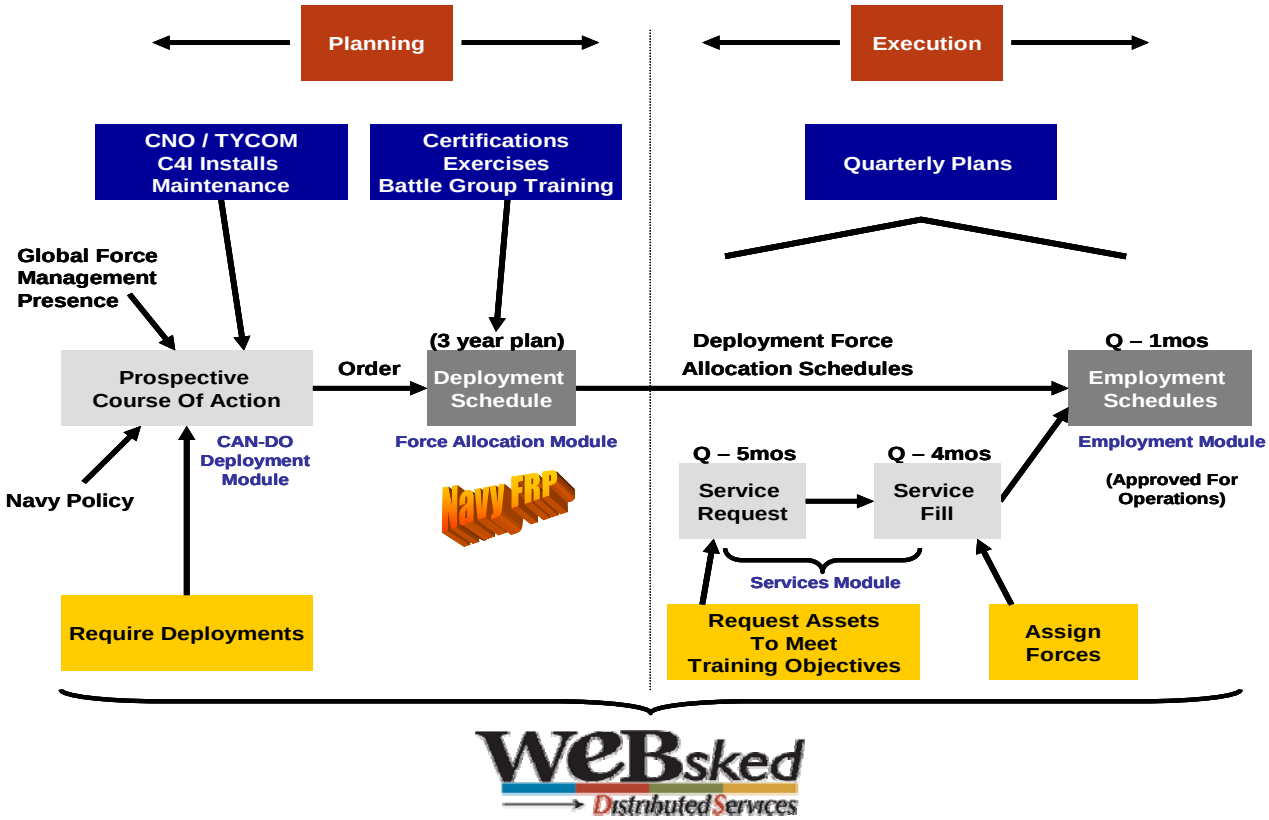

Figure 1 – The Navy Schedule Planning and Execution Process as Fully Automated by WebSked DS

made into policy by the Chief of Naval Operations in 2003 to implement these readiness goals in the Navy deployment planning process. The FRP helps meet certain quantitative readiness goals by focusing on finding the force allocation combinations that yield the optimal deployment dates for specific missions.

The very nature of FRP production and its alteration during Crisis Response Planning is complex. Formulation of multiple options and analysis of alternatives is a tractable problem for an automated system to support, but only when the parameters from external systems and personnel are appropriately enumerated and brought together in a single data store. The results of our ongoing WebSked Distributed Services system development work in this area are discussed in this paper and the resulting C2 framework is presented.

The Space and Naval Warfare Systems Center San Diego (SPAWAR) has fielded a Web-based employment scheduling and deployment planning system for the Navy called WebSked Distributed Services (WebSked DS) [Ambrosius, et al., 2004]. It has been designated by the Chief of Naval Operations (CNO) as the sole employment scheduling system for the Navy [CNO N3N5, 2004]. Work is currently underway to integrate additional aspects of the deployment and crisis response planning processes in this automated architecture and thus increase speed of Command.

With the consolidation of all authoritative Navy ship, aircraft, and amphibious movement schedules into a single WebSked DS data store available worldwide, it has now become possible to integrate the entire Navy deployment planning process from requirements to actual sailings into an automated architecture. The Navy planning process is given in Figure 1. In addition, the process of changing the plan of force projection in the very near-term due to emergent conditions, known as crisis response planning, can also be incorporated. The integration of these processes into an automated

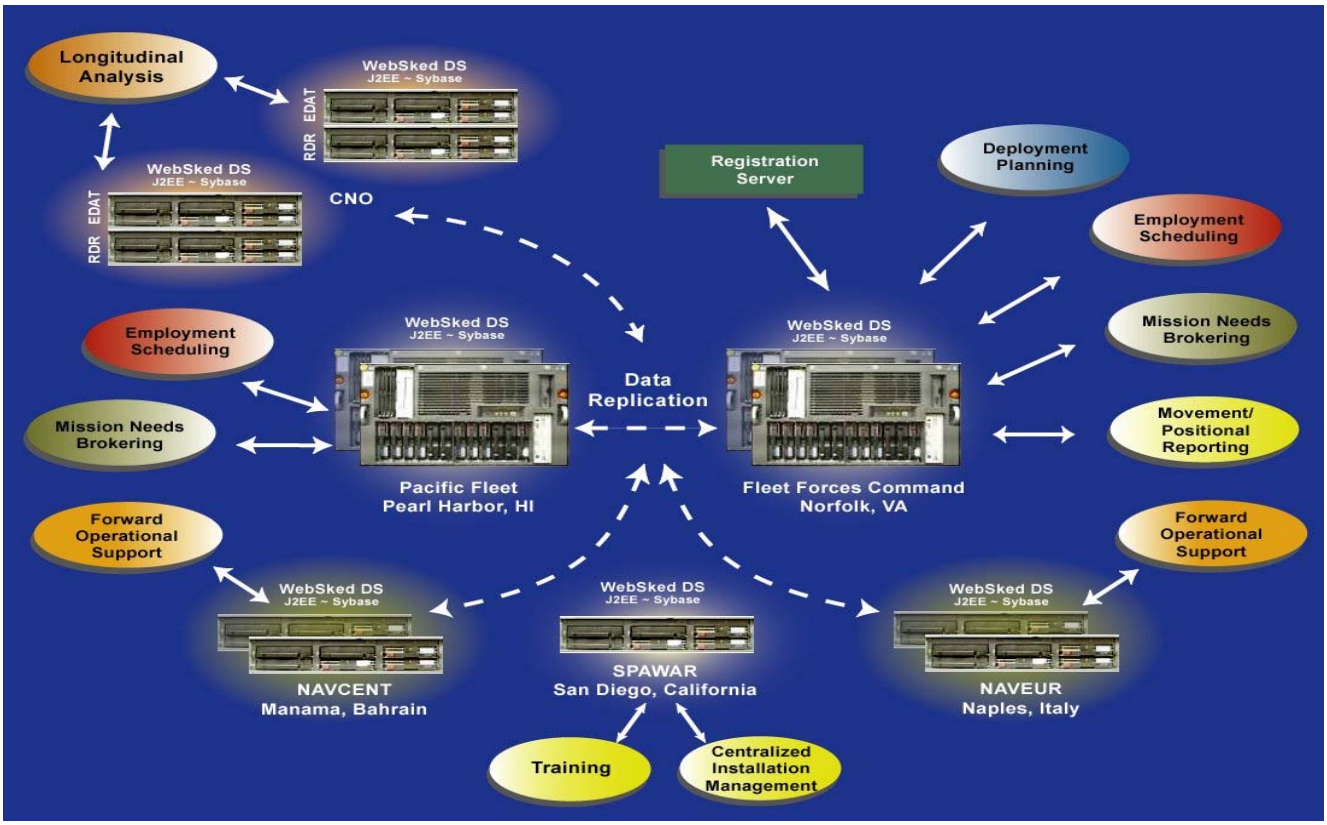

Figure 2 – The WebSked Distributed Services Architecture

C2 architecture holds great promise for shortening the time required for deliberative and reactive planning cycles and thus enhancing Command and Control capabilities for the Navy.

1.1 WebSked DS Overview

SPAWAR first deployed WebSked DS in June of 2002. It is an entirely web browser-based system for scheduling and planning the movement of major maritime assets, such as ships, squadrons, and other embarkable Units. It operates on the Secure Internet Protocol Routing Network (SIPRNET) to manipulate and distribute scheduling data, most of which is classified at the SECRET or CONFIDENTIAL level. Its major end-user features include:

- Visual employment scheduling
- Optional offline editing and printing on the desktop
- Automated schedule workflow
- Mission needs brokering (Services)
- Deployment plan/Fleet Response Plan editing and maintenance (Force Allocations)
- Integrated schedule picture available from any server world-wide

Since WebSked DS became the authoritative Navy data source for Unit employment schedules the need for other maritime and Joint systems to pull schedule data from and submit proposed changes directly into WebSked DS as part of a Service Oriented Architecture (SOA) has emerged. Therefore WebSked DS features an encrypted Simple Object Access Protocol (SOAP)-based service utilizing Extensible Markup Language (XML) for approved schedule retrieval, and bi-directional schedule transfer with other authenticated systems.

The system architecture is shown in Figure 2. It consists of twelve servers with J2EE and Sybase database support at six physical Fleet sites around the world and has the capacity to expand to more than 50 servers as needed. The

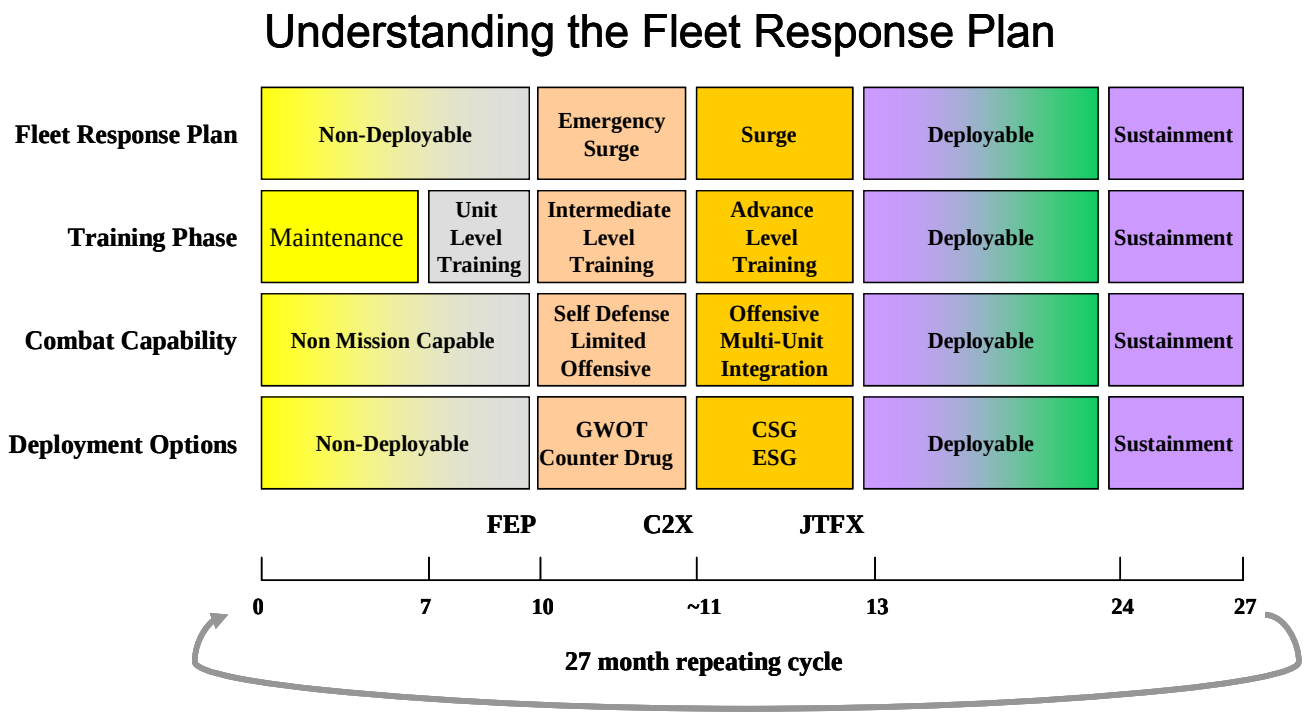

Figure 3 – The Fleet Response Plan and Relationship to Deployment Options

system incrementally replicates data among all servers to maintain a consistent scheduling picture (~3 seconds on-site, 30 minutes between sites) everywhere.

1.2 Deployment Planning Overview

Deployment planning is defined as operational planning directed toward the movement of forces and sustainment resources from their original locations to a specific operational area for conducting the joint operations contemplated in a given plan [DOD 2005]. It encompasses all activities from origin or home station through destination, specifically including intra-continental United States, inter-theater, and intra-theater movement legs, staging areas, and holding areas.

Deployments of major Navy force groups must follow the Navy nominal 27-month deployment cycle. This cycle is illustrated in Figure 3. The Figure shows the approximate times targeted for achievement of the Fleet Response Plan states of Non-Deployable, Emergency Surgeable, Surgeable, Deployable, and Sustainment. It also shows that combat capabilities and deployment options are limited in some FRP states.

The deployment planning process may be broken down into three phases: data gathering, planning, and execution. Data gathering pulls together the authoritative information a planner must have prior to starting the planning process. Planning is the blending of requirements, inventory, and policy to produce a series of options to meet the requirements. Execution is the selection and tasking of a plan for implementation.

1.2.1 Data Gathering

Navy deployment planners report that the single most time-consuming part of deployment planning is gathering and manually entering the comprehensive information required to understand all the requirements to be satisfied and the scheduling constraints of the units and personnel involved. Information is gathered in the following areas:

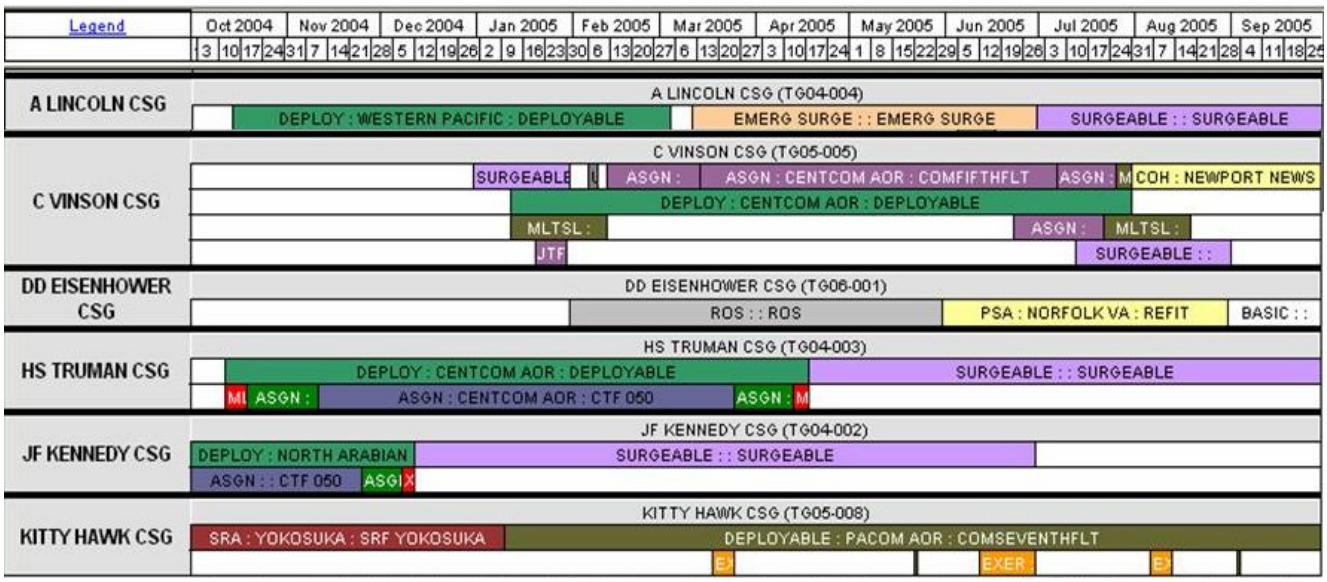

Figure 4 – Selected Carrier Strike Group Deployments in WebSked Distributed Services

a. Deployment requirements – A listing of approved and proposed requests for Navy assets to be placed under the control of a combatant commander.
b. Force structure – The inventory of assets that may be drawn from to meet deployment requirements.
c. Modernization considerations – A schedule of the down-times of units that are required to be taken out of service periodically to have needed maintenance and modernization performed.
d. Training considerations – The training required for a unit's personnel to be ready to perform a specific mission.

Modernization is a major deployment planning factor, since these periods affect shipyard utilization. Shipyard capacity and suitability are tightly constrained, therefore the ability to change modernization periods is similarly difficult.

Training is also especially important to planning. During down-time periods a unit's ability to conduct its wartime mission will degrade. Upon completion of modernization, a time-to-train period is required to regain war-fighting capability.

The information above is currently gathered and entered into spreadsheets and slides manually. However, much of the data gathered during this phase is available from electronic sources. The time required for this phase could be substantially reduced by automated gathering and entry into a planning database wherever possible.

1.2.2 Planning

Once the inputs to the deployment planning process are brought together, they are then used to formulate one or more options to meet the requirements. This is a highly creative process that has the following basic steps:

1. Visualization – Layering requirements, assets, and considerations onto a single display to assist the planner in viewing the big picture.
2. Rule development – Generate rules based on dates, events, and locations that implement Navy policy and procedures on asset utilization.
3. Course Of Action (COA) development – The process of blending force structure, modernization and training considerations to develop one or more courses of action to

meet the deployment requirements. COA development requires special skills in the following areas:

a. Movement Planning – The ability to consider time, distance, and speed when moving a unit from its home staging area to its forward deployed area.
b. Tomahawk Planning – The ability to plan the number (by variant) of Tomahawk missiles that each ship/sub shall deploy with to meet theater requirements.
c. Crisis Planning - The time-sensitive planning for possible deployment of forces and resources that occurs in response to an emerging situation.

4. Plan Collaboration – The process of vetting a COA with Navy Combatant Commander (COCOM) and Type Commander (TYCOM) representatives.

Crisis planning during COA development is naturally time-limited. A key task during crisis planning is the selection of the best asset for the requirement to be filled. Assets are selected based on availability and capability. Automation of this best ship fit process could decrease the time required to arrive at an acceptable solution.

The collaborative review and correction of plans is performed by a group known as the TeamSked community. This group is made up of representatives from CNO, Commander, Fleet Forces Command (CFFC), Commander, Pacific Fleet (CPF), the TYCOMs, the numbered Fleets (2nd, 3rd, 5th, 6th, and 7th), and Headquarters Marine Corps (HQMC). As the members of this community are geographically spread throughout the world, much time is spent in the gathering and synchronization of responses to COAs put out for review. Automating this collaboration on-line could speed up the workflow in this area.

1.2.3 Execution

Once a package of COAs have been planned and vetted by the TeamSked community, they are considered valid and can then be sent up the chain of command for approval and issued as orders for execution. This involves the following actions:

a. Plan approval – The plans go through increasing echelons of flag level review. Process culminates with SecDef decision to proceed with one particular COA.
b. Orders issuance – The Joint Staff issues a Global Force Management (GFM)-Naval Presence Schedule (NPS) update containing SecDefs direction. The supporting COCOMs relay the change to affected units as a warning order or prepare to deploy order that triggers the transition of the plan to executable schedules in WebSked DS (in action C below). When the time comes to execute the plan (sometime months after approval) a deployment order is issued to execute the employment schedules already approved within WebSked DS.
c. Transition of plan to a schedule – The SecDef-approved COA is entered as a Force Allocation schedule into WebSked DS. An example of carrier deployments given as Force Allocation schedules is given in Figure 4. The subsequent warning or prepare to deploy orders authorize the affected Units to log onto WebSked DS and update their employment schedules using the Force Allocation schedule already populated in WebSked DS. Units then add pre-deployment activities into WebSked DS to complete the COA solution. Compliance of unit employment schedules to the COA is automatically checked and reported on by WebSked DS.

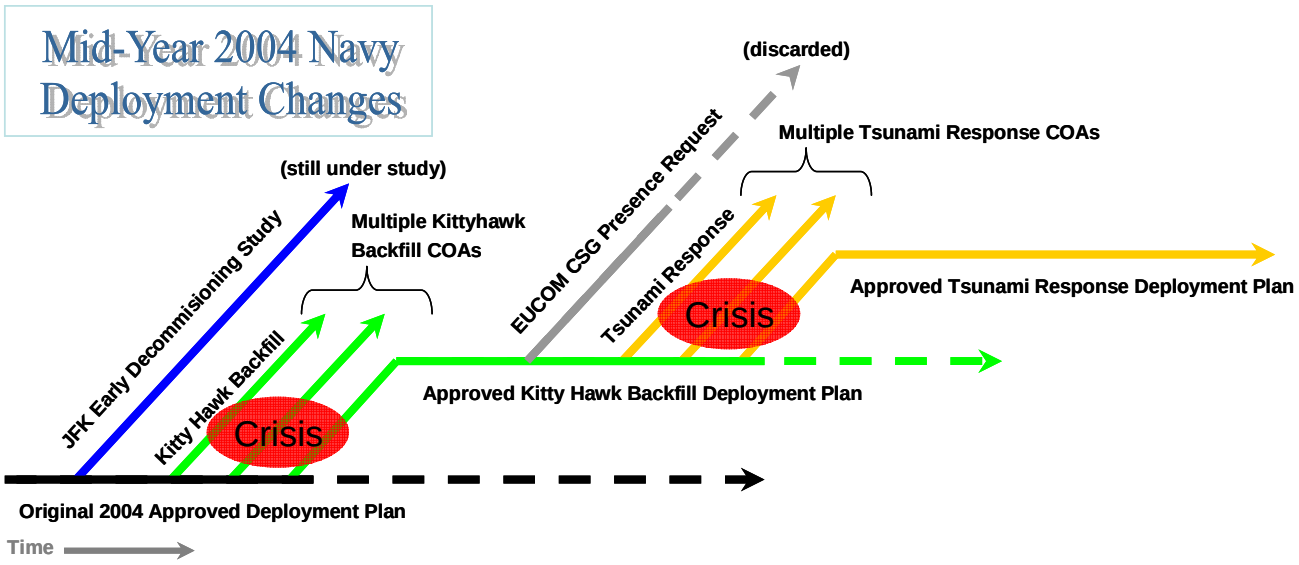

Figure 5 – Major Navy Deployment Changes Mid-Year 2004

2 The Need for Automated Deployment Planning

As Force Structure in the Navy has declined from 529 ships in 1991 to 281 ships today the operating tempo has grown due to the many factors, including the Global War On Terror (GWOT), Maritime Homeland Security (MHS), and Maritime Homeland Defense (MHD). With the Navy being asked to do more with less, it is crucial that the operational planners be provided the tools to be able to quickly model the impacts of a Request For Forces (RFF) or change to the Global Naval Force Presence Policy (GNFPP) on the current Fleet lay down and its ability to support and sustain the requirement.

2.1 Deployment Planning Case Study

The following case study was drawn from real world events in during the last half of year 2004. In order for it to be unclassified, actual impact statements have been modified. It illustrates the complex nature of deployment planning and the many factors involved.

2.1.1 USS Kitty Hawk Backfill

The 2004 Global Naval Force Presence Schedule (GNFPS) was originally approved with the aircraft carrier USS Kitty Hawk providing theater presence in the Pacific Command (PACOM) Area of Responsibility (AOR). However, due to certain emergent theater concerns, PACOM issued a Request For Forces for another carrier to backfill the Kitty Hawk.

This RFF started a crisis response deployment planning cycle. Several initial COAs were developed by the TeamSked community in a collaborative process taking into account operational availability of the carrier force structure, effects on the long range operational and maintenance schedules, training requirements, and personnel tempo policies.

Although the Central Command (CENTCOM) AOR is geographically close to the PACOM AOR, CENTCOM demands in supporting Operation Iraqi Freedom (OIF) would make sourcing an additional carrier to PACOM from there a real challenge. Drawing a carrier from CENTCOM to give to PACOM would just move the problem to another AOR. If a CENTCOM carrier was lost (used in the backfill of Kitty Hawk), there were the following options:

a. The Air Force could deploy forces to cover the loss.

b. Another carrier deployment could be extended beyond 6 months (this is a policy problem).

c. A non-deployed carrier that had not completed all its training requirements (it would not be fully mission capable to fight a major conflict) could be brought in.

d. A combination of the options above.

The deployment planning cycle proceeded as described in Section 1.2 above. Lengthy delays in the planning cycle were caused by a lack of input from all Commands. There was no system in place to track who replied and to capture the concurrences or rejections of the COAs. Timeliness of replies was up to the respondent. Group collaboration was limited to the group respondents chose to email their replies to. Further, no graphical means to incorporate suggested changes was available. Thus, TeamSked members were sometime required to evaluate suggestions based on a notional concept of them alone and updates were the responsibility of a single individual.

Fifteen courses of action were eventually produced and reviewed before the three best solutions were picked by consensus. These COAs were determined to be valid by the TeamSked participants, fully annotated for the impacts they would cause, and moved up the chain of command. One solution was eventually put forth for SecDef consideration. This COA solution proposed "surging" (early deployment) of the carrier USS Lincoln to fill the presence gap in PACOM. In mid-2004, SecDef signed the order directing the execution of this new plan for use of Navy forces. Navy units then updated their employment schedules in WebSked DS to reflect this new deployment order.

2.1.2 Frequent Change in 2004

The USS Kitty Hawk backfill example above illustrates that many courses of action may have to be generated, examined for impact and fully reviewed by many stakeholders to eventually arrive at the solution for a single planning cycle and thus change the Navy's Fleet Response Plan. However, this example was just one of many change cycles that occurred throughout the planning year 2004.

For example, four major changes occurred in the last half of year 2004. These changes are shown in Figure 5. Before the Kitty Hawk backfill request (Section 2.1.1) was received a deployment planning cycle was executed to study the early decommissioning of the carrier USS John F. Kennedy. This study required significant COA development and review but was never approved for execution. It is currently under on-going study. The Kitty Hawk backfill request was received and resulted in fifteen COAs being generated and reviewed before a final solution, the early deployment of the USS Lincoln, was chosen and approved. Not long after that, Joint Forces Command (JFCOM) relayed an RFF to the Navy to double the carrier presence in EUCOM in 2006. This initiated another deployment planning cycle. After COA development and review, impacts were deemed to be too severe and this request was determined to be infeasible. Finally, on December 26, 2004, a massive Tsunami (caused by the Sumatra-Andaman earthquake) hit several countries on the Indian Ocean resulting in enormous devastation and loss of life. Crisis response deployment planning was immediately begun and COAs quickly developed, leading to the diversion of the Bon Homme Richard Expeditionary Strike Group (ESG) from its transit to the Persian Gulf into disaster relief. The deployment of the carrier USS Lincoln was also extended to provide support.

From this example it can be seen that the approved Navy deployment plan changes

frequently due to future planning and emergent requirement. Both deliberate planning and crisis response planning cycles are executed throughout the year.

2.2 Benefits of Automated Deployment Planning

Full implementation of automated deployment planning within the WebSked DS scheduling system as shown in Figure 1 could provide a remarkable improvement in the speed of command in deployment re-planning operations. The reasons for this are described along with the deployment process in Sections 1.2.1, 1.2.2, and 1.2.3.

Table 1: Comparison of Current and Expected Planning Times

Deployment Planning Phase/Step	Time Current (Days)	Time Automated (Days)
Data Gathering		
Research Current Plans	2.0	1.0
Calculate Unit Availability	2.0	0.25
Manual Data Entry	1.5	0.25
Planning		
Plan Development	4.5	1.5
Course Of Action Analysis	4.5	2.5
Collaboration	6.0	3.0
Execution		
Order Issuance	5.0	5.0
Plan Transition	10.0	3.5
Totals	35.5	17.0

Automation of the employment scheduling process (day-to-day employment of units) by the current WebSked DS system has already shown the kind of time reduction in planning business process that is possible for this area. WebSked DS was shown to have brought the schedule generation and approval process timeline from weeks to days [Ambrosius, *et al.*, 2004].

A comparison of the actual planning times for the components of the USS Kitty Hawk backfill planning cycle (given in Section 2.1.1) to expected new planning times once fully automated within WebSked DS are shown in Table 1. The new times are based on interviews with Navy deployment planners and experience in automation of similar processes within current WebSked DS modules.

Table 1 shows that planning time for the USS Kitty Hawk backfill could be reduced as much as 53% (18.5 days) through automation. The time for planning cycles varies with the complexity of the request. Still, ten similar deployment planning cycles were carried out in 2004 (one rotational, six RFF, and 3 smaller re-planning). If they together had an average complexity level of the USS Kitty Hawk example (this is quite possible in any given year), possibly 188 planning days might have been able to be saved through automation.

3 Implementation of the WebSked DS Deployment Planning Solution

The Force Allocation module of WebSked DS has already been fielded operationally to house and manage the Navy's approved Fleet Response Plan. Current work on WebSked DS version 2.5 will provide the Initial Operating Capability (IOC) of Deployment Planning, which builds the Fleet Response Plan. This deployment planning module of WebSked DS is called WebSlider[2] (sliding graphical controls).

3.1 Features of the WebSlider Module

The requirements of the Navy deployment planning process described in Section 1.2 have caused the WebSlider Module of WebSked DS to be designed to provide the following capabilities:

[2] Based in part on original work for the U.S. Navy by Dr. Stuart Dunn at the Center For Naval Analysis

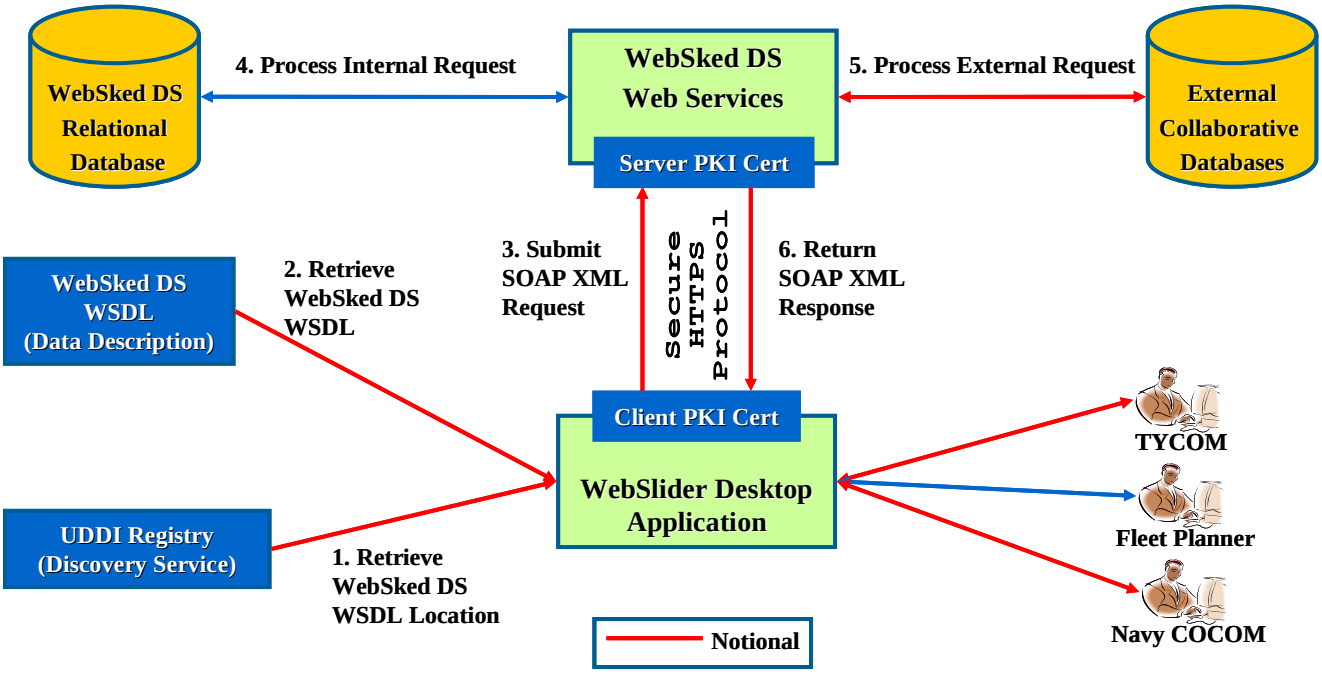

Figure 6 – WebSlider Deployment Desktop Application Utilizing Web Services

a. The ability to specify presence requirements for Carrier Strike Groups (CSGs), Expeditionary Strike Groups (ESGs), and Surface Strike Groups (SSGs) by theater of operation and effective dates.
b. A collaborative workspace to manage Request for Forces and Capabilities (RFF/RFCs) that identifies whether the request is deliberative or crisis, provides its status, and assists in identifying units available to satisfy the request to assist in developing modifications to the current COA.
c. The ability to manage rules for determining notional FRP states, and rules to use during schedule sourcing validation.
d. The capability to load maintenance, Navy Mission Essential Task List (NMETL), Readiness, force composition, and force allocation data for selected units from WebSked DS to create COAs.
e. A graphical, easy to use interface that allows TeamSked community members to easily identify and schedule units, add events, create presentations, import and export data, and validate the sourcing solution of COAs.
f. Provide a collaborative workspace to post and download COAs for review and concurrence, provide comments, and manage unit sourcing solutions to satisfy the COA.
g. Provide the capability to update force allocation data based on the sourcing data from SecDef approved COAs.
h. Provide the capability to validate sourcing data against the scheduling rules (turnaround ratio, nights out of home port, operational tempo, retention, etc.), and identify and remark on any violations.
i. Manage access to the workspace and modification of COAs and sourcing data.

3.2 Architecture Considerations

The WebSlider capabilities being developed for the deployment planning community are being designed using the evolving Joint Command and Control (JC2) system architecture guidelines and concepts. WebSked DS implements a Service Oriented Architecture (SOA) that will allow it to more easily adopt the JC2 platform as it is rolled out. WebSked DS publishes and accepts data using Simple Object Access Protocol (SOAP) web services that use

Extensible Markup Language (XML). It is also a customer of web services provided by other systems to capture maintenance, training, and readiness information from the appropriate authoritative data sources. Every effort has been made to abstract the system behind a small number of well-defined network interfaces.

In keeping with the SOA concept, the visualization component of the WebSlider module is planned for implementation as a desktop application (for speed and local control) connected to WebSked DS and other data sources via web services (for easy data exchange). Figure 6 shows the planned architecture. Courses of action will be posted to the WebSked DS website for collaborative review by the TeamSked community. TeamSked members will be able to vote on and make adjustments to proposed courses of action. The deployment planning facilitator will be able to monitor and manage the COAs going through review. Once COAs are approved as deployment orders, the execution component of the WebSlider module (server-based) will move the new deployment plan into the WebSked DS Force Allocation module as the new Fleet Response Plan. The Force Allocation and Employment scheduling modules then communicate to ensure compliant employment schedules are generated from the Fleet Response Plan.

4 Summary and Conclusions

This paper has shown that deployment planning is a complex process that is ripe for automation. The origins of the Fleet Response Plan were discussed (Section 1) and its relationship to deployment planning given. The phases of deployment planning itself were discussed (Section 1.2) and the many external parameters enumerated (Sections 1.2.1, 1.2.2). The need for automated deployment planning due to decreasing inventory and increasing operational tempo was given (Section 2). A real-world case study of the planning cycle was outlined (Section 2.1.1) and the complexity of the ever-changing deployment plan using events from the year 2004 were described (Section 2.1.2). Areas where the current planning process could be improved were given (Sections 1.2.1, 1.2.2, 1.2.3, and 2.1.1).

Also described in this paper was the WebSked Distributed Services system and its Deployment Planning module currently under construction to improve the Navy planning process. An overview of WebSked DS was given (Section 1.1). Features of the WebSked DS Deployment Planning module, known as WebSlider, were described (Section 3.1) and some architecture considerations for alignment with JC2 and the Service-Oriented Architecture were discussed (Section 3.2).

Finally, the potential benefits from the automation of this process in WebSked DS were described and quantified (Section 2.2). It was shown that the overall time for the planning cycle process in the future may be able to be cut by more than half (53%) bringing planning time in one real-world example case from over a month to about two weeks. This represents a significant potential increase in speed of command for the Navy command chain and will contribute to more agile military response once deployed.

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