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Evaluation of fleet ownership versus global allocation of ships in the Combat Logistics Force

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THESIS

EVALUATION OF FLEET OWNERSHIP VERSUS GLOBAL ALLOCATION OF SHIPS IN THE COMBAT LOGISTICS FORCE

by

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September 2006

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13. ABSTRACT (maximum 200 words)

Military Sealift Command (MSC) introduced its new Dry Cargo and Ammunition Ship (T-AKE) in June 2006, to replace its retiring ammunition and fast combat stores supply ships. MSC seeks new ways to use T-AKEs, fleet replenishment oilers, and fast combat support ships to better support the U.S. Navy. We evaluate two alternate ways to manage these ships, one where each ship operates under a particular "fleet ownership," and another where these ships are "globally allocated," serving any fleet customer as needed worldwide. We introduce an optimization-based scheduling tool, and use it to evaluate an expository 181-day peacetime scenario. We track daily inventories of 13 battle groups --- carrier strike groups, expeditionary strike groups, surface strike groups, and a littoral combat ship squadron --- to gain insight into how to best employ CLF ships. We determine that, in our scenario, global allocation provides significantly better service to fleet customers.

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EVALUATION OF FLEET OWNERSHIP VERSUS GLOBAL ALLOCATION OF SHIPS IN THE COMBAT LOGISTICS FORCE

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Military Sealift Command (MSC) introduced its new Dry Cargo and Ammunition Ship (T-AKE) in June 2006, to replace its retiring ammunition and fast combat stores supply ships. MSC seeks new ways to use T-AKEs, fleet replenishment oilers, and fast combat support ships to better support the U.S. Navy. We evaluate two alternate ways to manage these ships, one where each ship operates under a particular “fleet ownership,” and another where these ships are “globally allocated,” serving any fleet customer as needed worldwide. We introduce an optimization-based scheduling tool, and use it to evaluate an expository 181-day peacetime scenario. We track daily inventories of 13 battle groups --- carrier strike groups, expeditionary strike groups, surface strike groups, and a littoral combat ship squadron --- to gain insight into how to best employ CLF ships. We determine that, in our scenario, global allocation provides significantly better service to fleet customers.

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LIST OF ACRONYMS AND ABBREVIATIONS

BBLS	Barrels
BG	Battle Group
CG	Guided-Missile Cruiser
CLF	Combat Logistics Force
CINCLANTFLT	Commander-in-Chief, U.S. Atlantic Fleet
CNA	Center for Naval Analyses
CNO	Chief of Naval Operations
COMPACFLT	Commander, U.S. Pacific Fleet
CONSOL	Consolidation
CSG	Carrier Strike Group
CVN	Aircraft Carrier (Nuclear)
DDG	Guided-Missile Destroyer
DD(X)	Destroyer (Next Generation)
DFM	Distillate Fuel Marine (NATO F76)
ESG	Expeditionary Strike Group
FFC	Fleet Forces Command (formerly known as CINCLANTFLT
FFG	Guided-Missile Frigate
FLS	Forward Logistics Site
FORTRAN	Formula Translating System
GAMS	General Algebraic Modeling System
GCAM	General Campaign Analysis Model
GFM	Global Force Management (Manager)
GNFPP	Global Naval Force Presence Policy
JP5	Naval Aviation Fuel (NATO F44)
LCS	Littoral Combat Ship
LHA	Amphibious Assault Ship
LHD	Amphibious Assault Ship
LPD	Amphibious Transport Dock Ship
LSD	Amphibious Dock Landing Ship
LSOM	Logistics Scheme of Maneuver
MSC	Military Sealift Command
OPNAV	Office of the Chief of Naval Operations
OPNAV N3/5	Operations and Plans
OPNAV N42	Navy Strategic Mobility and Combat Logistics

OPNAV N6	Command and Control
OPNAV N70	Warfare Integration
OPNAV N81	Assessments Division
STONS	Short Tons
T-ADC(X)	Auxiliary Dry Cargo and Ammunition Ship (operational design for eventual T-AKE)
T-AE	Ammunition Ship
T-AFS	Combat Stores Ship
T-AKE	Auxiliary Dry Cargo and Ammunition Ship
T-AO	Fleet Oiler
T-AOE	Fast Combat Support Ship
T-AOE(X)	Fast Combat Support Ship (Next Generation)
UNREP	Underway Replenishment
WEBSKED	Web-Based Scheduling Tool

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EXECUTIVE SUMMARY

In June 2006, the first of a new class of re-supply ship, the Auxiliary Dry Cargo and Ammunition Ship (T-AKE) was delivered to the Military Sealift Command (MSC). Delivery of the T-AKE marks an important milestone in the history of the Combat Logistics Force (CLF) because the MSC is in the midst of decommissioning many of her older ammunition and combat stores ships (T-AEs and T-AFSs).

Today, there are 30 CLF ships, in five distinct ship classes. By 2011, the MSC plans to have decommissioned all ammunition and combat stores ships, reducing the total number of ship classes to just three. Between now and the year 2020, the Navy is planning to grow from its current force of 284 ships to over 310 ships. In 2020 the planned CLF will still consist of 30 ships, the same number currently in inventory and made up primarily of those same ships operating today.

Unlike previous studies of the CLF that have tried to determine the best composition and numbers of ships to properly support deployed battle groups in each fleet operating area, this thesis suggests changing the concept of operations for CLF shuttles. Historically, each numbered fleet (Second, Third, Fifth, Sixth, and Seventh) has "owned" the CLF ships that serve its naval forces. We categorize this concept as "fleet ownership" and consider whether this form of management restricts CLF capacity. We suggest allowing any CLF ship to serve any Navy customer ship regardless of fleet assignment. We term this "global allocation" and investigate this new concept of operations.

We present a 181-day peacetime scenario commensurate with common day-to-day operations to compare fleet ownership and global allocation effects on 13 deployed battle groups consisting of carrier strike groups, expeditionary strike groups, surface strike groups, and a littoral combat ship squadron. We collect historical data from WEBSKED, the Navy's web-based scheduling tool, to reflect actual worldwide operations. We select the six-month window commencing January 1 and ending on June

30, 2002; a time period that is now de-classified and depicts a peacetime scenario requested and approved by OPNAV N42.

We use an optimization model evolved from those used for prior Naval Postgraduate School analyses of CLF operations. We introduce the ability to assign fleet ownership to every latitude-longitude location in our scenario and to every CLF shuttle to analyze the effects on CLF capability of either fleet ownership or global allocation. We assign a location to each battle group for each day during the 181-day scenario. We use logistic planning factors approved by OPNAV N42 for the consumption and capacities of the individual ships that comprise our battle groups, tracking daily ship's fuel, aviation fuel, and consumable stores inventory levels. We do not track ammunition usage in our peacetime scenario. Daily stock levels incur penalties for running below safety (50% of total capacity), extremis (25% of total capacity) and zero (no remaining inventory) levels.

We formulate our model to maintain safety-stock levels and make efficient use of each shuttle replenishment. Our model endeavors to deliver exactly what each battle group consumes during the entire 181-day scenario.

We conclude that global allocation provides better CLF support to deployed naval battle groups; minimum inventory levels are consistently higher under every analysis we perform. We conjecture that the flexibility global allocation provides might allow for a reduction in the total number of forward-deployed CLF shuttles. Finally, we show that a modest T-AKE re-fueling capability affords greater flexibility to CLF scheduling, especially with fleet ownership, because limits on ship movements can force a single fleet T-AO to re-fuel multiple battle groups operating in the same area of responsibility.

I. INTRODUCTION

A. THE CURRENT FORCE AND THE FUTURE PLAN

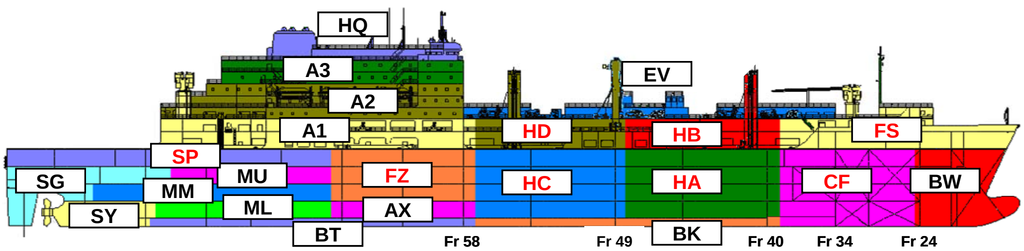
The mission of the Combat Logistics Force (CLF) is to provide ocean transportation of equipment, fuel, supplies, and ammunition to sustain U.S. Forces worldwide during peacetime and in war for as long as operational requirements dictate. CLF ships give our Navy two advantages: they reduce lost time and disruption from fleet at-sea operations, and they provide flexibility to operate in areas where hostile action precludes access to local ports or bases of re-supply. Re-supply at sea mitigates force protection requirements in foreign ports, and avoids port ammunition cargo handling restrictions. CLF ships are the vital link between land-based facilities and naval forces afloat.

In 2005, the CLF delivered 1.3 million square feet (approximately 100,000 short tons) of dry cargo and 11 million barrels of fuel [MSC, 2005].

CLF ships are separated into two mission categories: shuttle ships and station ships. A shuttle ship is traditionally a single- or dual-commodity ship that is deployed to a specific operating theater where it transits between land-based facilities and customer battle groups, acting as the logistics pipeline for the product(s) it carries. CLF shuttle ships are generally scheduled to cycle through low-threat areas and, consequently, are not capable of the greater speeds of station ships, nor do they have the increased armaments of traditional station ships. There are three classes of single-commodity shuttle ships: fleet replenishment oilers (T-AOs), combat stores ships (T-AFSs), and ammunition ships (T-AEs). Fleet oilers provide both ship's diesel fuel marine (DFM) and aviation jet fuel (JP5). Combat stores ships conduct underway replenishments (UNREPs) of all types of supplies including fresh, frozen and chilled food, dry provisions, and repair parts. Ammunition ships provide underway replenishment of various types of ammunition and frequently assist with the transfer of ammunition between weapons storage and maintenance facilities worldwide.

A station ship is generally assigned to a carrier strike group and serves as a logistics reservoir for all of the ships that comprise that group. For the most part, a station ship remains with its assigned strike group, but can be called upon by the fleet commander, especially in the Fifth and Seventh Fleets, to augment the operating shuttle ships in theater. A battle group could have more than one station ship assigned to it to provide storage for multiple commodities. However, the fast combat support ship, or T-AOE, has historically fulfilled the role of station ship due to its three-product capacity (fuel, stores, and ammunition), essentially providing one-stop shopping for its battle group customers. As an operating member of the battle group, a T-AOE requires enhanced propulsion systems (speeds capable of greater than 25 knots) and built-in survivability to ensure that it can remain in close proximity to the carrier strike group.

In June 2006, the first of a new class of re-supply ship, the Auxiliary Dry Cargo and Ammunition Ship or T-AKE (see Figure 1) was delivered to the Military Sealift Command (MSC). Delivery of the first T-AKE marks an important milestone in CLF history as the MSC is in the midst of decommissioning many of its older logistics ships.



Type	Zone	Description	Type	Zone	Description
Cargo	BK	Bilge Keel & Double Bottom	Mach	SG	Steering Gear
Cargo	HA	Multipurpose Hold #1	Cargo	FZ	Freeze/Chill
Cargo	HC	Multipurpose Hold #2	Cargo	CF	Cargo Fuel Tanks
Mach	AX	Auxiliary Machinery Room	Accom	A3	Accommodations Upper
Accom	A1	Accommodations Lower	Cargo	FS	Foc'sle
Mach	BT	Machinery Bilge & Waste Tanks	Cargo	HD	Topsides Hold 2
Mach	MU	Machinery Upper	Cargo	BW	Bow
Mach	ML	Machinery Lower	Cargo	HB	Topsides Hold 1
Mach	MM	Machinery Mid	Cargo	SP	Specialty Cargo
Mach	SY	Shaft Alley	Accom	HQ	Bridge & Communications
Accom	A2	Accommodations Mid	Cargo	EV	Elevator Houses

Figure 1. T-AKE (LEWIS AND CLARK) Class Ship Schematics
[From Schwaneke, 2004]

The arrival of the T-AKE does not signify an increase in the total number of the CLF ships currently in inventory (30 ships). The USNS LEWIS AND CLARK (T-AKE

1) will deploy for the first time in 2007 when it, along with subsequent ships of the same class, will begin the eventual replacement of all remaining ammunition ships (six of the KILAUEA or T-AE26 class) and combat stores ships (three of the MARS or T-AFS1 class and three of the SIRIUS or T-AFS8 class). The Military Sealift Command plans to retire all T-AEs and T-AFSs by 2011, leaving only three classes of ships to support the entire U.S. Navy. Figure 2 illustrates the current and future compositions of the CLF.

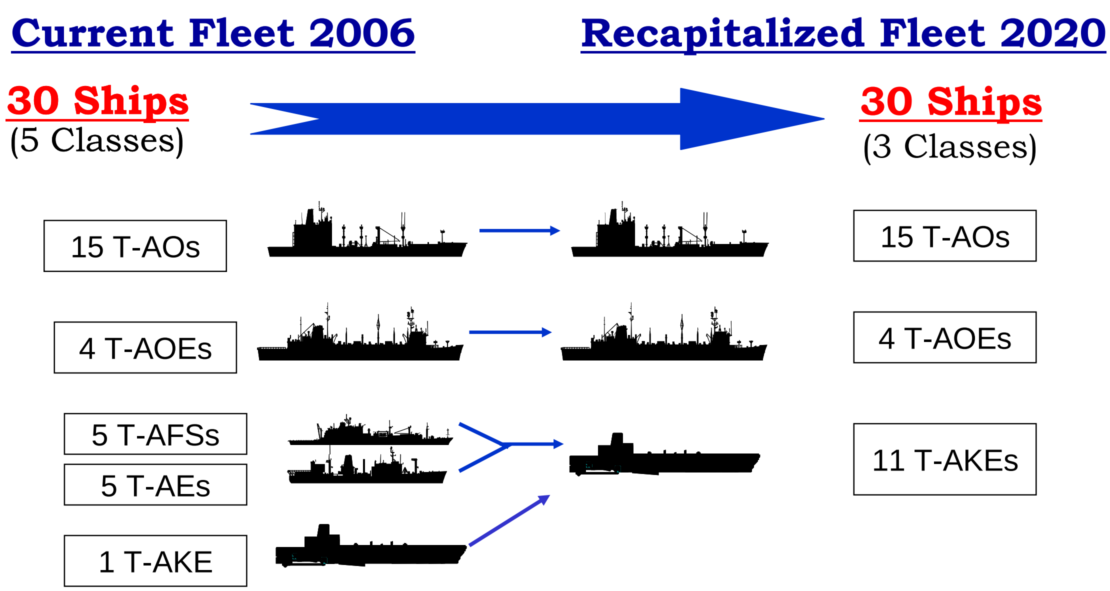


Figure 2. CLF Force Breakdown: 2006 and 2020

Five existing classes of CLF ships will be reduced to only three, with the same total number of ships.

Studies of CLF have sought its best composition (what classes of CLF ships are required to adequately support the fleet) and numbers (how many of each class are needed). CLF competes for funding with many other Navy programs, and must find ways to counter effects of an aging force with the responsibility to support a combatant fleet that is also changing. The U.S. plans to expand the size of its fleet from 284 now to more than 310 total ships by the year 2020, but the CLF is expected to just maintain its current numbers, continuing to operate many of the ships now in use [Futcher, 2006a]. Therefore, U.S. Navy strategic planning commands, including the Chief of Naval Operations Navy Strategic Mobility and Combat Logistics (OPNAV N42) and Fleet

Forces Command (FFC N8), continue to perform comparative analyses to preserve the CLF's at-sea replenishment capability to service a worldwide fleet.

B. THESIS OBJECTIVE

This thesis evaluates the effect of relaxing current fleet restrictions on the employment of CLF shuttle ships. Traditionally, each numbered fleet (Second, Third, Fifth, Sixth, and Seventh) "owns" the CLF shuttle ships that serve its ships (see Figure 3). We refer to this as "fleet ownership," and consider whether this restriction may degrade CLF capacity. What if we let each CLF shuttle ship serve *any* Navy customer, regardless of fleet? We describe this as "global allocation," and investigate whether this new concept of operations can increase the effective capacity of the CLF.

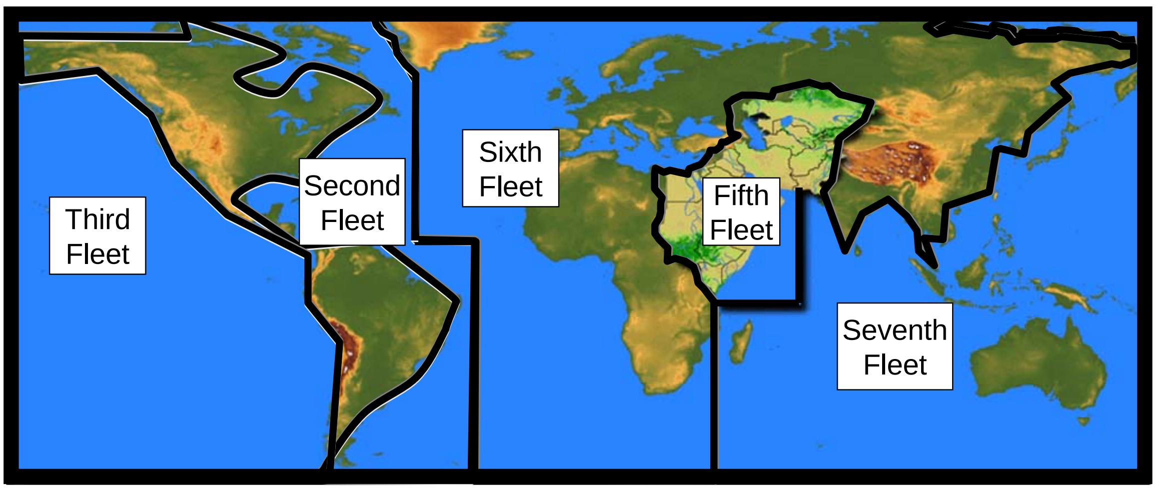


Figure 3. Fleet Areas of Responsibility

Worldwide responsibility is divided among the U.S. Navy's five numbered fleets. Second Fleet consists of the Western Atlantic and Caribbean Sea. Third Fleet extends from the west coast of the United States west to the International Date Line. Fifth Fleet stretches from the Suez Canal east to the Indian Ocean and is responsible for all naval activity in the Arabian Gulf. Sixth Fleet consists of the Eastern Atlantic Ocean, the Gulf of Guinea, the North Sea and Northern Europe and the Mediterranean Sea. The Seventh Fleet, the largest forward-deployed U.S. fleet, extends from the eastern coast of Africa east to the International Date Line.

II. BACKGROUND

A. WHY CHOOSE AN OPTIMIZATION MODEL?

An optimization model suggests the best feasible employment of CLF ships under any given set of operating constraints. A steady-state analysis of CLF operations describes average behavior, but smoothes over spikes in demand that are the hallmark of naval operations. Simulation may capture nuances and express uncertainty in operations, but it does not prescribe a best course of action, nor give any assessment of the quality of the plans discovered in comparison to those yet to be found. Givens [2002], Cardillo [2004], and DeGrange [2005] each evaluate all the literature at hand, and each chooses a prescriptive optimization model in lieu of a descriptive simulation or a steady-state model that estimates CLF capacity using average rates of consumption and delivery. Based on our review of available tools, we continue this line of analysis.

B. PAST RESEARCH

1. Optimizing the Number and Employment of Combat Logistics Force Shuttle Ships, with a Case Study of the T-AKE Ship

Borden [2001] introduces an optimization model to determine the required number of T-AKEs to sustain multiple carrier battle groups deployed in 6 different wartime scenarios. Borden’s adoption of optimization is a departure from the General Campaign Analysis Model (GCAM) simulations employed by the Office of the Chief of Naval Operations Assessment Division (OPNAV N81) [Futcher, 2006b] and the steady-state analysis performed by the Center for Naval Analyses (CNA) studying T-AKE support of a dual major theater war [Ince, 1998]. Ince suggests 18 T-AKEs are required to support future CLF requirements. Borden’s optimization study of the T-AKE shows how 12 can suffice with his scenarios and he offers further insight into how to best load and schedule supporting shuttle ships with the correct mix of fuel, ammunition, and consumable stores to re-supply each of his distinctly different scenarios. His model also prescribes where to preposition each shuttle to best support battle groups transiting to their theaters.

2. A Comparison of the Operational Potential and Capability of Two Combat Logistics Force Alternatives

Givens [2002] further develops Borden's model to evaluate the performance and flexibility of two proposed CLF configurations operating during a 134-day, dual major theater war (MTW) scenario. Alternative 1, developed by the Center for Naval Analyses, consists of 12 T-AKEs, 18 T-AOs, and 4 T-AOEs. Alternative 2, developed and approved by the Commander-in-Chief, U.S. Atlantic Fleet (CINCLANTFLT) [2001], prescribes 9 T-AKEs, 14 T-AOs, 4 T-AOE6s (SUPPLY class) and 4 T-AOE(X)s, the next generation triple-product replenishment ship. The Navy's preference for the second alternative stems from the belief that the additional T-AOE(X)s offer greater flexibility due to their higher speed and multi-commodity delivery capability. Like Borden, Givens uses optimization to evaluate the steady-state analysis of CNA and simulation by CINCLANTFLT used to study each alternative. Givens concludes that either alternative can support the dual-MTW scenario, and thus finds no justification for spending an additional $900 million on the T-AOE(X)s in Alternative 2. Givens also shows how to use a T-AKE and a T-AO as battle group station ships, in lieu of a T-AOE.

3. Optimizing Global Operations Plans for the Combat Logistics Force

Cardillo [2004] examines a 70-day notional scenario representing CLF operations supporting the U.S. Navy's Fleet Response Plan to surge six carriers in 30 days and an additional two in 90 days [GlobalSecurity.org, 2006a]. His scenario consists of worldwide deployments during two sequential, time-constrained wars against two different adversaries.

Cardillo's work challenges the results of a spreadsheet employed by OPNAV N81 to evaluate CLF requirements for an approved 10-30-30 scenario. The 10-30-30 concept suggests the U.S. military should plan to seize the initiative within 10 days of the start of a conflict, achieve limited military objectives within another 30 days and then be prepared to redeploy resources to another part of the world within another 30 days. Cardillo's scenario closely follows the one used by OPNAV N81, but unlike the OPNAV analysis which focuses only on intra-theater operations, Cardillo also accounts for inter-theater CLF support for the surging battle groups. Cardillo also forecasts the time of arrival of each battle group in the various theaters of operations.

Cardillo introduces maritime pre-positioning force future (MPF(F)) groups, squadrons of Littoral Combat Ships (LCS), and evaluates the impact of losing access to forward logistics sites (FLS).

Cardillo advises that despite the heavy dependence on fuel replenishment, 13 T-AOs and 4 T-AKEs could support any of the four 70-day scenarios. He concludes that 11 T-AKEs are required in light of CLF maintenance requirements. He also advises that 4 T-AOE(X) ships would be required to support a full Navy response exceeding the initial 70 days of his scenario. Cardillo also conjectures possible benefits and pitfalls associated with using CLF ships to serve all customers, rather than just their fleet owner.

> By strict optimization, a theater that has afloat groups operating in it may be void of shuttle ships because these shuttle ships are required elsewhere to support other combatants in our deterministic scenario. Operationally, fleet commanders will want at least one of each shuttle type present in a major theater and often they will desire two of each type. [Cardillo 2004, pp.52-53]

4. Optimizing Global Combat Logistics Force Support for Sea Base Operations

DeGrange [2005] further embellishes a CLF optimization to study sea base operations. He presents four different versions of a notional 60-day scenario that include intense preemptive combat operations followed immediately by humanitarian assistance support missions. In addition to his introduction of a sea base, DeGrange also expands upon Givens' insight into the use of a T-AKE and T-AO as a station ship pair by employing a T-AOE as a three-commodity shuttle ship. He also studies the effects of adjusting inventory safety levels on consumer ships, and tests the effects of our Navy using a single fuel, rather than separate diesel fuel marine and jet fuel.

C. CLF BOTTOM-UP REVIEW

In 2004, at the direction of the Chief of Naval Operations, Fleet Forces Command conducted a bottom-up review of CLF requirements to determine the total numbers of T-AKE, T-AO, T-AOE-6/(X), and High Speed Vessels to support the U.S. Navy from 2010 to 2020. The working group included representatives from various commands, including: Commander, Second Fleet, Commander, Pacific Fleet (COMPACFLT), Commander

Task Force 53/63/73 (CTF 53/63/73), Commander, Naval Surface Group Pacific Northwest, MSC, the Office of the Chief of Naval Operations (OPNAV N3/4/5/6/7/8), and Marine Forces Atlantic.

Three types of scenarios were introduced in the study: peacetime, transition from peacetime to wartime, and wartime. The peacetime analysis assumes an OPNAV N3/5 (Operations and Plans) distribution of combatants by theater to determine CLF levels for peacetime support. A similar steady-state analysis carries over into wartime. The review considers a range of single and dual major combat operations based on OPNAV N70 (Warfare Integration) and N81 (Assessment Division) operational plans. These scenarios do not consider any swing of forces between dual major combat operations. The wartime analysis also includes three levels of re-supply bases: "local," those within a specified, preferred distance of the theater, but susceptible to either attack or interdiction by the enemy, "next," those specified further than the preferred local and readily-accessible bases, and "assured," those guaranteed to re-supply, but at significant distance from combat operations. Using these war-fighting scenarios, re-supply bases, and logistics data, Fleet Forces Command (FFC) first establishes necessary peacetime CLF shuttle ship requirements. FFC then computes net product amounts delivered over time for petroleum, oil, and lubricants, ammunition, and stores. If the resulting output levels support the specific scenario, FFC establishes a CLF package for the given scenario re-supply base pair. If not, FFC continues to adjust CLF levels until the product levels of the scenario are acceptable and then records the derived CLF package.

The transition from peacetime to war considers important issues such as CLF maintenance concerns, CLF forward positioning, and the inventory status of surge combatants, but FFC simply uses the same steady-state analysis for battle groups transiting in and out of theaters en route to their ordered stations.

Fleet Forces Command considers additional CLF adjustments for transition or support in unengaged theaters, for operational availability and wartime attrition, and for sea base support.

Fleet Forces Command presented its findings to the Chief of Naval Operations on April 19, 2005, concluding that a CLF mix of 4 T-AOE6s, 15 T-AOs, and 12 T-AKEs would support a fleet response plan for seven total (six surge ready plus one to arrive shortly thereafter) carrier strike groups with oil re-supply available within 1,000 nautical miles and ammunition and stores available with 2,500 nautical miles of the theater of operations. The four proposed T-AOE6s are consistent with the OPNAV N81 wartime, OPNAV N6/7 (Warfare Requirements and Programs) peacetime and wartime requirements studies. Despite other feasible combinations of 6, 7, or 8 T-AOEs, FFC recommends canceling the T-AOE(X). FFC also recommends buying 12 T-AKEs, vice only 11, and developing a Fleet Logistics Concept of Operations (FLT LOG 21 CONOPS) [Ince, 2005].

D. PRESENCE REQUIREMENTS

In June 1997, Commander, Pacific Fleet, provided the Center for Naval Analyses (CNA) with CLF presence requirements deemed necessary to support battle force ships operating in the various theatres. CNA was provided the data as part of an ongoing study of the T-ADC(X), the experimental supply ship now known as the T-AKE. Four years later in 2001, a similar working panel, this time hosted by Commander, Atlantic Fleet, met once again to discuss CLF presence requirements in light of new force requirements. This new revision in August 2001 was due in large part to eventual Operation Iraqi Freedom requirements in the U.S. Central Command (CENTCOM).

	PACFLT		CENTCOM			LANTFLT	
	Western Pacific/Indian Ocean	Eastern Pacific/Middle Pacific	from PAC	from LANT	Total	LANT/Caribbean	Med
T-AOE	0.33	0.75	0.50	0.50	1.00	0.75	1.00
T-AO	2.00	2.00	1.00	0.00	1.00	2.33	2.00
T-AE	1.30	1.00	0.00	0.00	0.00	0.75	0.00
T-AFS	1.85	0.00	0.50	0.50	1.00	0.00	1.00

Table 1. August 2001 CLF Presence Requirements

A 1.00 T-AO presence factor in the Mediterranean Sea requires one available T-AO in this area every day of the year. A 0.75 factor requires a T-AO be present only 270 days of the year. [McCaffree and Trickey, 2002]

CLF presence requirements must be amplified to actual ship numbers to account for yard maintenance and other off-station time for these supply ships. For example, the requirement for 2 T-AOs in the Mediterranean Sea (see Table 1) over the course of a year to support the petroleum needs of ships transiting this Sixth Fleet area must be adjusted for maintenance periods and off-station time. A T-AO remains on station only 8 months per year, so 3 T-AO's are needed here.

There is no formal instruction regarding fleet assignments of CLF ships. The Global Naval Force Presence Policy (GNFPP) only addresses combatant forces [McCaffree and Trickey, 2002]. The GNFPP apportions available carrier strike groups and expeditionary strike groups among the Unified Commanders to ensure a continual forward presence at all times. The GNFPP does not address supporting forces that are instead determined by preceding handshake agreements or new emergent requests by the supported combatant commander.

Fleet Forces Command realizes this ad hoc approach does not guarantee the optimal use of logistics assets. A simple example used by FFC in its bottom up-review reveals the potential benefits that could be gained by sharing CLF assets across fleet areas of responsibility:

- To preserve 1.0 presence in its area, Fifth Fleet requires 1.6 T-AKEs.
- To preserve 3.0 presence in its area, Seventh Fleet requires 4.2 T-AKEs.
- With fleet ownership, the total integer requirement is 7 T-AKEs (2, rounded up from 1.6, plus 5, rounded up from 4.2).
- With sharing across areas, only 6 T-AKEs are required (1.6 plus 4.2 = 5.8 which rounds up to 6).

From July 2003 through February 2004, two T-AOs, apparently acting in accordance with prescribed CLF presence requirements, supported Sixth Fleet battle groups at an estimated cost of more than $14.5 million. The USNS LARAMIE conducted 25 underway replenishments, transferring 2.7 million gallons (65,000 barrels) of fuel and 720 short tons (8,800 square feet) of stores. Similarly, the USNS LEROY GRUMMAN conducted 32 replenishments, transferring 4 million gallons (95,000 barrels) of fuel and 500 short tons (6,100 square feet) of stores [Hering, 2004]. While the operational tempo and the distances covered by each ship during its deployment to the Sixth Fleet are unknown, we conjecture that given the relatively small number of replenishments during this eight-month epoch, only one T-AO was required in theater. Another fleet may have needed the second T-AO, sharing it with Sixth Fleet.

Fleet Forces Command considered only three levels of sharing during its 2004-2005 study: no sharing, sharing between Second and Sixth Fleets, and sharing between Second and Sixth Fleets and between Fifth and Seventh Fleets (see Figure 3). FFC did not consider a worldwide sharing of CLF shuttles allowing any ship to replenish any battle group operating in any fleet.

E. GLOBAL FORCE MANAGEMENT

In March 2004, the Secretary of Defense approved the Global Force Management concept [USJFCOM, 2004] to ensure the availability of the right capability at the right time-and-place to support the worldwide missions of operational commanders. As outlined in the Combat Logistics Force concept of operations currently under revision, the Global Force Manager (GFM) will be responsible for the strategic management of all CLF shuttles [Huber, 2006]. The Global Force Manager will assign CLF ships whenever and wherever necessary to meet commitments on a global, rather than regional, basis. The assignment of CLF ships will be determined by customer sustainment requirements based on: actual consumption data, combatant force composition, location, disposition, and mission, alternate regional venues of resource delivery, assessment of risk, and other qualitative factors (see Figure 4). GFM will reside at Fleet Forces Command to monitor the best use of the CLF on a daily basis and maximize the utility of its current inventory of 30 ships.

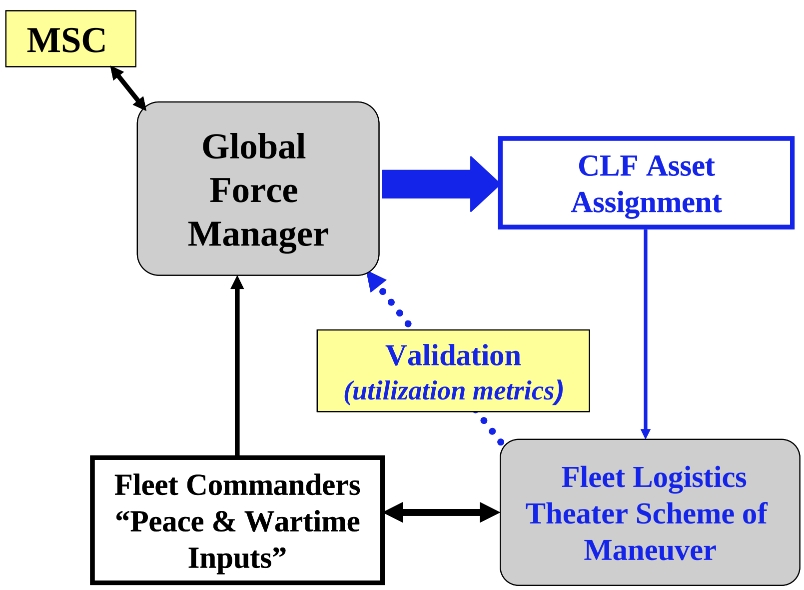


Figure 4. Global Force Manager Concept

Any request for a CLF ship will be processed through Fleet Forces Command (FFC). As the Global Force Manager, FFC will consult affected fleet commanders and the Military Sealift Command before unilaterally assigning CLF shuttles to support global operations. [From Frothingham, 2004]

F. LOGISTICS SCHEME OF MANEUVER

The Logistics Scheme of Maneuver (LSOM) tool was created in 2005 as part of Fleet Forces Command development of a logistics concept of operations and is considered “a new approach to combat logistics force allocation and scheduling.” [COMPACFLT, 2005] It is an EXCEL spreadsheet to enhance theater CLF allocation and scheduling of CLF ships using accepted consumption rate data. LSOM incorporates fleet commanders’ metrics (e.g., required days of supply and acceptable risk) provided to the Global Force Manager and then compares battle group consumer demands against available products to determine the readiness achieved and the number of CLF ships required. The ultimate goal of LSOM is to assess real-world CLF operations to determine viability for theater and global CLF allocation. A six-month test study focused on sharing CLF shuttle ships between only Third and Seventh Fleet for operations and training, but was open to Second, Fifth, and Sixth Fleets for informational purposes. Commander, Pacific Fleet, terminated LSOM in the summer of 2006 because it did not accurately represent peacetime operations nor did it capture the geographic dispersion of friendly forces [Borden, 2006].

III. SCENARIO DEVELOPMENT

A. 181-DAY PEACETIME SCENARIO

We present a 181-day unclassified peacetime scenario consisting of deployed carrier strike groups, expeditionary strike groups, surface strike groups, and a littoral combat ship squadron. We describe each of these afloat groups as a “battle group.” We develop a realistic scenario that considers various CLF shuttle-ship and station-ship configurations, and depicts the Navy conducting simultaneous at-sea operations worldwide. The scenario is based on archived data that conveys the scheme of maneuver for 13 deployed battle groups transiting Second, Third, Fifth, Sixth, and Seventh Fleets.

The Navy is distinct from its fellow services in that there is little difference between support during peacetime, during a ramp-up to conflict, or during the conflict itself. Although operational tempo quickens as we transition to conflict, and demands likewise increase for commodities such as JP5 fuel and ammunition, the responsibility for supply at sea remains the same. In peacetime or in war, combatant ships require supplies at sea and it is the mission of the CLF to provide them. Accordingly, our peacetime scenario conveys routine operations that define the daily workload for the CLF.

With OPNAV N42 approval for the premise of our scenario, we collected data from WEBSKED [Ambrosius, Do, Ferguson, Moone, and Rishmawi, 2004] to develop the CLF daily worldwide employment of the force. We selected the six-month window commencing on January 1 and ending on June 30, 2002. This time period is at once unclassified and depicts peacetime operations requested and approved by OPNAV N42. Furthermore, this period depicts the array of operational commitments of our fleets from standard carrier and expeditionary strike groups on station in the Arabian Gulf, to independent Cooperation Afloat Readiness and Training exercises and Baltic Operations. We also introduce a notional deployment of a littoral combat ship squadron [GlobalSecurity.org, 2006b]. Table 2 illustrates our 181-day employment schedule for one of the 13 scenario battle groups.

Battle Group 01 Carrier Strike Group (CSG) from San Diego USS John C. Stennis (CVN); USS Lake Champlain (CG); USS Decatur (DDG) USS Benfold (DDG); USNS Bridge (T-AOE)											
Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	Arabian Gulf	27.11	-52.00	2-Mar-02	Arabian Gulf	26.66	-51.30	1-May-02	West Pac	-35.43	-114.39
2-Jan-02	Arabian Gulf	28.75	-50.30	3-Mar-02	Arabian Gulf	26.18	-52.95	2-May-02	Freemantle	-32.14	-115.51
3-Jan-02	Arabian Gulf	26.18	-52.95	4-Mar-02	Arabian Gulf	27.90	-50.33	3-May-02	Freemantle	-32.14	-115.51
4-Jan-02	Arabian Gulf	27.90	-50.33	5-Mar-02	Arabian Gulf	27.11	-52.00	4-May-02	Freemantle	-32.14	-115.51
5-Jan-02	Arabian Gulf	27.11	-52.00	6-Mar-02	Arabian Gulf	28.85	-49.00	5-May-02	Freemantle	-32.14	-115.51
6-Jan-02	Arabian Gulf	28.85	-49.00	7-Mar-02	Arabian Gulf	26.66	-51.30	6-May-02	West Pac	-36.23	-114.59
7-Jan-02	Arabian Gulf	26.66	-51.30	8-Mar-02	Arabian Gulf	27.11	-52.00	7-May-02	West Pac	-40.02	-118.03
8-Jan-02	Arabian Gulf	27.11	-52.00	9-Mar-02	Arabian Gulf	28.75	-50.30	8-May-02	West Pac	-40.24	-124.15
9-Jan-02	Arabian Gulf	28.75	-50.30	10-Mar-02	Arabian Gulf	27.90	-50.33	9-May-02	West Pac	-40.27	-129.22
10-Jan-02	Arabian Gulf	27.90	-50.33	11-Mar-02	Arabian Gulf	26.18	-52.95	10-May-02	West Pac	-41.34	-136.08
11-Jan-02	Arabian Gulf	27.11	-52.00	12-Mar-02	Arabian Gulf	26.66	-51.30	11-May-02	Hobart	-43.34	-147.10
12-Jan-02	Arabian Gulf	26.66	-51.30	13-Mar-02	Arabian Gulf	28.85	-49.00	12-May-02	Hobart	-43.34	-147.10
13-Jan-02	Arabian Gulf	26.18	-52.95	14-Mar-02	Arabian Gulf	26.18	-52.95	13-May-02	Hobart	-43.34	-147.10
14-Jan-02	Arabian Gulf	27.90	-50.33	15-Mar-02	Arabian Gulf	27.11	-52.00	14-May-02	Hobart	-43.34	-147.10
15-Jan-02	Arabian Gulf	27.11	-52.00	16-Mar-02	Arabian Gulf	26.66	-51.30	15-May-02	Hobart	-43.34	-147.10
16-Jan-02	Arabian Gulf	28.85	-49.00	17-Mar-02	Arabian Gulf	26.18	-52.95	16-May-02	West Pac	-40.02	-154.26
17-Jan-02	Arabian Gulf	26.66	-51.30	18-Mar-02	Arabian Gulf	27.90	-50.33	17-May-02	West Pac	-35.47	-158.30
18-Jan-02	Arabian Gulf	27.11	-52.00	19-Mar-02	Arabian Gulf	27.11	-52.00	18-May-02	West Pac	-31.00	-162.55
19-Jan-02	Arabian Gulf	28.75	-50.30	20-Mar-02	Arabian Gulf	28.85	-49.00	19-May-02	West Pac	-25.43	-166.41
20-Jan-02	Arabian Gulf	27.90	-50.33	21-Mar-02	Arabian Gulf	26.66	-51.30	20-May-02	Mid Pac	-19.53	-169.11
21-Jan-02	Arabian Gulf	26.18	-52.95	22-Mar-02	Arabian Gulf	27.11	-52.00	21-May-02	Mid Pac	-14.01	-171.40
22-Jan-02	Arabian Gulf	26.66	-51.30	23-Mar-02	Arabian Gulf	28.75	-50.30	22-May-02	Mid Pac	-7.56	-173.05
23-Jan-02	Arabian Gulf	27.90	-50.33	24-Mar-02	Arabian Gulf	27.90	-50.33	23-May-02	Mid Pac	-1.45	-174.48
24-Jan-02	Arabian Gulf	27.11	-52.00	25-Mar-02	Arabian Gulf	26.18	-52.95	24-May-02	Mid Pac	-3.46	-177.47
25-Jan-02	Arabian Gulf	26.66	-51.30	26-Mar-02	Arabian Gulf	26.66	-51.30	25-May-02	Mid Pac	-9.00	-178.48
26-Jan-02	Arabian Gulf	26.18	-52.95	27-Mar-02	Arabian Gulf	28.85	-49.00	26-May-02	Mid Pac	13.45	174.40
27-Jan-02	Arabian Gulf	27.90	-50.33	28-Mar-02	Arabian Gulf	26.18	-52.95	27-May-02	Mid Pac	17.54	169.41
28-Jan-02	Arabian Gulf	27.11	-52.00	29-Mar-02	Arabian Gulf	25.85	-54.00	28-May-02	Mid Pac	21.35	164.25
29-Jan-02	Arabian Gulf	28.85	-49.00	30-Mar-02	Hormuz	26.57	-56.25	29-May-02	Pearl	21.40	158.17
30-Jan-02	Arabian Gulf	27.90	-50.33	31-Mar-02	West Pac	25.38	-57.02	30-May-02	Pearl	21.40	158.17
31-Jan-02	Arabian Gulf	26.18	-52.95	1-Apr-02	West Pac	24.47	-57.42	31-May-02	East Pac	23.14	151.20
1-Feb-02	Arabian Gulf	27.90	-50.33	2-Apr-02	West Pac	23.34	-61.19	1-Jun-02	East Pac	24.57	144.34
2-Feb-02	Arabian Gulf	27.11	-52.00	3-Apr-02	West Pac	24.19	-64.44	2-Jun-02	East Pac	26.35	137.39
3-Feb-02	Arabian Gulf	28.85	-49.00	4-Apr-02	West Pac	21.31	-66.06	3-Jun-02	East Pac	28.44	130.49
4-Feb-02	Arabian Gulf	26.66	-51.30	5-Apr-02	West Pac	19.07	-68.14	4-Jun-02	East Pac	30.51	123.59
5-Feb-02	Arabian Gulf	27.11	-52.00	6-Apr-02	West Pac	16.06	-67.18	5-Jun-02	East Pac	32.27	118.34
6-Feb-02	Arabian Gulf	28.75	-50.30	7-Apr-02	West Pac	14.13	-70.05	6-Jun-02	East Pac	32.37	117.16
7-Feb-02	Arabian Gulf	27.90	-50.33	8-Apr-02	West Pac	10.47	-69.31	7-Jun-02	In Homeport	32.72	117.18
8-Feb-02	Arabian Gulf	27.11	-52.00	9-Apr-02	West Pac	10.12	-73.00	8-Jun-02	In Homeport	32.72	117.18
9-Feb-02	Arabian Gulf	26.66	-51.30	10-Apr-02	West Pac	6.52	-72.26	9-Jun-02	In Homeport	32.72	117.18
10-Feb-02	Arabian Gulf	26.18	-52.95	11-Apr-02	West Pac	3.42	-72.13	10-Jun-02	In Homeport	32.72	117.18
11-Feb-02	Arabian Gulf	27.90	-50.33	12-Apr-02	West Pac	4.27	-75.38	11-Jun-02	In Homeport	32.72	117.18
12-Feb-02	Arabian Gulf	27.11	-52.00	13-Apr-02	West Pac	4.43	-78.50	12-Jun-02	In Homeport	32.72	117.18
13-Feb-02	Arabian Gulf	28.85	-49.00	14-Apr-02	West Pac	5.39	-81.54	13-Jun-02	In Homeport	32.72	117.18
14-Feb-02	Arabian Gulf	26.66	-51.30	15-Apr-02	West Pac	7.08	-84.53	14-Jun-02	In Homeport	32.72	117.18
15-Feb-02	Arabian Gulf	27.11	-52.00	16-Apr-02	West Pac	5.39	-88.06	15-Jun-02	In Homeport	32.72	117.18
16-Feb-02	Arabian Gulf	28.75	-50.30	17-Apr-02	West Pac	6.03	-90.27	16-Jun-02	In Homeport	32.72	117.18
17-Feb-02	Arabian Gulf	27.90	-50.33	18-Apr-02	West Pac	3.18	-92.01	17-Jun-02	In Homeport	32.72	117.18
18-Feb-02	Arabian Gulf	26.18	-52.95	19-Apr-02	West Pac	-0.49	-91.22	18-Jun-02	In Homeport	32.72	117.18
19-Feb-02	Arabian Gulf	26.66	-51.30	20-Apr-02	West Pac	-0.44	-91.01	19-Jun-02	In Homeport	32.72	117.18
20-Feb-02	Arabian Gulf	28.85	-49.00	21-Apr-02	West Pac	-6.23	-94.04	20-Jun-02	In Homeport	32.72	117.18
21-Feb-02	Arabian Gulf	26.18	-52.95	22-Apr-02	West Pac	-0.84	-98.12	21-Jun-02	In Homeport	32.72	117.18
22-Feb-02	Arabian Gulf	27.11	-52.00	23-Apr-02	West Pac	-11.15	-102.16	22-Jun-02	In Homeport	32.72	117.18
23-Feb-02	Arabian Gulf	26.66	-51.30	24-Apr-02	West Pac	-13.29	-105.19	23-Jun-02	In Homeport	32.72	117.18
24-Feb-02	Arabian Gulf	26.18	-52.95	25-Apr-02	West Pac	-17.20	-107.45	24-Jun-02	In Homeport	32.72	117.18
25-Feb-02	Arabian Gulf	27.90	-50.33	26-Apr-02	West Pac	-21.20	-109.06	25-Jun-02	In Homeport	32.72	117.18
26-Feb-02	Arabian Gulf	26.66	-51.30	27-Apr-02	West Pac	-25.47	-110.01	26-Jun-02	In Homeport	32.72	117.18
27-Feb-02	Arabian Gulf	28.85	-49.00	28-Apr-02	West Pac	-27.28	-110.27	27-Jun-02	In Homeport	32.72	117.18
28-Feb-02	Arabian Gulf	26.18	-52.95	29-Apr-02	West Pac	-30.32	-111.31	28-Jun-02	In Homeport	32.72	117.18
1-Mar-02	Arabian Gulf	27.11	-52.00	30-Apr-02	West Pac	-33.10	-112.57	29-Jun-02	In Homeport	32.72	117.18
								30-Jun-02	In Homeport	32.72	117.18

Table 2. Example of a single battle group track for our 181-day scenario.

The ships at the top of this table are located each day by operating area, and a latitude and longitude fix that day. For example, battle group 01 is located in the Arabian Gulf at 27.11^{o} N, 52.00^{o} E on 1 January 2002. The descriptions for all 13 battle group tracks can be found in the Appendix.

In addition to daily locations for each battle group, we use peacetime planning factors provided by OPNAV N42 [Futcher 2005, 2006c, 2006d]. By assuming that each battle group begins its deployment fully loaded, and then deducting, for every group, daily consumption amounts of fuel and stores, we are then able to forecast inventory levels on a day-to-day basis. We can also calculate any shortages when levels fall below set minimum percentages of total group capacities. Total capacity and total daily consumption for specific items are aggregated across the entire battle group to then determine when a group requires replenishment of cargo from a shuttle ship, or ships, and how much cargo it can receive.

B. WEB-BASED SCHEDULING TOOL

WEBSKED is a web browser for planning the movement of major maritime assets. WEBSKED operates on the Secure Internet Protocol Routing Network (SIPRNET) to manipulate and distribute classified scheduling data. WEBSKED provides all scheduling authorities a collaborative, near real time, and accurate database, display, and analysis of schedule data. WEBSKED was activated in June 2002 and is part of the Global Command and Control System-Maritime (GCCS-M).

WEBSKED is designed to not only assist higher levels of command that must disseminate deployment requirements, but also provides lower-echelon units the ability to petition higher commands to assign forces to meet validated operational, training, and testing requirements. Among its many features, WEBSKED maintains the following schedules which we reference to develop our scenario:

- Global Naval Force Presence Schedules;
- Deployment Schedules;
- Exercise Schedules;
- Operational Schedules; and
- Historical schedules (last 10 years of operational schedules).

WEBSKED does not provide daily locations for each battle group in its database, and so in order to create a six-month scenario we determine the daily positions of the 13 battle groups by establishing fictitious waypoints between the actual reported ship positions (see Figure 5). We assume a daily cruising speed of sixteen knots and ensure that no two at-sea or at-sea and port-of-call waypoints are greater than 384 (24 x 16) nautical miles apart.

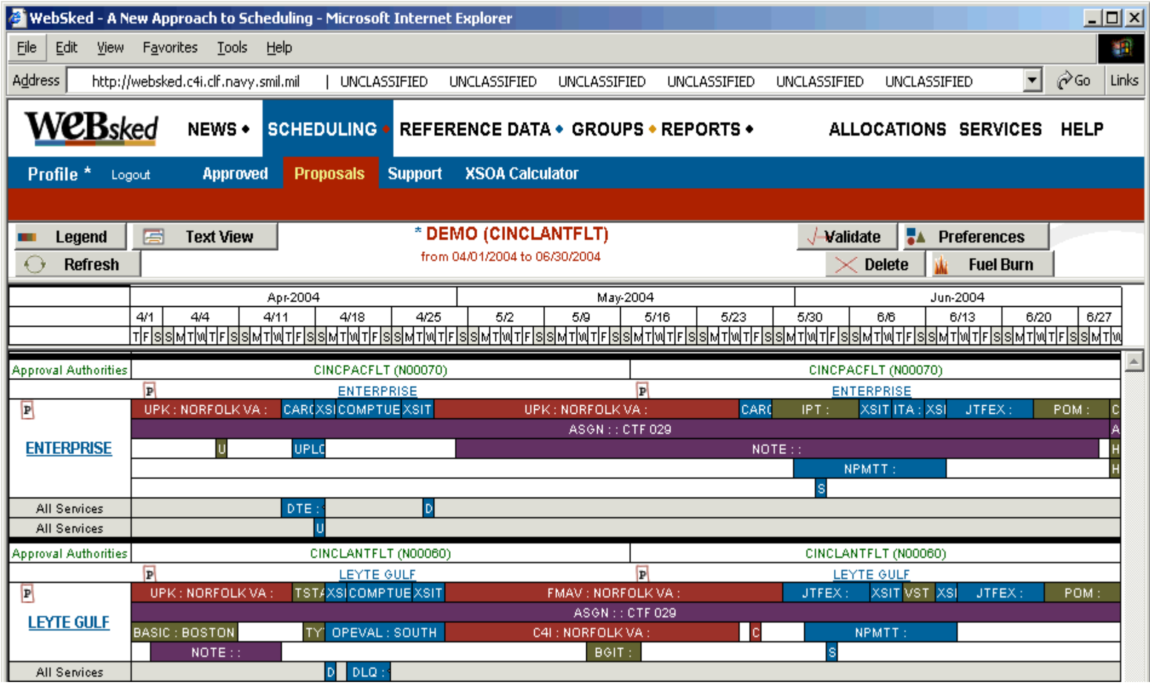


Figure 5. WEBSKED screen shot displaying ship employments and locations by calendar date

WEBSKED records both employment data and locations for any ship included in the program's database. This screen shot shows the recorded events of the USS ENTERPRISE and USS LEYTE GULF. For three months beginning in April 2004, the USS ENTERPRISE was assigned as part of Combined Task Force 029 (CTF 029). During this three-month period, ENTERPRISE spent time inport (Norfolk, VA) performing upkeep requirements and was underway conducting Composite Training Unit (COMPTUEX) and Joint Task Force (JTFEX) exercises. Any actual port visits would be highlighted with "IPT:" or "VST:" followed by the actual city (e.g., IPT: ROTA). [From Ambrosius, Do, Ferguson, Moone, and Rishmawi, 2004]

C. COMBATANT SHIP GROUPINGS

1. Carrier Strike Group

For this thesis, all carrier strike groups consist of a nuclear-powered aircraft carrier (CVN), a guided-missile cruiser (CG), two guided-missile destroyers (DDG), and a supporting fast combat replenishment ship. A carrier strike group is also accompanied by one or two submarines, but because submarines are self-sustaining, we do not replenish them in our model.

2. Expeditionary Strike Group

Expeditionary strike groups allow a core unit of an amphibious assault ship, either an LHA or LHD, a dock landing ship (LSD), and amphibious transport dock (LPD) to transport a Marine Expeditionary Unit under the protection of accompanying guided missile cruisers, destroyers, and submarines.

For the given scenario, an ESG consists of a LHD, a LPD, a LSD, a CG, and two DDGs.

3. Surface Strike Group

A surface strike group (SSG) consists of three ships. Two AEGIS ships are loaded with missile defense weapons while the third, preferably an AEGIS ship, provides protection for the task force.

For our scenario, a SSG consists of two DDGs and a CG.

4. Littoral Combat Ship Squadron

The Littoral Combat Ship (LCS) is an entirely new class of Navy warship that is being developed as a multi-mission platform to carry out the following possible operations:

- Anti-Surface Warfare;
- Mine Counter Measures;
- Littoral Anti-Submarine Warfare;
- Intelligence, Surveillance, and Reconnaissance ;
- Homeland Defense and Maritime Intercept;
- Special Operation Forces support; and
- Logistics support for the movement of personnel and supplies.

The LCS will proceed where the Navy's larger ships cannot safely navigate and will be capable of operating as part of a larger battle group, forward from an advanced sea base, or deploy independently to any of the world's littoral regions. At the request of OPNAV N42, we introduce an LCS squadron as one of the 13 battle groups in our scenario to evaluate its underway replenishment requirements and the impact it has on CLF scheduling.

The LCS squadron consists of three ships exhibiting logistics planning factors on par with an FFG.

D. COMBAT LOGISTICS FORCE

Currently, 5 T-AFSs, 5 T-AEs, 15 T-AOs, 4 T-AOEs, and 1 T-AKE comprise the CLF. In order to analyze the effects of global allocation on the future force, we include only the T-AKE, the T-AO, and the T-AOE in our model.

1. Lewis and Clark (T-AKE 1) Class

The primary mission of the T-AKE is to provide logistics lift as a shuttle ship from various sources of supply for eventual transfer at sea to battle group station ships. As a secondary mission, the T-AKE operates with a T-AO to support the carrier strike group in lieu of a T-AOE.

The T-AKE provides the CLF with a new and distinct capability: dry cargo convertible stowage. Unlike single-commodity ships such as the T-AE and T-AFS, and the T-AOE, with its dedicated storage hold for each of its multiple products, the T-AKE can configure its three primary holds to accommodate various ordnance and stores mixtures. The T-AKE is designed to carry 100% of either a T-AE or T-AFS load in a single cargo configuration, or approximately 65% of a T-AE and 65% of a T-AFS load when set up in a dual-cargo configuration. The dual-cargo configuration also includes 100% of the T-AFS refrigeration and frozen stores capacity [Douglas, 2005].

To analyze the effectiveness of the T-AKE and optimize its use, we consider both the T-AKE total storeroom capacity and its various cargo stowage configurations. Table 3 lists the T-AKE's full load capacities.

Cargo Stowage Area	Capacity Weight (stons)
Multi-purpose Holds 1 and 2 (stores and ordnance)	5,200
Stores Hold 3 (provisions to include frozen and chilled)	1,428
Stores specialty cargo (various)	1,401
Ordnance specialty cargo (various)	89
Pre-staging areas	512

Table 3. T-AKE Full Load Cargo Capacities [From Douglas, 2005]

The specialty cargo areas (stores and ordnance) contain cargo items and cannot be converted to carry other types of products. Pre-staging areas are for temporary storage in anticipation of an upcoming replenishment. We consider Holds 1 and 2 available for ammunition and consumable stores loading; Hold 3 is a consumable storeroom. We assume the T-AKE can store ammunition and consumable stores in the same hold, but not the same storeroom. There are eight different storerooms, each capable of carrying all ammunition, or all consumable stores, or a combination of both (see Table 4).

	Deck - Hold or Location	Type	Application
Hold 1	1-2	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
	1-3	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
	1-4	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
	1-5	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
Hold 2	2-2	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
	2-3	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
	2-4	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
	2-5	Multi-Purpose	Ordnance, Inert Weapon Components, or Non Refrigerated Food, Hull and Other Stores
Hold 3	3-2	Multi-Purpose	Freeze/Chill Stores or Hull and other Dry Stores
	3-3	Multi-Purpose	Freeze/Chill Stores or Hull and other Dry Stores
	3-4	Multi-Purpose	Freeze/Chill Stores or Hull and other Dry Stores

Table 4. T-AKE Ammunition and Consumable Stores Stowage

Holds 1 and 2 can carry any combination of ammunition or stores, but each individual storeroom in each of these two holds is limited to one type item. For example, Hold 1 may carry ammunition and stores, but locations 1-2, 1-3, 1-4, or 1-5 can hold either ammunition or stores, but not both. Hold 3 is a chilled storeroom for consumable stores. [After Regan, 2005]

The T-AKE has a fuel cargo capacity of 18,000 barrels [Futcher, 2006c]. This total capacity, carried across five onboard tanks, is just 16% of a T-AO's and 21% of a T-AOE's. Most planners have therefore considered the T-AKE as a single- or dual-cargo shuttle, discounting the T-AKE as a triple-commodity shuttle (or station) ship. While the T-AKE's greatest limitation to support a CSG as a station ship may be its speed (maximum sustained speed is 20 knots as compared to the T-AOE's 25 knots), its cargo fuel load can adequately re-fuel smaller battle groups or a single combatant ship acting autonomously. Peacetime daily diesel fuel marine consumption planning factors for the Littoral Combat Ship (LCS), Frigate-Guided Missile (FFG), Dock Landing Ship (LSD), Amphibious Transport Dock (LPD), Destroyer-Guided Missile (DDG), Destroyer-Next Generation (DDX), and Cruiser-Guided Missile (CG) vary from approximately 230 to 750 barrels. An LCS squadron consisting of three ships could be fueled for 17 days by a T-AKE. The T-AKE's refueling capability is useful, and we employ it in our model.

2. Henry J. Kaiser (T-AO 187) Class

Fleet replenishment oilers transport both diesel fuel marine for ship propulsion and JP5 fuel for aircraft. The 15 ships currently in inventory usually act as shuttle ships whereby they return to port following delivery to a combatant or T-AOE station ship. Most of the oilers are 10-15 years old with at least 20 years of service life remaining.

3. Supply (T-AOE6) Class

The fast combat support ship, or T-AOE, is a triple-product ship capable of storing fuel, ordnance, and dry and refrigerated stores. Its traditional role has been that of station ship for the carrier strike group (CSG), receiving the various commodities from CLF shuttle ships for further delivery to the CSG. Currently there are only four commissioned T-AOE6s in operation and an analysis of alternatives did not support the development of a replacement T-AOE(X) class [Ince, 2005]. The T-AOE has been an essential component of a deploying carrier strike group, but current numbers are incapable of supporting the U.S. Navy's Fleet Response Plan.

E. LOGISTICS PLANNING FACTORS

In his preeminent work on naval logistics, Eccles [1950, pg.37] states: "All logistics planning is based on usage factors which are average figures computed in many various ways." These usage factors have come to be called "logistics planning factors" and are determined by platform type, number of personnel, and activity. Unfortunately, the Navy does not maintain a standard operational logistics handbook comparable to those maintained by the other services that describes universally-accepted planning factors. Consequently, analysts either refer to outside literature to determine reasonable planning factors or they simply use generally-accepted factors currently employed by the Navy's logistics analysis commands. This model employs planning factors currently used by OPNAV N42 [Futcher, 2005].

1. Consumption Rates

Our peacetime scenario tracks the daily consumption of dry stores, ship's fuel, and aviation fuel. Dry stores consist primarily of food items, demand for which is constant whether a ship is in transit or on station in its area of responsibility. The only factor affecting dry stores consumption rates is the number of personnel on board each customer ship. We also use constant daily platform-specific consumption rates for both types of fuel.

At the suggestion of OPNAV N42 [Futcher 2005], no battle group uses any ammunition despite real-world possibilities to at least train with live ammunition while en route to, and on station in, a particular area of responsibility. A wartime scenario would include daily ammunition consumption, depending on the phase of operations currently underway.

2. Capacity Totals

Each ship has a maximum load capacity.

While the T-AKE maintains convertible tanks for both DFM and JP5, we use a standard 3:1 mix of diesel to aviation fuel (DFM to JP5). Owing to a lack of operational data on T-AKE, this particular planning factor was suggested by the author and approved by OPNAV N42 [Futcher 2006c].

While T-AKE only shuttles stores during our peacetime scenario, we still consider the approximately 15,000 short tons of forward-deployed ammunition stocks that the current fleet of T-AEs carry in their storerooms in the event of a fleet surge or the outbreak of hostilities anywhere in the world. We equally divide this total among the seven operating T-AKEs; each T-AKEs carries in excess of 2,000 short tons of ammunition in 3 of its 8 storerooms leaving its remaining capacity devoted to transport consumable dry stores in support of the peacetime scenario. When we alter the number of T-AKEs supporting the scenario, we reallocate the forward-deployed 15,000 short tons among the remaining active T-AKEs.

Tables 5 through 8 describe the planning factors for DFM, JP5, consumable stores, and ammunition.

		CLASS III	CLASS III	CLASS III
		POL Petroleum, Oil, Lubricants	POL Petroleum, Oil, Lubricants	POL Petroleum, Oil, Lubricants
Hull Type	Hull Name	DFM Diesel Fuel Marine Barrels (Bbls) Capacity	DFM Diesel Fuel Marine Barrels (Bbls) Consumption	DFM Diesel Fuel Marine Barrels (Bbls) Days of Supply (DOS)
CG	Cruiser - Guided Missile	15,032	757	19.86
CVN	Carrier - Nuclear	0	0	NA
DDG	Destroyer - Guided Missile	10,518	646	16.28
FFG	Frigate - Guided Missiles	4,286	304	14.10
LCS	Littoral Combat Ship	3,428	232	14.78
LHD	Amphibious Assault Ship (Multi-Purpose)	42,976	1,070	40.16
LPD	Amphibious Transport Dock	23,750	528	44.98
LSD	Dock Landing Ship	19,150	446	42.94
T-AKE	Dry Cargo/Ammunition Ship	12,000	407	29.48
T-AO	Oiler	98,139	343	286.12
T-AOE	Fast Combat Support Ship	91,824	960	95.65

Table 5. OPNAV N42 Peacetime DFM (Capacity and Consumption) Planning Factors

This table shows DFM total capacity, daily consumption, and days of supply (without replenishment) for each ship class [After Futcher 2005, 2006c, 2006d]. A Surface Strike Group, comprised of two DDGs and one CG, consumes 2,049 barrels of DFM per day. After 16 days without re-fueling, a T-AO could replenish 32,784 barrels, reducing its own cargo to 65,355 until it replenishes another ship or returns to port to fill its tanks.

		CLASS III	CLASS III	CLASS III
		POL Petroleum, Oil, Lubricants	POL Petroleum, Oil, Lubricants	POL Petroleum, Oil, Lubricants
Hull Type	Hull Name	JP5 Jet Propulsion 5 Barrels (Bbls) Capacity	JP5 Jet Propulsion 5 Barrels (Bbls) Consumption	JP5 Jet Propulsion 5 Barrels (Bbls) Days of Supply (DOS)
CG	Cruiser - Guided Missile	475	19	25.00
CVN	Carrier - Nuclear	74,642	3,000	24.88
DDG	Destroyer - Guided Missile	475	19	25.00
FFG	Frigate - Guided Missiles	475	19	25.00
LCS	Littoral Combat Ship	380	19	20.00
LHD	Amphibious Assault Ship (Multi-Purpose)	9,952	143	69.59
LPD	Amphibious Transport Dock	6,700	34	197.06
LSD	Dock Landing Ship	1,144	17	67.29
T-AKE	Dry Cargo/Ammunition Ship	6,000	18	333.33
T-AO	Oiler	57,600	0	NA
T-AOE	Fast Combat Support Ship	42,446	18	2,358.11

Table 6. OPNAV N42 Peacetime JP5 (Capacity and Consumption) Planning Factors

This table shows JP5 total capacity, daily consumption, and days of supply (without replenishment) for each ship class [After Futcher 2005, 2006c, 2006d]. For example, a CG's re-fueling support of flight operations consumes 19 barrels of JP5 on a daily basis. A CG's maximum JP5 capacity is 475 barrels.

		CLASS I, VI, IX	CLASS I, VI, IX	CLASS I, VI, IX
		Subsistence Personal Demand Items Repair Parts	Subsistence Personal Demand Items Repair Parts	Subsistence Personal Demand Items Repair Parts
Hull Type	Hull Name	Stores Short Tons (Stons) Capacity	Stores Short Tons (Stons) Consumption	Stores Short Tons (Stons) Days of Supply (DOS)
CG	Cruiser - Guided Missile	68	2	32.00
CVN	Carrier - Nuclear	1,710	53	32.28
DDG	Destroyer - Guided Missile	55	2	30.56
FFG	Frigate - Guided Missiles	35	1	30.70
LCS	Littoral Combat Ship	5	0	21.74
LHD	Amphibious Assault Ship (Multi-Purpose)	520	15	34.97
LPD	Amphibious Transport Dock	195	5	36.79
LSD	Dock Landing Ship	140	4	35.00
T-AKE	Dry Cargo/Ammunition Ship	6,628	1	6,628.00
T-AO	Oiler	15	1	15.00
T-AOE (X)	Fast Combat Support Ship - Next Generation	990	1	990.00

Table 7. OPNAV N42 Peacetime Consumable Stores (Capacity and Consumption) Planning Factors

This table shows consumable stores total capacity, daily consumption, and days of supply (without replenishment) for each ship class [After Futcher 2005, 2006c, 2006d]. The T-AKE's total capacity of 6,628 short tons supports a single-load configuration (stores only). The T-AOE's total capacity of 990 short tons includes both consumable stores for the T-AOE's crew and an additional 950 short tons of stores for further transfer to accompanying ships in the battle group.

		CLASS V	CLASS V	CLASS V
		Ammunition	Ammunition	Ammunition
Hull Type	Hull Name	Ordnance Short Tons (Stons) Capacity	Ordnance Short Tons (Stons) Consumption	Ordnance Short Tons (Stons) Days of Supply (DOS)
CG	Cruiser - Guided Missile	94	0.00	NA
CVN	Carrier - Nuclear	1,765	0.00	NA
DDG	Destroyer - Guided Missile	48	0.00	NA
FFG	Frigate - Guided Missiles	16	0.00	NA
LCS	Littoral Combat Ship	20	0.00	NA
LHD	Amphibious Assault Ship (Multi-Purpose)	391	0.00	NA
LPD	Amphibious Transport Dock	88	0.00	NA
LSD	Dock Landing Ship	38	0.00	NA
T-AKE	Dry Cargo/Ammunition Ship	5,200	0.00	NA
T-AO	Oiler	0	0.00	NA
T-AOE (X)	Fast Combat Support Ship - Next Generation	1,800	0.00	NA

Table 8. OPNAV N42 Peacetime Ammunition (Capacity and Consumption) Planning Factors

This table shows ammunition stores total capacity, daily consumption, and days of supply (without replenishment) for each ship class [After Futcher 2005, 2006c, 2006d]. T-AKE capacity of 5,200 short tons fills Holds 1 and 2. A T-AKE carrying a full ammunition load could still carry 1,428 short tons of stores in Hold 3. Although we carry ammunition, there is zero ammunition consumption in our peacetime scenario.

IV. MODEL DEVELOPMENT

We present the latest in a succession of optimization models started by Borden [2001] and further developed by Givens [2002], Cardillo [2004], and DeGrange [2005]. We illustrate a navigable world sea route model to determine the daily positions of our CLF shuttles and 13 battle groups and describe the steps to assign fleet responsibility to every node in the underlying network. We repeat salient assumptions from previous theses, but offer additional considerations commensurate with both the fleet ownership concept of operations currently employed by the CLF, and our new global allocation concept, i.e., sharing shuttles across fleet boundaries. Finally, we present our measures of effectiveness to quantify our results.

A. NAVIGABLE WORLD SEA ROUTE MODEL

The movement of all ships in our model is deterministic.

We define a fixed set of worldwide nodes consisting of 70 at-sea waypoints and 32 ports. These 102 nodes are independent of the scenario and can be increased in number to offer greater fidelity in areas of anticipated travel (see Figure 6). For example, we include additional at-sea waypoints in the North Sea and Eastern Atlantic to accommodate shuttles transiting to and from battle groups operating in these two Sixth Fleet areas of responsibility. Fixed at-sea waypoints include the Straits of Gibraltar and Hormuz, the Panama Canal, and the Liberian Coast. Fixed ports include Rota, Augusta Bay, Bahrain, Diego Garcia, Okinawa, and Norfolk.

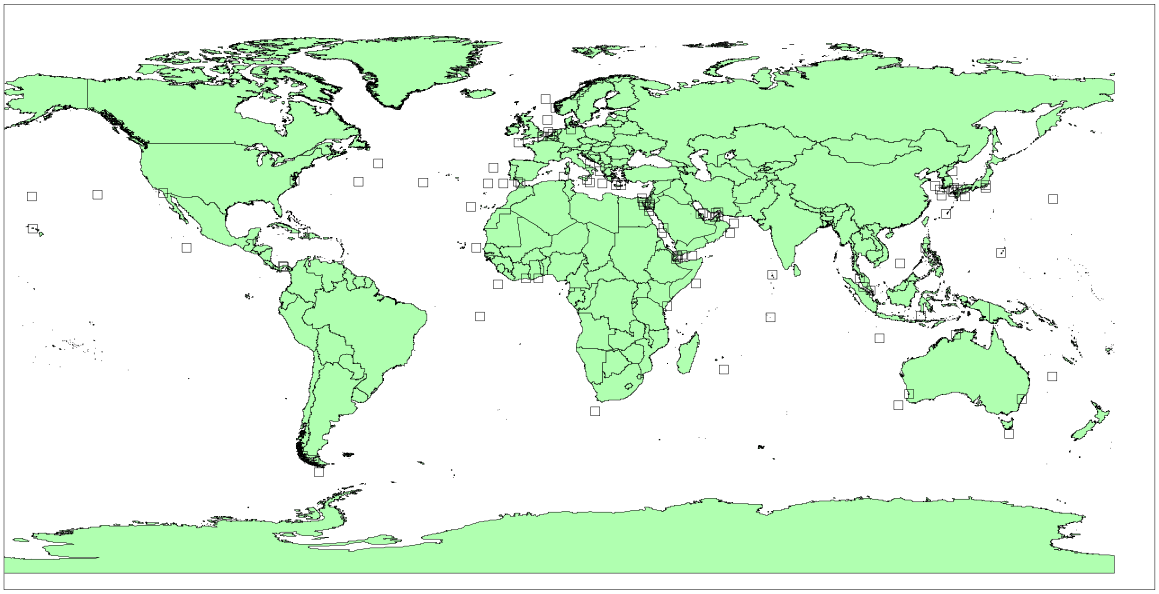


Figure 6. Fixed Set of Worldwide Nodes

Independent of the scenario, we locate nodes for at-sea waypoints and port locations to form the static part of our sea route network. At-sea nodes consist of the Strait of Hormuz, the Strait of Gibraltar, the Panama and Suez Canals, and various locations in the Atlantic, Pacific and Indian Oceans. Port nodes are designated as potential replenishment locations to include: Rota, Augusta Bay, Bahrain, Diego Garcia, Okinawa, and Norfolk.

We then add nodes, additional at-sea waypoints and ports, for each daily position of each battle group in the scenario (see Figure 7). We moderate the total number of nodes, wherever feasible, to reduce the density of our world sea route network (and to limit the execution time of our shortest-path calculations). For example, any east coast battle group transiting from Norfolk to Rota proceeds for our purposes along the same great-circle route and the same set of waypoints. We identify the pairs of nodes that are adjacent in the sense that we can navigate between them on a great-circle route.

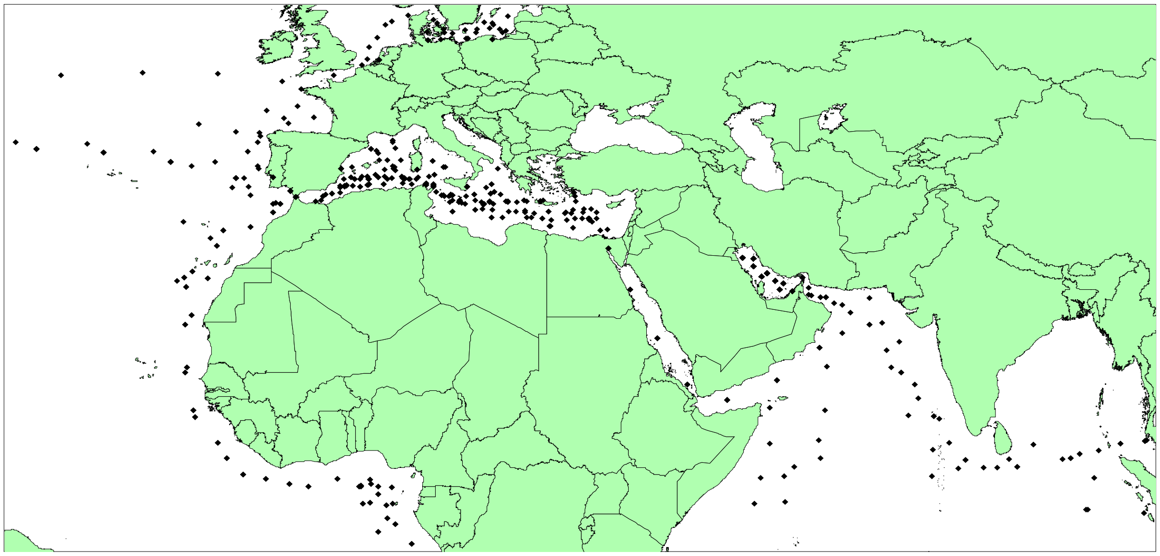


Figure 7. Battle Group Track Waypoints in Fifth and Sixth Fleets.

Many waypoints are shared by multiple battle groups. See Appendix A for a complete list of at-sea and port nodes generated by the 13 battle group tracks.

The time required to transit between any adjacent pair of nodes is mathematically determined by vessel speed and great-circle distance, except for a few distinguished "slow arcs" with a fixed transit time. Slow arcs include, for instance, the Panama and Suez Canals.

Given this network of nodes and their adjacent arcs with transit times for each, we solve for the shortest paths by vessel (or vessel type, depending on whether fleet ownership restricts passage where global allocation does not) between all worldwide nodes using the Floyd-Warshall algorithm (see Ahuja, et. al. [1993], p.144). The result is a navigable, connected (i.e. we can navigate, eventually, from any admissible node to any other admissible node worldwide) world sea route model, and it provides feasible transit times for our optimization model to conduct global shuttle operations (see Figure 8).

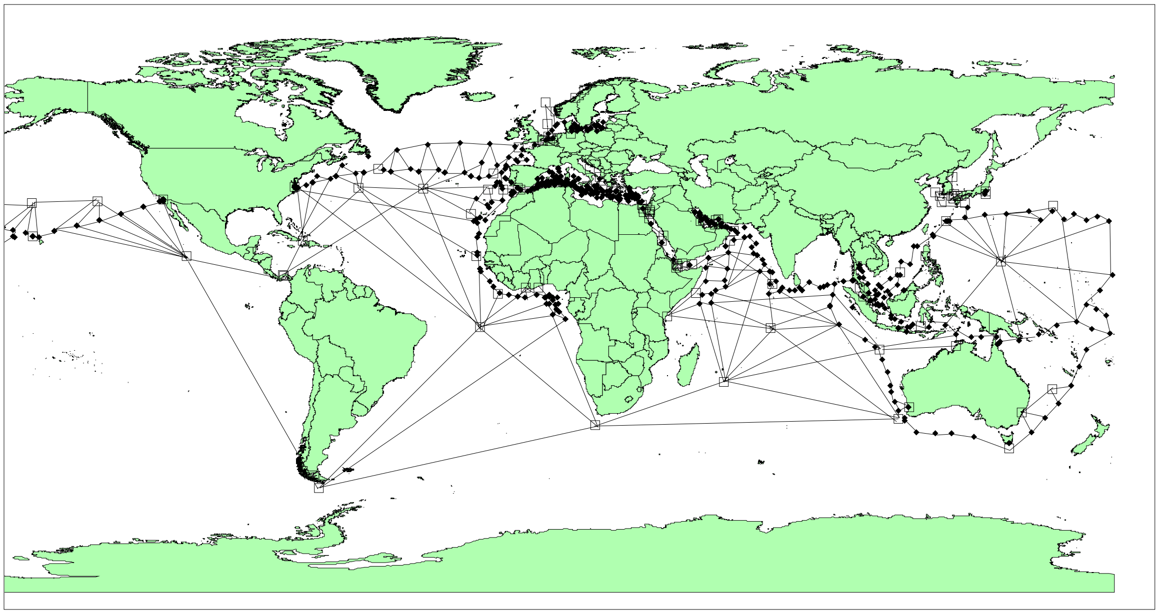


Figure 8. Worldwide Sea Route Network.

Our network results from the intersection of a fixed set of nodes comprised of at-sea waypoints and ports, and the waypoints and ports determined by the tracks of the 13 battle groups.

Our sea route network assumes CLF shuttle ships can navigate in the tracks used by the battle groups. They can also depart a customer battle group at any time and traverse arcs in our network to sail to a port, replenish, and depart for another required battle group consolidation (CONSOL), a shuttle ship's replenishment of a station ship. CONSOLs allow for subsequent underway replenishments (UNREPS) between station ships and the accompanying ships of the battle group. We do not distinguish between CONSOLs and direct deliveries to the battle group ships in our model.

B. MODELING FLEET OWNERSHIP

Our sea routes model generalizes those presented by Borden [2001], Givens [2002], Cardillo [2004], and DeGrange [2005], by labeling each node with a fleet number that may be used to restrict shuttle ship access, or with a label permitting any shuttle ship access. This permits us to accurately limit CLF shuttle operations to assigned fleet areas of responsibility for a fleet ownership scenario and then relax this constraint to test the benefits of global allocation.

Earlier versions of the basic model include a feature to restrict each shuttle to be able to serve only a specified subset of battle groups. This supports study of shuttles "owned" by the groups in a numbered fleet, or by an individual battle group. While this toggle ensures desired shuttle-battle group UNREPs, it does not control the location of the underway replenishment. For example, the earlier model allows a Fifth Fleet shuttle to rendezvous with a battle group in the Red Sea, but it also permits the same shuttle to re-supply that group in the Mediterranean Sea.

We encode every waypoint in our sea route network with a fleet number restriction (e.g., none = 0, Second Fleet = 2, Third Fleet = 3, Fifth Fleet = 5, Sixth Fleet = 6, or Seventh Fleet = 7). Shuttle ships and ports are similarly labeled in accordance with their fleet areas of responsibility. If a shuttle ship is restricted to a fleet number, it can only use waypoints and ports that are restricted to that fleet, or are not restricted at all.

By a simple toggle we can restrict or relax these fleet ownership requirements.

C. ASSUMPTIONS

We assume that daily time resolution is adequate for a 181-day notional scenario.

The total number of shuttle and station ships is fixed at the current number of such assets in the Second, Third, Fifth, Sixth, and Seventh Fleets. We allow the model to preposition each shuttle ship for its first delivery in the scenario.

We assume that all ships, be they shuttle, station or combatant, leave port full on their first operating day in the scenario.

Any port listed in the scenario can provide all three products: DFM, JP5, and stores. Entry to each port may be restricted by shuttle ship class, or individual shuttle ship. This accommodates details such as draft of vessel versus depth of port, and cargo and fuel handling equipment. In-port turnaround time is two days.

With fleet ownership enforced, shuttle ships can only re-supply at same-fleet ports, or any port lacking a fleet restriction. For example, a Second Fleet T-AKE can only re-load in Norfolk, the only Second Fleet port in our network.

Battle groups with any in-homeport time prior to their deployment are considered full when deploying. Similarly, any battle group returning to its homeport following a deployment is not considered for further CONSOL events.

Each battle group has equal priority for shuttle service. Our concern is to keep inventories for each commodity, in each battle group, above safety levels.

We limit shuttle ship replenishments during certain transit times at sea (e.g., Strait of Hormuz), as well as during any in port period.

Battle groups continue to consume dry stores in port, but there is no in-port DFM or JP5 usage.

Shuttle ships are self-sustaining. We do not plan underway replenishments of T-AOs or T-AKEs.

The commodity capacity and consumption rates of each battle group are based on the cumulative properties of all ships comprising the group. We assume that as long as the station ship for the carrier strike group receives the proper quantity of supplies, it will transfer these in subsequent UNREPs in a manner that will maintain a uniform inventory level among the component ships of the battle group. For those groups not sailing with a station ship T-AOE, we assume direct delivery between the shuttle and the battle group through a series of UNREPs with each component ship. Underway replenishments by a shuttle ship can take place any time during a day and all shuttle ship-battle group meetings last a total of one day. We can restrict some days in a battle group deployment and/or certain arcs in our sea route network as being infeasible for an UNREP.

D. MEASURES OF EFFECTIVENESS

We want to minimize the amount and duration of commodity shortfalls below battle group safety-stock levels.

We want to maximize the volumes of commodities delivered to the 13 battle groups, thereby "topping them off" whenever possible. When we plan a visit by a T-AKE or T-AO, we want the visit to be worthwhile. We want to make as few visits as possible, making efficient use of any time shuttle ship CONSOL.

E. MODEL FORMULATION

1. Indices [~cardinality]

$s \in S$ Shuttle ship [~25]

$p \in P$ Port available to load shuttle ships [~35]

$bg \in BG$ BG [~13] (alias bx, by)

$d \in D$ Day [~181] (alias dx, dy, dh)

$c \in C$ Commodity (DFM, JP5, STOR, ORDN) [~4]

$\hat{c} \subseteq C$ Dry commodity subject to load fraction restrictions (STOR, ORDN) (alias $\hat{c}$)

2. Provided Data [units]

$spdSHUTTLE_s$ Speed of shuttle ship s [nm/day]

$inptTAT$ Time to reload shuttle ship in port [days]

$portok4s_{s,p}$ Binary indicator that shuttle ship *s* can reload at port *p*

$legdays_{s,bg,d,p}$ Shuttle ship *s* transit time from *bg* position on day *d* to port *p* following given sea routes and/or BG tracks [days]

$useBG_{bg,d,c}$ Consumption by *bg* during day *d* of commodity *c* [*c*-units]

$mxload_{bg,c}$ Maximum capacity of *bg* to carry commodity *c* [*c*-units]

$safety_c$ Minimum desired fraction of $mxload_{bg,c}$ to be held at all times

$extremis_c$ Extreme minimum desired fraction of $mxload_{bg,c}$ to be held at all times

$hitOK_{bg,d}$ Logical indicator if *bg* can CONSOL on day *d*

$capacity_{s,c}$ Shuttle ship s capacity to deliver commodity *c* [*c*-units]

$mnfrac_{\hat{c}}, mxfrac_{\hat{c}}$ Minimum, maximum fraction of T-AKE dry capacity that must be loaded with dry commodity $\hat{c}$

$safety\_penalty_c$ Penalty per deficit unit of desired storage below safety-stock held by any BG [penalty per *c*-unit]

3. Derived Data

$mxconsol_{s,bg,d,c}$ Maximum delivery shuttle ship *s* can make to *bg* on any day *d* of commodity *c* [*c*-units]. This is defined as:

$$\min\{mxload_{bg,c}, capacity_{s,c}\}$$

In addition, for T-AKE shuttle ships and dry commodities $\hat{c}$ sharing dry storage, and subject to limits on the minimum and maximum fractions of dry capacity that must be carried in every T-AKE load, this is restricted to:

$$\min\{mxload_{bg,,c}, \min[mxfrac_{\hat{c}}, 1 - \sum_{\tilde{c} \neq \hat{c}} mnfrac_{\tilde{c}}] * capacity_{s,\hat{c}}\}$$

or, the maximum permitted T-AKE load of dry commodity $\hat{c}$, or the amount of commodity $\hat{c}$ that can be loaded after the minimum loads of other dry commodities $\tilde{c} \neq \hat{c}$ sharing dry storage are loaded.

$legdays_{s,bg,d,p}$ The number of steaming days for shuttle *s* to transit between *bg* on day *d* and port *p*.

$cycledays_{s,bg,d,bx,dx}$ If shuttle ship s departs *bg* on day *d* to reload at some port *p*, the minimum number of days before a rendezvous with BG *bx* on day *dx* is

$$\min\left\{ \infty, \min_{p | portok4s_{s,p}} \left[\min_{\substack{dx \geq legdays_{bg,d,p} \\ +inptTAT \\ +legdays_{bx,dx,p}}} \left(legdays_{bg,d,p} + inptTAT + legdays_{bx,dx,p} \right) \right] \right\}$$

Note that this admits a cycle with slack time (or, “shuttle waiting time”) $dx - d - cycledays_{s,bg,d,bx,dx} \geq 0$, and that because of the relative motion of a shuttle ship and a BG over navigable sea routes, and their daily proximity to ports and to each other, there will be cases in which planning for a shuttle to wait for this amount of time is better than restricting plans to have no such slack.

$directdays_{s,bg,d,bx,dx}$ The number of steaming days for shuttle *s* to transit from BG *bg* on day *d* to BG *bx* on day *dx.* (Policy limits may govern the minimum, or maximum days allowed between these planned events.)

4. Decision Variables

$HIT_{s,bg,d}$ Binary indicator of shuttle *s* CONSOL visit to *bg* on day *d*

$HIT2_{s,bg,d,bx,dx}$ Binary indicator of shuttle *s* CONSOL visit to *bg* on day *d*, followed by a second CONSOL visit to *bx* on day *dx* before returning to port

$CONSOL_{s,bg,d,c}$ Shuttle *s* delivery to *bg* on day *d* of commodity *c* [*c*-units]

$CONSOL12_{s,bg,d,bx,dx,c}, CONSOL22_{s,bg,d,bx,dx,c}$ Shuttle *s* deliveries to, respectively, *bg* on day *d* and *bx* on day *dx* of commodity *c* [*c*-units]

$SHORTAGE_{bg,d,c}$ *bg*, at end of day *d*, has this deficiency of *c* [*c*-units]

$EXTREMIS_{bg,d,c}$ *bg*, at end of day *d*, has this extreme deficiency of *c* [*c*-units]

$NEGINV_{bg,d,c}$ *bg*, at end of day *d*, has this negative inventory of *c* [*c*-units]

5. Formulation

$$\text{s.t.} \sum_{s,dh\le d} CONSOL_{s,bg,dh,c} + \sum_{s,dh\le d,bx,dx} CONSOL12_{s,bg,dh,bx,dx,c} + \sum_{s,dh\le d,bx,dx} CONSOL22_{s,bx,dx,bg,dh,c} \le \sum_{dh\le d} useBG_{bg,dh,c} \qquad \forall bg,d,c \qquad (1)$$

$$\sum_{s,dh\le d} CONSOL_{s,bg,dh,c} + \sum_{s,dh\le d,bx,dx} CONSOL12_{s,bg,dh,bx,dx,c} + \sum_{s,dh\le d,bx,dx} CONSOL22_{s,bx,dx,bg,dh,c} + SHORTAGE_{bg,d,c} + EXTREMIS_{bg,d,c} + NEGINV_{bg,d,c} \le \sum_{dh\le d} useBG_{bg,dh,c} - (1-safety_c)mxload_{bg,c} \qquad \forall bg,d,c \qquad (2)$$

$$CONSOL_{s,bg,d,c} \le\in \overline{CONSOL}_{s,bg,d,c} HIT_{s,bg,d} \qquad \forall s,bg,d,c \qquad (3)$$

$$CONSOL12_{s,bg,d,bx,dx,c} + CONSOL22_{s,bg,d,bx,dx,c} \le \overline{CONSOL22}_{s,bg,d,c} HIT2_{s,bg,d,bx,dx} \qquad \forall s,bg,d,bx,dx,c \qquad (4)$$

$$HIT_{s,bg,d} + \sum_{\substack{by,dy| \\ d-dy \ge directdays_{s,by,dy,bg,d}}} HIT2_{s,by,dy,bg,d} + HIT_{t,bx,dx} + \sum_{\substack{by,dy| \\ dy-dx \ge directdays_{s,bx,dx,by,dy}}} HIT2_{s,bx,dx,by,dy} \le 1$$

$$\forall s,bg,d,bx,dx \mid dx-d > cycledays_{s,bg,d,bx,dx} \qquad (5)$$

$$\sum_{bg} HIT_{s,bg,d} + \sum_{\substack{bg, \\ dx \le d \le dy}} HIT2_{s,bx,dx,by,dy} \le 1 \qquad \forall s,d \qquad (6)$$

$$HIT_{s,bg,d} \in \{0,1\} \qquad \forall s,bg,d \qquad (7)$$

$$HIT2_{s,bg,d,bx,dx} \in \{0,1\} \qquad \forall s,bg,d,bx,dx \qquad (8)$$

$$0 \le CONSOL_{s,bg,d,c} \le \overline{CONSOL}_{s,bg,d,c} \qquad \forall s,bg,d,c \qquad (9)$$

$$0 \le CONSOL12_{s,bg,d,bx,dx,c} \le \overline{CONSOL22}_{s,bg,d,bx,dx,c} \qquad \forall s,bg,d,bx,dx,c \qquad (10)$$

$$0 \le CONSOL22_{s,bg,d,bx,dx,c} \le \overline{CONSOL22}_{s,bg,d,bx,dx,c} \qquad \forall s,bg,d,bx,dx,c \qquad (11)$$

$$0 \le SHORTAGE_{bg,d,c} \le \overline{SHORTAGE}_{bg,d,c} \qquad \forall bg,d,c \qquad (12)$$

$$0 \le EXTREMIS_{bg,d,c} \le \overline{EXTREMIS}_{bg,d,c} \qquad \forall bg,d,c \qquad (13)$$

$$0 \le NEGINV_{bg,d,c} \qquad \forall bg,d,c \qquad (14)$$

$$\underset{\substack{HIT,HIT2,\\CONSOL,CONSOL12,CONSOL22,\\SHORTAGE,EXTREMIS,NEGINV}}{\text{MIN}} \sum_{s,bg,d,c} -0.1 safety\_penalty_c CONSOL_{s,bg,d,c}$$

$$+ \sum_{\substack{s,bg,d,bx,dx| \\ dx-d \geq directdays_{s,bg,d,bx,dx}}} -0.1 safety\_penalty_c (CONSOL12_{s,bg,d,bx,dx} + CONSOL22_{s,bg,d,bx,dx})$$

$$+ \sum_{bg,d,c} safety\_penalty_c * SHORTAGE_{bg,d,c}$$

$$+ \sum_{bg,d,c} extremis\_factor * safety\_penalty_c * EXTREMIS_{bg,d,c}$$

$$+ \sum_{bg,d,c} negatuve\_factor * safety\_penalty_c * NEGINV_{bg,d,c} \qquad (15)$$

6. Discussion

Inequalities (1) limit day-by-day cumulative CONSOL volumes of each commodity to the cumulative usage of each BG through the end of that day. We assume that on the first day, each BG is full to capacity with every commodity. Thereafter, daily use is deducted, and replenishments are accounted from shuttle consolidations. Elastic inequalities (2) reckon cumulative inventory state of each commodity at the end of each planning day, and compare this to the cumulative usage less desired safety-stock level at the end of that day, representing any shortage, extreme shortage, or negative inventory required to reconcile this state. Each inequality (3) limits the consolidation volume transferred from a shuttle ship, to a BG, on some given day, to be zero unless a replenishment event takes place. Similarly, each inequality (4) controls the successive consolidation volumes transferred from a shuttle to a BG on some given day, followed by a second consolidation on a BG on some given later day, to be zero unless a replenishment event takes place for that shuttle on BG on that day, followed by the second BG on the second day. Constraints (5) restrict successive shuttle rendezvous with battle groups so that each such visit is followed by sufficient time to cycle to a port for re-supply. Each constraint (6) permits a shuttle to engage in at most one activity on a given day. Variable domains are stated by constraints (7)-(14). The objective (15) expresses a penalty with a component for any shortage below safety-stock, and extreme shortage below minimum stock, and any negative inventory, less rewards for commodity volume delivered.

Our model can schedule a single shuttle ship sortie from port to make two separate CONSOL visits, perhaps to two different battle groups. Allowing multiple CONSOLs does not help in our large scenario, and it increases the solve times significantly, so we do not use this feature in our scenario. For a small 30-day scenario in the Arabian Gulf, with three battle groups being supported by one T-AKE, we find that allowing multiple CONSOLs per sortie increases the overall minimum inventory levels seen, but that the difference is small. We include this feature to allow the model to represent a situation that could occur in the real world, but we conjecture that it is useful in a few circumstances where many battle groups are close to each other for extended periods, and have low to moderate consumption of the relevant commodities. The two-consolidation sorties can be toggled on and off, so for completeness, we display in our formulation the fully general model we have implemented.

F. IMPLEMENTATION

We implement our CLF optimization model in the General Algebraic Modeling System (GAMS) [GAMS, 2004]. Because GAMS is not very fast with computational procedures, we use a FORTRAN program to generate the sea route network and calculate all shortest paths for all vessel types. The results are tabulated for use in our GAMS implementation. We use the integer linear program solver CPLEX to optimize each scenario.

1. Solving Using a Problem Cascade

An instance of this large-scale, long-term CLF planning problem is not always easy to solve. The sheer size of these scenarios presents a challenge, and one can argue that a globally-optimal solution that anticipates far-future demand may be “too” optimal, or unrealistic. We present an alternate, myopic solution method that is faster.

We specify a maximum solve time and a maximum acceptable interval of uncertainty -- the relative or absolute difference between the value of the best integer solution found and an upper bound on this value. If we do not satisfy this tolerance in the allotted solve time, we resort to a time-myopic problem cascade [Brown, et. al 1987, p.341]. Figure 9 offers a simple example of such a cascade.

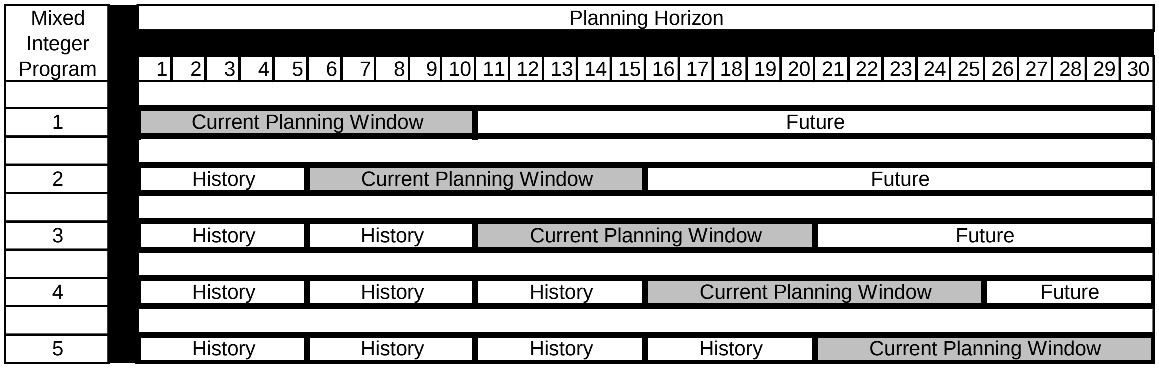


Figure 9. Example of a Problem Cascade.

This illustrates solving a 30-day planning horizon by considering a sliding planning window of 10 days, and advancing this planning window 5 days at a time. As we advance, we fix our history at that last seen in a planning window. For example, in the third integer program, we have ten days of decisions that are fixed (days 1-10), ten days of decisions available to the model (days 11-20), and ten days that do not yet appear in the model (days 21-30).

Our cascade is defined with three terms: days in planning horizon, days in planning window, and days advanced per solve. For the simple example, these are respectively 30, 10, and 5. As we advance the planning window through the number of days comprising the planning horizon, we divide the optimization into three components: history, current planning window, and future. In the initial step, the first mixed integer program (MIP) solves only the current planning window, returning a solution when the integer tolerance is satisfied. The second MIP then advances to the next planning window, fixing the last-determined values for those variables in our history, and relaxes all historic constraints save those that still have influence on the new current planning window. We pay no attention to the variables and data for future time periods until they comprise part of the current planning window. This iteration repeats until the final day of the planning horizon is included in the current planning horizon.

We add another key feature to our cascade. When we cannot solve a current planning window, our solver memorizes the last, “goal day” of this solve window, then halves the window length and the number of the days to advance in order to solve this new, and now smaller, planning window. Despite the reduced planning window, the MIP advances from where we last started and attempts to once again solve the current cascade window. If necessary, this halving continues recursively until a planning window of only two days, and an advance of just one day might fail, in which hypothetical case we would abnormally terminate. When we finally solve a planning window that ends on or after the goal day, we restore the days in the current planning window and the days advanced per solve to their original values until we either reach the end of the planning horizon, or need to repeat the recursive steps when we cannot solve a subsequent current planning window.

Admittedly, the cascade we use in this model returns a restricted solution. The variables we fix during the early periods have an impact on the later decision variables as the history period grows. For example, a T-AO replenishment on day 3 of a 30-day scenario may offer the optimal solution for this current planning window. However, establishing this same T-AO replenishment on day 3 of the 181-day scenario could result in a sub-optimal solution for the complete scenario, because the day 3 replenishment does not "anticipate" necessary later requirements in the complete planning horizon. We might see this same effect in the initial pre-positioning of CLF shuttles. We allow the model to locate shuttles based on the initial planning window regardless of later requirements in the planning horizon.

Nevertheless, a time-myopic optimization may be more realistic than the omniscient, global monolithic one. Our scenario, dependent on known consumption and capacity data, assumes deterministic demand, allowing us to anticipate every future battle group nuance. Omniscient planning similar to this is, arguably, "too optimal." The temporal cascade more closely mimics CLF planning that considers recent history and a reasonable forecast of near-term demands to develop shuttle schedules for upcoming CONSOLs. While we concede formal optimality, and admit that the current planning window does not consider possible future spikes in demand, actual experience reveals that a cascade returns feasible solutions that are not far from omniscient-optimal. The cascade offers us a robust solution strategy and can potentially highlight unusually challenging windows of the planning horizon, through the need to recursively halve the planning window, to alert CLF and individual fleet planners to the need for added shuttle capacity.

V. ANALYSIS OF RESULTS

A. SYNOPSIS

We present three levels of findings.

First, we analyze the battle group commodity levels and shuttle ship activity resulting from the global allocation and fleet ownership scenarios. We evaluate each concept of operations using the complete planning horizon (181 days).

For our primary analysis of our 181-day scenario, we solve both the global allocation and fleet ownership models using a planning window of 60 days and advancing 30 days per solve (181-60-30). We allow one hour solving each mixed integer program. We then reduce the planning window and advance days per solve to 30 and 15 days (181-30-15), respectively, and restrict the solve time to two minutes.

Table 9 presents a synopsis of our primary results, illustrating the effects of the cascade and the potential benefits of global allocation. The longer cascade windows in both 181-60-30 cases provide for better long-term planning of the shuttles. For either cascade setup, global allocation provides better DFM, JP5, and consumable stores support.

	Global Allocation 181-60-30	Fleet Ownership 181-60-30	Global Allocation 181-30-15	Fleet Ownership 181-30-15
Total BG Days Below Safety Level (50% of Capacity)	64	293	84	309
BG DFM Days Below Safety Level	24	109	31	100
BG JP5 Days Below Safety Level	16	24	26	28
BG Stores Days Below Safety Level	24	160	27	181
Total BG Days in Extremis (25% of Capacity)	2	85	10	75
BG DFM Days in Extremis	2	29	7	15
BG JP5 Days in Extremis	0	0	0	0
BG Stores Days in Extremis	0	56	3	60
Total BG Days Below Zero (0 Capacity)	0	19	0	10
BG DFM Days Below Zero	0	4	0	1
BG JP5 Days Below Zero	0	0	0	0
BG Stores Days Below Zero	0	15	0	9

Table 9. Battle Group Commodity Days Below Safety (50% of battle group's total aggregated capacity), in Extremis (25% of battle group's total aggregated capacity) and runouts (0 total aggregated capacity)

The longer cascade planning window provides a better view of future needs of our scenario and allows for better planning. A shorter window is more restrictive, but returns planning results much more quickly. The lack of vision of future events restricts shuttle movement throughout the scenario, resulting in less support to the 13 battle groups. Global allocation avoids any runouts and reduces the number of below-safety level days to one quarter of those endured under fleet ownership.

Next, we perform sensitivity analyses in which we reduce the number of globally-allocated shuttles to see if we can operate with fewer forward-deployed CLF ships. Finally, we prohibit the DFM and JP5 re-fueling capability of the T-AKE to illustrate the adverse effect this can have on global allocation and fleet ownership. For all of these sensitivity analyses, we only use the 181-30-15 cascade with two-minute solve times.

The navigable sea routes model takes 13 minutes to solve for the global allocation scenario versus 21 minutes for fleet ownership. Computing all shortest paths for the fleet ownership model takes considerably longer because we must calculate the paths for each specific shuttle and its fleet label, rather than for each shuttle vessel type. Our world sea route network supporting the complete 181-day scenario consists of 878 nodes and 770,844 connecting arcs.

The optimization model for the 181-60-30 global allocation scenario takes about 10 hours to solve as compared to half an hour for the 181-30-15 model. The 181-60-30 and 181-30-15 fleet ownership models take four hours and 6 minutes, respectively. We solve all scenarios on a 2-MHz personal computer.

B. BATTLE GROUP INVENTORY LEVELS

To analyze global allocation effectiveness, we monitor minimum inventory to judge performance of the CLF. We use the average inventory levels of each battle group as a gauge of overall CLF capability. Given that we can maintain minimum inventories above safety-stock levels (or extremis levels or, in the worst case, runout), we prefer higher average inventory levels. Global allocation provides better minimum inventory performance in every analysis we perform. While global allocation does not guarantee a better average inventory level for every battle group commodity, our results show that the worldwide travel of CLF shuttles ensures that average inventories are maintained at or above safety levels. Conversely, with fleet ownership, the Sixth Fleet's battle group 11 average inventory levels drop below safety levels (see Table 10), signaling a clear shortfall in CLF capacity in the Sixth Fleet.

					Average Levels					
Battle Group	Commodity	Starting Level	Safety Level	Extremis Level	Global Allocation 181-60-30	Fleet Ownership 181-60-30	Global Allocation Greater?	Global Allocation 181-30-15	Fleet Ownership 181-30-15	Global Allocation Greater?
BG01	DFM	127.892	63.946	31.973	108.001	105.474	Yes	111.749	102.458	Yes
	JP5	118.513	59.257	29.628	100.154	90.222	Yes	100.518	98.745	Yes
	Stores	2878.000	1439.000	719.500	2535.175	2220.706	Yes	2528.080	2239.163	Yes
BG02	DFM	127.892	63.946	31.973	112.491	95.747	Yes	123.322	101.100	Yes
	JP5	118.513	59.257	29.628	83.339	104.189	No	92.058	98.182	No
	Stores	2878.000	1439.000	719.500	2593.956	2295.652	Yes	2687.698	2263.394	Yes
BG03	DFM	127.892	63.946	31.973	116.514	105.639	Yes	119.041	112.762	Yes
	JP5	118.513	59.257	29.628	100.563	88.811	Yes	109.679	103.359	Yes
	Stores	2878.000	1439.000	719.500	2438.892	2348.431	Yes	2630.926	2317.760	Yes
BG04	DFM	121.944	60.972	30.486	88.796	103.961	No	103.436	105.085	No
	JP5	19.221	9.611	4.805	18.515	17.172	Yes	18.572	17.169	Yes
	Stores	1033.000	516.500	258.250	819.654	796.318	Yes	812.397	778.116	Yes
BG05	DFM	121.944	60.972	30.486	118.092	94.978	Yes	108.606	105.090	Yes
	JP5	19.221	9.611	4.805	18.808	17.567	Yes	18.394	18.187	Yes
	Stores	1033.000	516.500	258.250	793.800	793.800	No	793.800	899.329	No
BG06	DFM	121.944	60.972	30.486	93.267	96.681	No	97.000	98.144	No
	JP5	19.221	9.611	4.805	18.354	14.897	Yes	18.684	16.154	Yes
	Stores	1033.000	516.500	258.250	884.125	798.287	Yes	915.615	819.547	Yes
BG07	DFM	121.944	60.972	30.486	99.678	98.144	Yes	107.113	102.763	Yes
	JP5	19.221	9.611	4.805	18.536	15.103	Yes	18.268	14.677	Yes
	Stores	1033.000	516.500	258.250	867.436	748.486	Yes	921.281	769.732	Yes
BG08	DFM	36.068	18.034	9.017	28.338	28.212	Yes	27.163	28.254	No
	JP5	1.425	0.713	0.356	1.096	1.062	Yes	1.029	1.186	No
	Stores	178.000	89.000	44.500	130.510	138.857	No	134.061	148.949	No
BG09	DFM	36.068	18.034	9.017	27.506	24.551	Yes	28.101	26.357	Yes
	JP5	1.425	0.713	0.356	1.216	1.082	Yes	1.122	1.099	Yes
	Stores	178.000	89.000	44.500	134.282	112.846	Yes	142.273	120.686	Yes
BG10	DFM	36.068	18.034	9.017	26.124	23.439	Yes	26.964	26.605	Yes
	JP5	1.425	0.713	0.356	1.147	1.004	Yes	1.100	1.099	Yes
	Stores	178.000	89.000	44.500	141.479	137.585	Yes	132.889	123.770	Yes
BG11	DFM	25.322	12.661	6.331	20.225	12.520	Yes	18.403	15.719	Yes
	JP5	1.425	0.713	0.356	1.228	1.065	Yes	0.962	1.077	No
	Stores	145.000	72.500	36.250	112.987	87.154	Yes	104.715	61.201	Yes
BG12	DFM	38.468	19.234	9.617	29.467	30.083	No	31.881	29.756	Yes
	JP5	2.094	1.047	0.524	1.894	1.528	Yes	1.880	1.766	Yes
	Stores	243.000	121.500	60.750	185.077	182.466	Yes	180.509	194.731	No
BG13	DFM	10.284	5.142	2.571	7.225	7.184	Yes	6.778	6.692	Yes
	JP5	1.140	0.570	0.285	0.852	0.867	No	0.828	0.840	No
	Stores	15.000	7.500	3.750	10.821	7.862	Yes	10.522	8.941	Yes

Table 10. Global Allocation and Fleet Ownership Average Inventory Levels

In some cases, fleet ownership maintains better average inventory levels than those afforded by global allocation to the same battle group for the same commodity. This makes sense for a lucky battle group that does not have to share fleet-restricted shuttle service. However, our results show that across all battle groups and all commodities, global allocation maintains inventories at higher levels. Averaging over all battle groups and commodities, global allocation maintains inventories at 82% of total battle group capacity, or 65% above safety-stock levels.

Our global allocation scenario does not have any day on which any battle group commodity reaches zero, an event we call a “runout.” Mathematically, our model represents a runout by a negative inventory for a commodity on one day. This represents consumption that cannot be satisfied with the battle group inventory of that commodity on that day. With fleet ownership, 3 of the 13 battle groups suffer runouts. Battle groups 09, 11, and 13 all operate in Sixth Fleet from day d045 to d105. Battle group 09 operates in the Mediterranean Sea, while groups 11 and 13 are operating in the North Sea and along the west coast of Africa respectively. The two lone Sixth Fleet shuttles (a T-AO and T-AKE) can not overcome the “tyranny of distance” presented by fleet ownership, resulting in runouts for these battle groups (see Figure 10). With fleet ownership, MSC would need to activate additional shuttles. Otherwise, the Navy would limit the total number of deployed battle groups, limiting its operational commitments around the world.

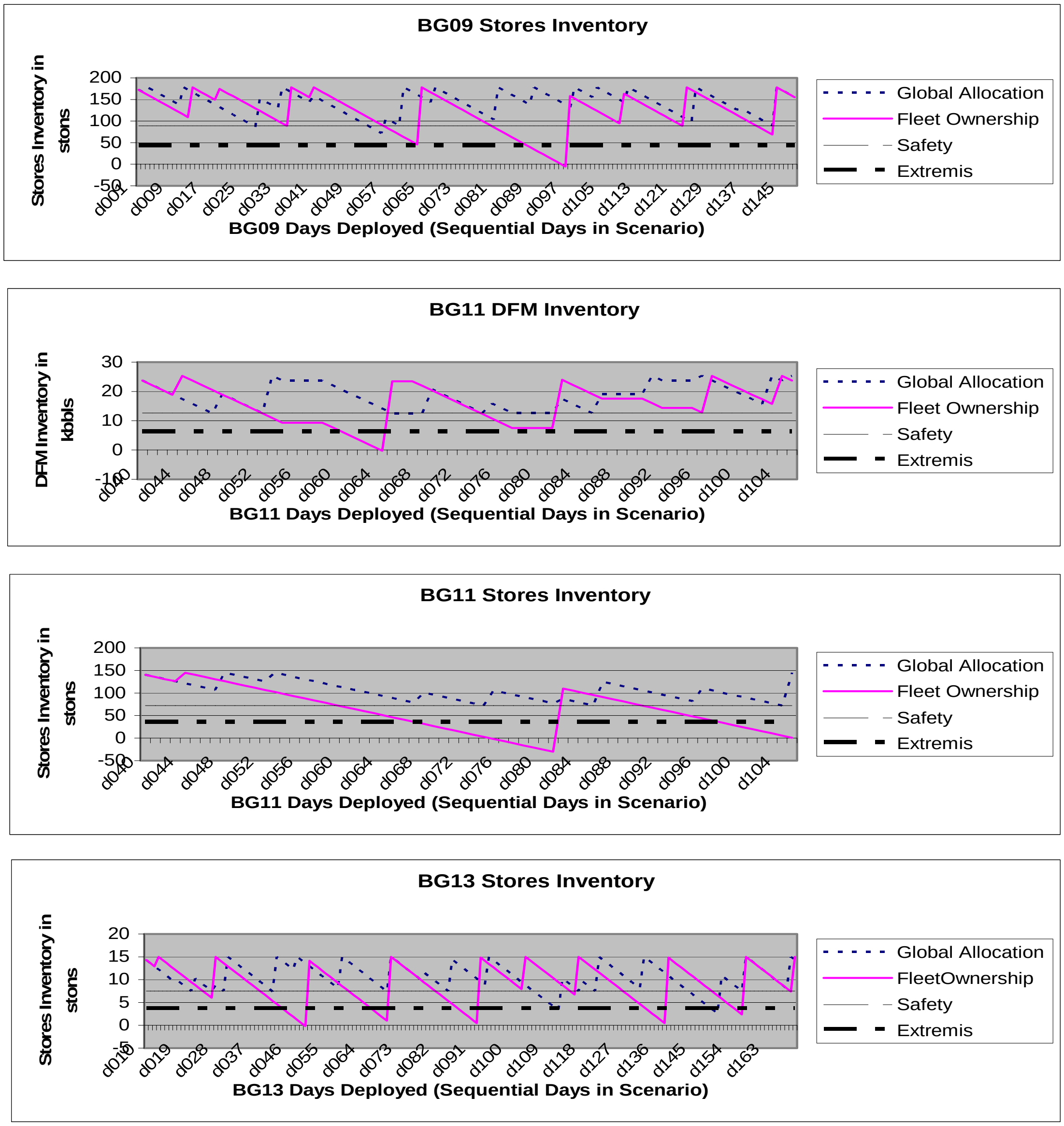


Figure 10. Battle Groups 09, 11, and 13 Runout Commodities (Fleet Ownership)

With fleet ownership, three battle groups suffer runouts. Battle groups 09 and 13 suffer consumable stores runouts. Battle group 11, operating primarily alone in the North Sea and off Northern Europe suffers runouts of both DFM and consumable stores. Battle groups 09, 11, and 13 are 3 of the 8 battle groups which transit through Sixth Fleet. During shared periods of time, battle group 13 draws this fleet's only T-AKE and T-AO from groups 09 and 11. Battle group 11 suffers consumable stores runout for a week. Operationally, the Navy would be forced to either reduce the number of deployed battle groups or activate additional shuttles to accommodate the increased demand.

Global allocation is able to maintain above-zero inventory levels for all battle groups. Our results favor global allocation and a complete description of all minimum attained commodity levels can be found in Table 11.

					Minimum Levels			
Battle Group	Commodity	Starting Level	Safety Level	Extremis Level	Global Allocation 181-60-30	Fleet Ownership 181-60-30	Global Allocation 181-30-15	Fleet Ownership 181-30-15
BG01	DFM	127.892	63.946	31.973	63.946	63.946	63.946	45.892
	JP5	118.513	59.257	29.628	63.013	59.257	59.257	44.713
	Stores	2878.000	1439.000	719.500	1439.000	1320.340	1440.160	841.060
BG02	DFM	127.892	63.946	31.973	72.973	63.946	109.838	63.946
	JP5	118.513	59.257	29.628	46.807	63.988	59.257	63.013
	Stores	2878.000	1439.000	719.500	1739.710	1619.890	2338.810	1320.340
BG03	DFM	127.892	63.946	31.973	64.703	63.946	73.730	73.730
	JP5	118.513	59.257	29.628	50.032	59.107	75.463	63.163
	Stores	2878.000	1439.000	719.500	1380.250	1380.250	1979.350	1380.250
BG04	DFM	121.944	60.972	30.486	60.972	60.972	60.972	60.972
	JP5	19.221	9.611	4.805	15.205	10.364	15.958	12.946
	Stores	1033.000	516.500	258.250	516.500	435.000	516.500	255.600
BG05	DFM	121.944	60.972	30.486	109.665	68.735	93.293	93.293
	JP5	19.221	9.611	4.805	17.715	15.958	17.464	17.464
	Stores	1033.000	516.500	258.250	554.600	554.600	554.600	734.000
BG06	DFM	121.944	60.972	30.486	60.972	60.549	52.786	60.972
	JP5	19.221	9.611	4.805	16.209	9.611	16.962	12.444
	Stores	1033.000	516.500	258.250	576.300	516.500	614.400	255.600
BG07	DFM	121.944	60.972	30.486	60.972	60.972	65.065	60.972
	JP5	19.221	9.611	4.805	16.209	9.611	15.205	9.109
	Stores	1033.000	516.500	258.250	516.500	195.800	704.100	255.600
BG08	DFM	36.068	18.034	9.017	17.593	18.034	7.382	18.034
	JP5	1.425	0.713	0.356	0.713	0.713	0.627	0.542
	Stores	178.000	89.000	44.500	74.860	74.860	74.860	89.000
BG09	DFM	36.068	18.034	9.017	13.529	3.284	13.970	8.990
	JP5	1.425	0.713	0.356	0.713	0.513	0.542	0.656
	Stores	178.000	89.000	44.500	77.540	-16.820	71.810	-5.360
BG10	DFM	36.068	18.034	9.017	11.887	4.892	15.578	9.431
	JP5	1.425	0.713	0.356	0.713	0.570	0.713	0.684
	Stores	178.000	89.000	44.500	80.590	80.590	80.590	29.020
BG11	DFM	25.322	12.661	6.331	12.554	-1.810	12.554	-0.214
	JP5	1.425	0.713	0.356	0.798	0.456	0.371	0.513
	Stores	145.000	72.500	36.250	72.500	-1.940	72.500	-30.380
BG12	DFM	38.468	19.234	9.617	18.877	19.234	19.234	19.234
	JP5	2.094	1.047	0.524	1.379	1.047	1.324	1.489
	Stores	243.000	121.500	60.750	121.500	121.500	119.410	126.680
BG13	DFM	10.284	5.142	2.571	1.236	0.540	1.662	0.540
	JP5	1.140	0.570	0.285	0.399	0.342	0.285	0.342
	Stores	15.000	7.500	3.750	6.030	-6.570	2.580	-0.180

Table 11. Global Allocation and Fleet Ownership Minimum Inventory Levels

Negative numbers represent the amount of shortfall in a commodity and represent a runout. In our fleet ownership scenario, battle groups 09, 11, and 13 each suffer inventory runouts for at least one commodity type. The three battle groups operate primarily in Mediterranean Sea, North Sea, and East Atlantic off the coast of Africa, requiring extensive transit times for the Sixth Fleet's only T-AKE and T-AO.

Adding the LCS battle group to our scenario has significant impact on the other battle groups. With fleet ownership, 4 different shuttles (T-AOs and T-AKEs from the Second and Sixth Fleets) conduct 17 CONSOLs with the LCS battle group operating primarily off the west coast of Africa and in the Mediterranean Sea. Battle group 13 is deployed for 160 days of the 181-day scenario and requires DFM every 7 days, JP5 every 10 days, and consumable stores every 11 days, to avoid falling below safety-stock levels. With global allocation, 12 different CLF shuttles conduct 33 CONSOLs to replenish the LCS battle group.

With fleet ownership and only 12 battle groups, we see no runout. While global allocation can accommodate the addition of battle group 13 to our scenario, we observe runouts across 3 battle groups in the fleet ownership scenario. With fleet ownership, MSC can support 12 battle groups, but would require at least one additional shuttle to adequately support all 13. Global allocation supports all 13 battle groups using the current force of 7 T-AKEs and 9 T-AOs.

C. SHUTTLE SHIP ACTIVITY

Fleet ownership severely limits the delivery potential of the CLF; the restricted assignment of ships does not adequately support the battle groups in our scenario. Table 12 describes the future planned assignment of T-AO and T-AKE shuttle ships that is used in the fleet ownership model to initially restrict ships in their respective areas of responsibility.

	Location	Fleet
T-AKE 01	Atlantic	Second
T-AKE 02	Western Mediterranean	Sixth
T-AKE 03	Arabian Gulf	Fifth
T-AKE 04	Western Pacific	Seventh
T-AKE 05	Indian Ocean	Seventh
T-AKE 06	Western Pacific	Seventh
T-AKE 07	Eastern Pacific	Third
T-AO 01	Atlantic	Second
T-AO 02	Western Mediterranean	Sixth
T-AO 03	Arabian Gulf	Fifth
T-AO 04	Arabian Gulf	Fifth
T-AO 05	Western Pacific	Seventh
T-AO 06	Western Pacific	Seventh
T-AO 07	Western Pacific	Seventh
T-AO 08	Western Pacific	Seventh
T-AO 09	Middle Pacific	Third

Table 12. Planned Disposition of CLF Shuttle Ships.

Although the first T-AKE was delivered to the Military Sealift Command in June 2006, it is yet to deploy to a forward area in one of the numbered fleets. This table provides a possible schedule of T-AKE and T-AO shuttles and is used to assign CLF assets in the fleet ownership model [Futcher, 2006e]. All seven T-AKEs and nine T-AOs are "free" to start anywhere in the equivalent global allocation model.

Of the 2,353 total battle group days in our scenario (13 x 181), 1,202 are available CONSOL days. The majority of these days, 51%, are in Fifth Fleet while 30% are in Sixth Fleet, 11% are in Seventh Fleet, and 4% each are in Second and Third Fleets (see Figure 11).

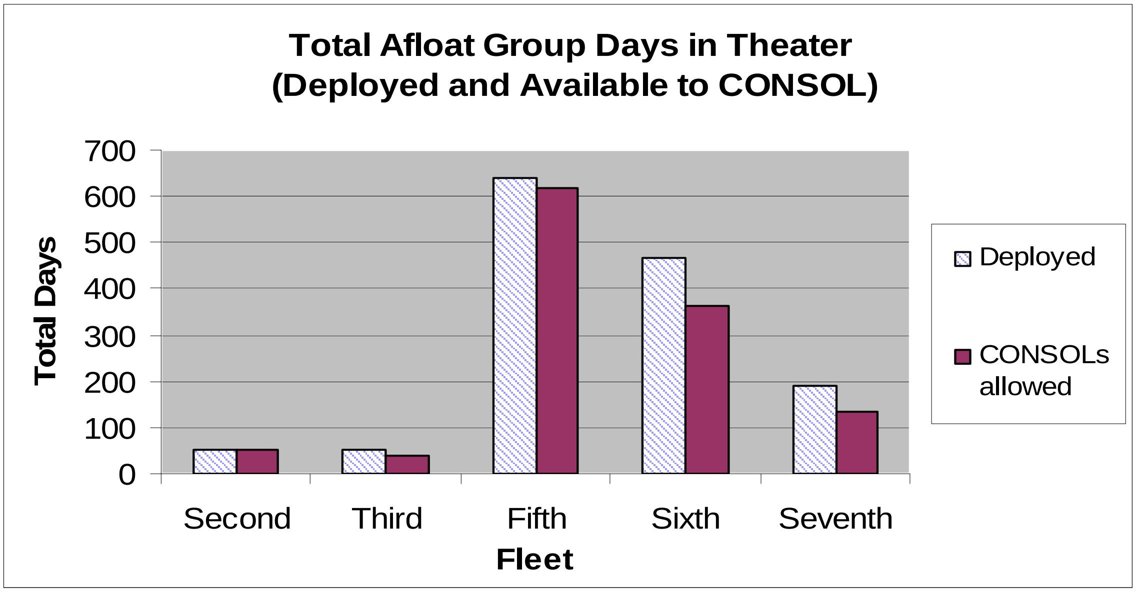


Figure 11. Total Battle Group Days in Theater.

Of the 2,353 battle group days in our scenario (13 x 181), the 13 battle groups are deployed away from homeport for a total of 1,397 days. Of these 1,397 deployed days, only 1,202 are available for CONSOLs owing to either in port time when replenishment is prohibited or a particular battle group underway in a restricted waterway (e.g., Strait of Hormuz). More than 80% of both the deployed days and the available CONSOL days are in the Fifth and Sixth Fleets.

With fleet ownership, only 29% of the available T-AKEs and 33% of the servicing T-AOs operate in the Fifth and Sixth fleets to support the majority of the scenario's activity. Fifth Fleet extends from the Suez Canal east to the Indian Ocean and from the Arabian Gulf south to the Seychelles (see Figure 3), but the majority of the battle group operating time spent in this region is in the Arabian Gulf, where any position is within a day's transit of the area's supporting ports. However, our scenario portrays Sixth Fleet battle groups conducting concurrent operations in the North Sea, the Mediterranean Sea, and along the west coast of Africa as far south as the Gulf of Guinea. With fleet ownership, a single T-AO and a single T-AKE service this entire area. Although we can address any fleet's deficiency in our scenario by simply changing ownership of a few shuttles (e.g., moving a T-AKE from Seventh Fleet to Sixth Fleet), this is not practical for long-term CLF management.

With global allocation, initial battle group locations attract the starting locations of the 16 shuttles. In the first 30 days of our scenario, Fifth Fleet has a disproportionate share (63%) of available CONSOL days while Sixth Fleet only has 29%. However, Sixth Fleet is assigned as many T-AKEs and more T-AOs than Fifth Fleet because Sixth Fleet battle groups are geographically dispersed, operating off the coast of Africa, the Eastern Atlantic, and the Mediterranean Sea. Table 13 illustrates the initial assigned placement of CLF shuttles.

	Global Allocation 181-60-30		Fleet Ownership 181-60-30		Global Allocation 181-30-15		Fleet Ownership 181-30-15	
	Location	Fleet	Location	Fleet	Location	Fleet	Location	Fleet
T-AKE 01	Western Mediterranean	Sixth	Atlantic	Second	Western Mediterranean	Sixth	Atlantic	Second
T-AKE 02	Western Mediterranean	Sixth	Western Mediterranean	Sixth	Western Mediterranean	Sixth	Western Mediterranean	Sixth
T-AKE 03	Atlantic	Second	Arabian Gulf	Fifth	Atlantic	Second	Arabian Gulf	Fifth
T-AKE 04	Arabian Gulf	Fifth	Indian Ocean	Seventh	Arabian Gulf	Fifth	Western Pacific	Seventh
T-AKE 05	Arabian Gulf	Fifth	Western Pacific	Seventh	Arabian Gulf	Fifth	Indian Ocean	Seventh
T-AKE 06	Western Mediterranean	Sixth	Indian Ocean	Seventh	Western Mediterranean	Sixth	Western Pacific	Seventh
T-AKE 07	Arabian Gulf	Fifth	Eastern Pacific	Third	Arabian Gulf	Fifth	Eastern Pacific	Third
T-AO 01	Western Mediterranean	Sixth	Atlantic	Second	Western Mediterranean	Sixth	Atlantic	Second
T-AO 02	Eastern Atlantic	Sixth	Eastern Atlantic	Sixth	Eastern Atlantic	Sixth	Western Mediterranean	Sixth
T-AO 03	Western Mediterranean	Sixth	Arabian Gulf	Fifth	Western Mediterranean	Sixth	Arabian Gulf	Fifth
T-AO 04	Arabian Gulf	Fifth	Arabian Gulf	Fifth	Arabian Gulf	Fifth	Arabian Gulf	Fifth
T-AO 05	Indian Ocean	Seventh	Western Pacific	Seventh	Indian Ocean	Seventh	Western Pacific	Seventh
T-AO 06	Eastern Mediterranean	Sixth	Western Pacific	Seventh	Eastern Mediterranean	Sixth	Western Pacific	Seventh
T-AO 07	Eastern Atlantic	Sixth	Western Pacific	Seventh	Eastern Mediterranean	Sixth	Western Pacific	Seventh
T-AO 08	Arabian Gulf	Fifth	Western Pacific	Seventh	Arabian Gulf	Fifth	Western Pacific	Seventh
T-AO 09	Atlantic	Second	Middle Pacific	Third	Atlantic	Second	Middle Pacific	Third
	Notes: T-AO 07 not active until day d034		Notes: T-AKE 05 not active until day d102 T-AKE 07 not active until day d099 T-AO 05 not active until day d106 T-AO 06 not active until day d100 T-AO 07 not active until day d103 T-AO 09 not active until day d147		Notes: T-AO 07 not active until day d034		Notes: T-AKE 04 not active until day d104 T-AKE 06 not active until day d095 T-AKE 07 not active until day d098 T-AO 01 not active until day d048 T-AO 05 not active until day d101 T-AO 06 not active until day d096 T-AO 07 not active until day d114 T-AO 08 not active until day d104 T-AO 09 not active until day d147	

Table 13. Shuttle Starting Locations for the Global Allocation and Fleet Ownership Scenarios

With fleet ownership or global allocation, the optimization is attracted to preposition shuttles to serve customer battle groups. With fleet ownership, the optimization locates shuttles where *fleet* battle groups require their first CONSOLs. With global allocation, the optimization locates shuttles where *any* battle group requires its first CONSOL, locating multiple shuttles in the same area of responsibility if there are multiple CONSOL requirements in that area. With global allocation, over 90% of the CONSOLs in the first 30 days are in the Fifth and Sixth Fleets, attracting a majority of CLF shuttles to “commence” operations in these two theaters.

Restricting each shuttle to a specific fleet diminishes its effectiveness, as shown in Table 13. We classify a shuttle ship as employed if it is conducting a CONSOL, is either en route to or returning from a battle group to port, or if it is in port re-loading (two days turn around time). Otherwise, we categorize the shuttle as idle. With fleet ownership, Seventh Fleet shuttles, three T-AKEs and four T-AOs, remain idle for 50% of the 181-day scenario.

In both the fleet ownership and the global allocation scenarios, CLF shuttles transfer the same amount of cargo to the customer battle groups. However, with fleet ownership, shuttles are working harder during their limited CONSOLs to deliver the same amount of DFM, JP5, and consumable stores. While CONSOLs in the fleet ownership model are getting more "bang for the buck," the restricted case prevents needed replenishments and must make up for them when the CLF shuttle is finally made available (see Table 14). This equates to less flexibility for the operating battle groups where scheduling replenishments can take priority over a change in operations. On average, the global allocation model permits 50% more CONSOL opportunities. The increased number of CONSOLs offered through global allocation demonstrates a potential for additional delivery in either a transition to war or wartime scenario when even greater amounts of fuel and stores will be required.

With global allocation, each shuttle transits through at least two of the numbered fleets to replenish battle group customers. While many of the scenario's shuttles limit operations to the two busiest fleets, namely the Fifth and Sixth, many visit at least three. There are also some instances of round-the-world travel visiting all five fleets.

	Global Allocation 181-60-30	Fleet Ownership 181-60-30	Global Allocation 181-30-15	Fleet Ownership 181-30-15
Total DFM Delivered (kbbls)	3365.531	3398.268	3395.523	3262.639
Total JP5 Delivered (kbbls)	1216.956	1224.235	1220.896	1178.674
Total Stores Delivered (stons)	37567.17	37625.75	37951.69	36080.74
Total Number of CONSOLs	336	238	362	216
Total T-AKE Days Employed	1014	636	1055	554
Percentage (%)	80.03%	50.20%	83.27%	43.73%
Total T-AO Days Employed	1100	652	1181	551
Percentage (%)	67.53%	40.02%	72.50%	33.82%

Table 14. Global Allocation and Fleet Ownership Shuttle Employment Data

With both fleet ownership and global allocation, shuttles deliver comparable amounts of the three commodities. With fleet ownership, shuttles deliver DFM, JP5, and consumable stores when a battle group is in severe need, making up for earlier operational constraints. With global allocation, shuttles maintain DFM, JP5, and consumable stores inventories at acceptable levels.

D. SENSITIVITY ANALYSIS

We reduce the number of T-AOs and/or T-AKEs by either one or two per class to see if global allocation can still service our scenario with these reduced numbers of shuttle ships. We preserve the T-AKE's ability to re-fuel and compare our results using only the 30-day planning window and 15-day advance per solve cascade. Global allocation permits reducing the number of forward-deployed shuttles while still providing a better level of service than fleet ownership allows. Table 15 shows the total quantities of DFM, JP5, and consumable stores delivered by the varied number of shuttles.

	9 T-AOs & 7 T-AKEs		Global Allocation 181-30-15				
	Global Allocation 181-30-15	Fleet Ownership 181-30-15	1 Less T-AO (8 Total)	2 Less T-AOs (7 Total)	1 Less T-AKEs (6 Total)	2 Less T-AKEs (5 Total)	1 Less T-AO 1 Less T-AKE (8 T-AOs & 6 T-AKEs)
Total DFM Delivered (kbbls)	3395.523	3262.639	3305.661	3329.979	3379.983	3325.293	3328.755
Total JP5 Delivered (kbbls)	1220.896	1178.674	1204.628	1206.706	1208.689	1188.876	1194.008
Total Stores Delivered (stons)	37951.69	36080.74	37049.96	36737.8	37314.1	35094.93	36303.4
Total Number of CONSOLs	362	216	340	307	357	318	331
Total Number of T-AKE CONSOLs	185	99	169	171	166	132	158
Total T-AKE Days Employed	1055	554	995	991	912	745	878
T-AKE Employment Percentage (%)	83.27%	43.73%	78.53%	78.22%	83.98%	82.32%	80.85%
Total Number of T-AO CONSOLs	177	117	171	136	191	186	173
Total T-AO Days Employed	1181	551	974	915	1153	1154	1007
T-AO Employment Percentage (%)	72.50%	33.82%	67.27%	72.22%	70.78%	70.84%	69.54%

Table 15. Shuttle Employment (Sensitivity Analysis)

Decreasing the number of shuttles reduces the total number of CONSOLs. Even with global allocation, decreasing the total number of shuttles reduces the total delivery of DFM, JP5, and consumable stores to the 13 battle groups. Note: “employment percentage” is the percentage of days available in which shuttles are actively serving fleet needs (i.e., either in transit, replenishing in port, or conducting a battle group CONSOL). Shuttles are actively utilized much more under global allocation than under fleet ownership.

Any reduction in the number of shuttles available of one shuttle type results in the remaining shuttles of that type working harder to keep battle group inventories at acceptable levels. With global allocation, the average DFM delivery per CONSOL is 12.04 thousand barrels. The average JP5 delivery is 4.53 thousand barrels and average consumable stores delivery is 227.25 short tons. The reduction in T-AO shuttles from 9 to 8, and then from 8 to 7, results in 8% and 17% increases respectively in T-AO and T-AKE per CONSOL DFM delivery, and 3% and 21% increases in T-AO and T-AKE per-CONSOL JP5 delivery. Similarly, delivery of consumable stores increases by 8% and 22% when the total number of T-AKEs is reduced from 7 to 6, and then from 6 to 5. Here, the shuttles are working harder per-CONSOL event rather than traveling farther to get to where they need to be as is the case in the simple comparison of global allocation with fleet ownership.

With global allocation, we observe an increase in average quantity delivered with each reduction in the total number of available shuttles still remaining in the scenario. However, we also see, for the first time, an inventory runout. Table 16 depicts the total number of battle group days (by commodity type) below safety, in extremis, and runout inflicted by the gradual reduction of CLF shuttles in our scenario.

	9 T-AOs & 7 T-AKEs		Global Allocation 181-30-15				
	Global Allocation 181-30-15	Fleet Ownership 181-30-15	1 Less T-AO (8 Total)	2 Less T-AOs (7 Total)	1 Less T-AKE (6 Total)	2 Less T-AKEs (5 Total)	1 Less T-AO 1 Less T-AKE (8 T-AOs & 6 T-AKEs)
Total BG Days Below Safety Level (50% of Capacity)	84	309	65	104	83	88	89
BG DFM Days Below Safety Level	31	100	31	40	27	15	40
BG JP5 Days Below Safety Level	26	28	12	14	22	7	16
BG Stores Days Below Safety Level	27	181	22	50	34	66	33
Total BG Days in Extremis (25% of Capacity)	10	75	0	12	3	5	3
BG DFM Days in Extremis	7	15	0	3	1	0	3
BG JP5 Days in Extremis	0	0	0	0	2	0	0
BG Stores Days in Extremis	3	60	0	9	0	5	0
Total BG Days Below Zero (0 Capacity)	0	10	0	1	0	0	0
BG DFM Days Below Zero	0	1	0	0	0	0	0
BG JP5 Days Below Zero	0	0	0	0	0	0	0
BG Stores Days Below Zero	0	9	0	1	0	0	0

Table 16. Battle Group Days Below Safety, in Extremis and Runout (Sensitivity Analysis)

We see that a reduction in shuttles results in remaining active shuttles working harder to re-supply the 13 battle groups. For a reduction of one T-AO, the total number of DFM days below-safety level is held constant and there is a reduction in the total number of JP5 below-safety level days. A reduction in the total number of T-AOs by 2 results in an increase of DFM days below safety level and the elimination of either one or two T-AKEs results in increased number of battle group stores days below safety levels.

Our results show that with global allocation, the Military Sealift Command could remove a T-AO from active service and recoup its operating costs. Average commodity levels for each battle group are maintained at or above safety levels for each separate study in our sensitivity analysis, including the elimination of one T-AO. A look at the minimum commodity levels achieved by the 13 battle groups in the scenario also supports this reduction in force (see Table 17).

					Minimum Levels						
					Global Allocation 181-30-15	Fleet Ownership 181-30-15	Global Allocation 181-30-15				
Battle Group	Commodity	Starting Level	Safety Level	Extremis Level	9 T-AOs & 7 T-AKEs	9 T-AOs & 7 T-AKEs	1 Less T-AO (8 Total)	2 Less T-AOs (7 Total)	1 Less T-AKE (6 Total)	2 Less T-AKEs (5 Total)	1 Less T-AO & 1 Less T-AKE (8 T-AOs & 6 T-AKEs)
BG01	DFM	127.892	63.946	31.973	63.946	45.892	63.946	63.946	85.766	82.703	70.721
	JP5	118.513	59.257	29.628	59.257	44.713	62.482	81.163	59.257	59.938	59.407
	Stores	2878.000	1439.000	719.500	1440.160	841.060	1440.160	1320.340	1439.000	1440.160	1440.160
BG02	DFM	127.892	63.946	31.973	109.838	63.946	79.748	91.784	63.946	63.946	103.766
	JP5	118.513	59.257	29.628	59.257	63.013	59.257	68.482	65.407	93.763	75.463
	Stores	2878.000	1439.000	719.500	2338.810	1320.340	1919.440	2039.260	1799.620	1799.620	2159.080
BG03	DFM	127.892	63.946	31.973	73.730	73.730	88.775	76.739	85.766	103.820	63.946
	JP5	118.513	59.257	29.628	75.463	63.163	87.613	59.257	84.688	87.763	75.463
	Stores	2878.000	1439.000	719.500	1979.350	1380.250	1859.530	1799.620	1678.640	1439.000	1558.820
BG04	DFM	121.944	60.972	30.486	60.972	60.972	48.270	56.879	52.786	60.972	60.972
	JP5	19.221	9.611	4.805	15.958	12.946	16.209	13.197	13.699	15.707	15.456
	Stores	1033.000	516.500	258.250	516.500	255.600	516.500	516.500	464.900	494.800	464.900
BG05	DFM	121.944	60.972	30.486	93.293	93.293	97.386	94.921	97.386	101.479	109.665
	JP5	19.221	9.611	4.805	17.464	17.464	16.460	17.464	16.711	17.966	18.468
	Stores	1033.000	516.500	258.250	554.600	734.000	763.900	853.600	883.500	674.200	883.500
BG06	DFM	121.944	60.972	30.486	52.786	60.972	76.921	64.642	60.972	60.972	54.414
	JP5	19.221	9.611	4.805	16.962	12.444	17.966	16.460	16.711	16.962	15.958
	Stores	1033.000	516.500	258.250	614.400	255.600	614.400	456.700	524.700	554.600	494.800
BG07	DFM	121.944	60.972	30.486	65.065	60.972	60.972	67.898	66.270	60.972	56.879
	JP5	19.221	9.611	4.805	15.205	9.109	15.958	15.456	16.209	14.954	15.958
	Stores	1033.000	516.500	258.250	704.100	255.600	494.800	554.600	524.700	464.900	516.500
BG08	DFM	36.068	18.034	9.017	7.382	18.034	17.627	13.529	7.382	9.838	15.578
	JP5	1.425	0.713	0.356	0.627	0.542	0.713	0.542	0.257	0.656	0.428
	Stores	178.000	89.000	44.500	74.860	89.000	77.540	57.670	63.400	57.670	46.210
BG09	DFM	36.068	18.034	9.017	13.970	8.990	17.627	15.985	13.936	15.985	11.921
	JP5	1.425	0.713	0.356	0.542	0.656	0.798	0.713	0.713	0.855	0.656
	Stores	178.000	89.000	44.500	71.810	-5.360	69.130	89.000	89.000	57.670	89.000
BG10	DFM	36.068	18.034	9.017	15.578	9.431	13.936	9.838	18.034	15.985	13.936
	JP5	1.425	0.713	0.356	0.713	0.684	0.713	0.485	0.570	0.713	0.656
	Stores	178.000	89.000	44.500	80.590	29.020	89.000	83.270	63.400	40.480	77.540
BG11	DFM	25.322	12.661	6.331	12.554	-0.214	12.554	12.554	12.554	12.661	10.958
	JP5	1.425	0.713	0.356	0.371	0.513	0.713	0.884	0.713	0.713	0.798
	Stores	145.000	72.500	36.250	72.500	-30.380	72.500	72.500	73.900	72.500	72.500
BG12	DFM	38.468	19.234	9.617	19.234	19.234	17.727	17.727	18.961	19.234	13.206
	JP5	2.094	1.047	0.524	1.324	1.489	1.434	1.269	1.599	1.214	1.324
	Stores	243.000	121.500	60.750	119.410	126.680	90.330	97.600	119.410	112.140	75.790
BG13	DFM	10.284	5.142	2.571	1.662	0.540	2.628	1.662	3.750	4.020	2.358
	JP5	1.140	0.570	0.285	0.285	0.342	0.456	0.399	0.456	0.456	0.342
	Stores	15.000	7.500	3.750	2.580	-0.180	6.030	-0.090	3.960	1.200	4.650

Table 17. Minimum Inventory Levels (Sensitivity Analysis)

Eliminating more than one T-AO inflicts a consumable stores runout for battle group 13, the littoral combat ship squadron operating off the west coast of Africa and in the Gulf of Guinea. The loss of the T-AO affects all T-AKEs that must divert from potential stores CONSOLs to provide additional fuel to the scenario's 13 battle groups.

E. PROHIBITING T-AKE RE-FUELING CAPABILITY

We analyze prohibiting the T-AKE's re-fueling capability and the restriction this places on CLF DFM and JP5 support to the scenario's 13 battle groups. The T-AKE's re-fueling capability, though limited when compared to that of a T-AO or T-AOE, is still useful. Table 18 highlights the impact of removing T-AKE's re-fueling capability.

	Global Allocation T-AKE Can Re-fuel 181-30-15	Fleet Ownership T-AKE Can Re-fuel 181-30-15	Global Allocation T-AKE Can Not Re-fuel 181-30-15	Fleet Ownership T-AKE Can Not Re-fuel 181-30-15
Total BG Days Below Safety Level (50% of Capacity)	**84**	**309**	**100**	**529**
BG DFM Days Below Safety Level	**31**	**100**	**60**	**236**
BG JP5 Days Below Safety Level	**26**	**28**	**15**	**115**
BG Stores Days Below Safety Level	**27**	**181**	**25**	**178**
Total BG Days in Extremis (25% of Capacity)	**10**	**75**	**1**	**238**
BG DFM Days in Extremis	**7**	**15**	**1**	**133**
BG JP5 Days in Extremis	**0**	**0**	**0**	**42**
BG Stores Days in Extremis	**3**	**60**	**0**	**63**
Total BG Days Below Zero (0 Capacity)	**0**	**10**	**0**	**108**
BG DFM Days Below Zero	**0**	**1**	**0**	**81**
BG JP5 Days Below Zero	**0**	**0**	**0**	**19**
BG Stores Days Below Zero	**0**	**9**	**0**	**8**

Table 18. Battle Group Days Below Safety, in Extremis and Runout (Prohibiting T-AKE Re-fueling Capability)

Eliminating the T-AKE's ability to re-fuel greatly reduces the level of support afforded by the scenario's shuttles. Prohibiting this capability in global allocation compels shuttles to preserve inventories above extremis levels, achieving this with an increase in the total amount of battle group DFM days falling below safety levels. The 9 T-AOs can adequately support the modest JP5 requirement of the scenario and do not require T-AKE support.

Limiting DFM and JP5 delivery to T-AOs, only exacerbates battle group commodity deficiencies (see Table 19). With fleet ownership, in the case where T-AKE can re-fuel battle groups, battle groups 09, 11, and 13 experience a total of 10 inventory runout days across all three commodities. Battle groups 09 and 13 experience at least one runout day in consumable stores inventory, and battle group 11 experiences at least one runout day in both DFM and consumable stores inventories. No battle group experiences a JP5 runout day. Eliminating T-AKE DFM and JP5 fuel delivery capabilities increases the total number of runout days to 108. Battle groups 11 and 13 are the hardest hit, suffering runout days in all three inventories: DFM, JP5, and consumable stores. Battle group 13 is without DFM for 26% of its total 160 deployed days and battle group 11 is without DFM for 48% of its 66-day deployment. This obvious shortfall would require MSC to deploy additional shuttles or force the Navy to limit or postpone two battle group deployments until adequate naval logistics support was made available.

Global allocation accommodates prohibiting T-AKE re-fueling capability: no battle group experiences a runout.

					Average Levels		Minimum Levels	
Battle Group	Commodity	Starting Level	Safety Level	Extremis Level	Global Allocation T-AKE Can Not Re-fuel 181-30-15	Fleet Ownership T-AKE Can Not Re-fuel 181-30-15	Global Allocation T-AKE Can Not Re-fuel 181-30-15	Fleet Ownership T-AKE Can Not Re-fuel 181-30-15
BG01	DFM	127.892	63.946	31.973	109.929	103.119	63.946	63.946
	JP5	118.513	59.257	29.628	97.219	99.497	59.257	59.257
	Stores	2878.000	1439.000	719.500	2558.226	2363.232	1440.160	1320.340
BG02	DFM	127.892	63.946	31.973	102.164	102.367	63.946	63.946
	JP5	118.513	59.257	29.628	100.177	102.683	59.257	66.238
	Stores	2878.000	1439.000	719.500	2622.149	2271.852	2039.260	1140.610
BG03	DFM	127.892	63.946	31.973	109.426	105.132	63.946	63.946
	JP5	118.513	59.257	29.628	103.564	99.318	69.313	60.088
	Stores	2878.000	1439.000	719.500	2487.929	2267.815	1679.800	1320.340
BG04	DFM	121.944	60.972	30.486	96.586	101.025	52.786	60.549
	JP5	19.221	9.611	4.805	18.352	16.654	15.456	11.691
	Stores	1033.000	516.500	258.250	855.939	771.457	516.500	225.700
BG05	DFM	121.944	60.972	30.486	112.313	94.978	97.386	68.735
	JP5	19.221	9.611	4.805	18.630	17.567	17.715	15.958
	Stores	1033.000	516.500	258.250	899.329	899.329	734.000	734.000
BG06	DFM	121.944	60.972	30.486	106.994	98.804	69.158	52.363
	JP5	19.221	9.611	4.805	18.505	15.858	15.456	9.432
	Stores	1033.000	516.500	258.250	910.578	794.675	606.200	195.800
BG07	DFM	121.944	60.972	30.486	108.681	101.711	68.735	60.549
	JP5	19.221	9.611	4.805	18.022	15.900	15.205	10.938
	Stores	1033.000	516.500	258.250	857.136	814.593	524.700	285.500
BG08	DFM	36.068	18.034	9.017	26.201	27.637	9.431	18.034
	JP5	1.425	0.713	0.356	1.029	1.126	0.656	0.713
	Stores	178.000	89.000	44.500	130.300	138.188	51.940	63.400
BG09	DFM	36.068	18.034	9.017	27.799	21.264	11.887	-3.677
	JP5	1.425	0.713	0.356	1.038	1.050	0.656	0.342
	Stores	178.000	89.000	44.500	137.852	122.224	89.000	0.370
BG10	DFM	36.068	18.034	9.017	26.446	22.114	15.578	1.235
	JP5	1.425	0.713	0.356	1.151	1.065	0.713	0.456
	Stores	178.000	89.000	44.500	148.129	118.002	103.510	11.830
BG11	DFM	25.322	12.661	6.331	16.910	1.536	9.362	-22.558
	JP5	1.425	0.713	0.356	1.058	0.732	0.713	-0.285
	Stores	145.000	72.500	36.250	119.195	61.201	72.500	-30.380
BG12	DFM	38.468	19.234	9.617	28.439	33.369	14.356	20.384
	JP5	2.094	1.047	0.524	1.457	1.800	0.992	1.214
	Stores	243.000	121.500	60.750	190.893	195.399	119.410	121.500
BG13	DFM	10.284	5.142	2.571	7.698	3.142	2.358	-8.508
	JP5	1.140	0.570	0.285	0.918	0.631	0.399	-0.399
	Stores	15.000	7.500	3.750	11.396	9.277	4.650	-0.180

Table 19. Battle Group Average and Minimum Commodity Levels (Prohibiting T-AKE Re-fueling Capability)

Under global allocation, prohibiting T-AKE re-fueling does not lead to any fuel runouts. With fleet ownership, removing the T-AKE's re-fueling capability increases the total number of battle group runouts. For example, with fleet ownership and the T-AKE's re-fueling capability, battle group 13 suffers only a consumable stores runout. When we prohibit the T-AKE's re-fueling capability, battle group 13 also suffers runouts in both DFM and JP5.

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. THE ATTRACTION OF GLOBAL ALLOCATION

We find that fleet ownership restricts the CLF's ability to support deployed battle groups. With fleet ownership, shuttles are approximately 50% idle, waiting for customers to arrive in "their" theater. With global allocation, and the free passage between fleets, shuttles are capable of constantly "topping off" battle groups. We find that, on average, global allocation can support battle groups 7-10% more efficiently (comparing average inventory levels) than with fleet ownership. *In our scenario, with global allocation, there are no runouts.*

We find that global allocation offers the opportunity to reduce the number of total deployed shuttles while still ensuring adequate commodity inventories for all deployed battle groups.

We find that the T-AKE's modest DFM and JP5 re-fueling ability can significantly assist CLF support to deployed battle groups. With global allocation we see marginal increases in average commodity levels due to the free travel of shuttles into and out of fleet areas of responsibility. With fleet ownership, we see more modest gains. Our fleet ownership results show an 84% increase in average DFM levels and a 7% increase in average JP5 levels.

B. FUTURE DEVELOPMENT

Our model can suggest efficient ways to employ the T-AKE as this new class of ship becomes operational. While we do not consider ammunition consumption and delivery in our peacetime scenario, we preserve this ability in our model to support future analyses of various T-AKE load configurations.

Global allocation affords a better opportunity to properly employ the CLF. Additional analyses should consider testing the effectiveness of the T-AO and T-AKE station ship pairing, eliminating station ships completely, and forward-deploying the four T-AOEs as multi-commodity shuttles.

Finally, every shuttle in our global allocation scenario operates in at least two different fleets to support our 13 battle groups. This suggests that even a minimal sharing of assets will result in more efficient and effective shuttle use. Our model accommodates analysis to determine which fleet areas could be serviced by a common pool of CLF shuttles.

APPENDIX: BATTLE GROUP TRACKS

A. BATTLE GROUP 01 (BG01)

Battle Group 01
Carrier Strike Group (CSG) from San Diego
USS John C. Stennis (CVN); USS Lake Champlain (CG); USS Decatur (DDG) USS Benfold (DDG); USNS Bridge (T-AOE)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	Arabian Gulf	27.11	-52.00	2-Mar-02	Arabian Gulf	26.66	-51.30	1-May-02	West Pac	-35.43	-114.39
2-Jan-02	Arabian Gulf	28.75	-50.30	3-Mar-02	Arabian Gulf	26.18	-52.95	2-May-02	Freemantle	-32.14	-115.51
3-Jan-02	Arabian Gulf	26.18	-52.95	4-Mar-02	Arabian Gulf	27.90	-50.33	3-May-02	Freemantle	-32.14	-115.51
4-Jan-02	Arabian Gulf	27.90	-50.33	5-Mar-02	Arabian Gulf	27.11	-52.00	4-May-02	Freemantle	-32.14	-115.51
5-Jan-02	Arabian Gulf	27.11	-52.00	6-Mar-02	Arabian Gulf	28.85	-49.00	5-May-02	Freemantle	-32.14	-115.51
6-Jan-02	Arabian Gulf	28.85	-49.00	7-Mar-02	Arabian Gulf	26.66	-51.30	6-May-02	West Pac	-36.23	-114.59
7-Jan-02	Arabian Gulf	26.66	-51.30	8-Mar-02	Arabian Gulf	27.11	-52.00	7-May-02	West Pac	-40.02	-118.03
8-Jan-02	Arabian Gulf	27.11	-52.00	9-Mar-02	Arabian Gulf	28.75	-50.30	8-May-02	West Pac	-40.24	-124.15
9-Jan-02	Arabian Gulf	28.75	-50.30	10-Mar-02	Arabian Gulf	27.90	-50.33	9-May-02	West Pac	-40.27	-129.22
10-Jan-02	Arabian Gulf	27.90	-50.33	11-Mar-02	Arabian Gulf	26.18	-52.95	10-May-02	West Pac	-41.34	-136.08
11-Jan-02	Arabian Gulf	27.11	-52.00	12-Mar-02	Arabian Gulf	26.66	-51.30	11-May-02	Hobart	-43.34	-147.10
12-Jan-02	Arabian Gulf	26.66	-51.30	13-Mar-02	Arabian Gulf	28.85	-49.00	12-May-02	Hobart	-43.34	-147.10
13-Jan-02	Arabian Gulf	26.18	-52.95	14-Mar-02	Arabian Gulf	26.18	-52.95	13-May-02	Hobart	-43.34	-147.10
14-Jan-02	Arabian Gulf	27.90	-50.33	15-Mar-02	Arabian Gulf	27.11	-52.00	14-May-02	Hobart	-43.34	-147.10
15-Jan-02	Arabian Gulf	27.11	-52.00	16-Mar-02	Arabian Gulf	26.66	-51.30	15-May-02	Hobart	-43.34	-147.10
16-Jan-02	Arabian Gulf	28.85	-49.00	17-Mar-02	Arabian Gulf	26.18	-52.95	16-May-02	West Pac	-40.02	-154.26
17-Jan-02	Arabian Gulf	26.66	-51.30	18-Mar-02	Arabian Gulf	27.90	-50.33	17-May-02	West Pac	-35.47	-158.30
18-Jan-02	Arabian Gulf	27.11	-52.00	19-Mar-02	Arabian Gulf	27.11	-52.00	18-May-02	West Pac	-31.00	-162.55
19-Jan-02	Arabian Gulf	28.75	-50.30	20-Mar-02	Arabian Gulf	28.85	-49.00	19-May-02	West Pac	-25.43	-166.41
20-Jan-02	Arabian Gulf	27.90	-50.33	21-Mar-02	Arabian Gulf	26.66	-51.30	20-May-02	Mid Pac	-19.53	-169.11
21-Jan-02	Arabian Gulf	26.18	-52.95	22-Mar-02	Arabian Gulf	27.11	-52.00	21-May-02	Mid Pac	-14.01	-171.40
22-Jan-02	Arabian Gulf	26.66	-51.30	23-Mar-02	Arabian Gulf	28.75	-50.30	22-May-02	Mid Pac	-7.56	-173.05
23-Jan-02	Arabian Gulf	27.90	-50.33	24-Mar-02	Arabian Gulf	27.90	-50.33	23-May-02	Mid Pac	-1.45	-174.48
24-Jan-02	Arabian Gulf	27.11	-52.00	25-Mar-02	Arabian Gulf	26.18	-52.95	24-May-02	Mid Pac	-3.46	-177.47
25-Jan-02	Arabian Gulf	26.66	-51.30	26-Mar-02	Arabian Gulf	26.66	-51.30	25-May-02	Mid Pac	-9.00	-178.48
26-Jan-02	Arabian Gulf	26.18	-52.95	27-Mar-02	Arabian Gulf	28.85	-49.00	26-May-02	Mid Pac	13.45	174.40
27-Jan-02	Arabian Gulf	27.90	-50.33	28-Mar-02	Arabian Gulf	26.18	-52.95	27-May-02	Mid Pac	17.54	169.41
28-Jan-02	Arabian Gulf	27.11	-52.00	29-Mar-02	Arabian Gulf	25.85	-54.00	28-May-02	Mid Pac	21.35	164.25
29-Jan-02	Arabian Gulf	28.85	-49.00	30-Mar-02	Hormuz	26.57	-56.25	29-May-02	Pearl	21.40	158.17
30-Jan-02	Arabian Gulf	27.90	-50.33	31-Mar-02	West Pac	25.38	-57.02	30-May-02	Pearl	21.40	158.17
31-Jan-02	Arabian Gulf	26.18	-52.95	1-Apr-02	West Pac	24.47	-57.42	31-May-02	East Pac	23.14	151.20
1-Feb-02	Arabian Gulf	27.90	-50.33	2-Apr-02	West Pac	23.34	-61.19	1-Jun-02	East Pac	24.57	144.34
2-Feb-02	Arabian Gulf	27.11	-52.00	3-Apr-02	West Pac	24.19	-64.44	2-Jun-02	East Pac	26.35	137.39
3-Feb-02	Arabian Gulf	28.85	-49.00	4-Apr-02	West Pac	21.31	-66.06	3-Jun-02	East Pac	28.44	130.49
4-Feb-02	Arabian Gulf	26.66	-51.30	5-Apr-02	West Pac	19.07	-68.14	4-Jun-02	East Pac	30.51	123.59
5-Feb-02	Arabian Gulf	27.11	-52.00	6-Apr-02	West Pac	16.06	-67.18	5-Jun-02	East Pac	32.27	118.34
6-Feb-02	Arabian Gulf	28.75	-50.30	7-Apr-02	West Pac	14.13	-70.05	6-Jun-02	East Pac	32.37	117.16
7-Feb-02	Arabian Gulf	27.90	-50.33	8-Apr-02	West Pac	10.47	-69.31	7-Jun-02	In Homeport	32.72	117.18
8-Feb-02	Arabian Gulf	27.11	-52.00	9-Apr-02	West Pac	10.12	-73.00	8-Jun-02	In Homeport	32.72	117.18
9-Feb-02	Arabian Gulf	26.66	-51.30	10-Apr-02	West Pac	6.52	-72.26	9-Jun-02	In Homeport	32.72	117.18
10-Feb-02	Arabian Gulf	26.18	-52.95	11-Apr-02	West Pac	3.42	-72.13	10-Jun-02	In Homeport	32.72	117.18
11-Feb-02	Arabian Gulf	27.90	-50.33	12-Apr-02	West Pac	4.27	-75.38	11-Jun-02	In Homeport	32.72	117.18
12-Feb-02	Arabian Gulf	27.11	-52.00	13-Apr-02	West Pac	4.43	-78.50	12-Jun-02	In Homeport	32.72	117.18
13-Feb-02	Arabian Gulf	28.85	-49.00	14-Apr-02	West Pac	5.39	-81.54	13-Jun-02	In Homeport	32.72	117.18
14-Feb-02	Arabian Gulf	26.66	-51.30	15-Apr-02	West Pac	7.08	-84.53	14-Jun-02	In Homeport	32.72	117.18
15-Feb-02	Arabian Gulf	27.11	-52.00	16-Apr-02	West Pac	5.39	-88.06	15-Jun-02	In Homeport	32.72	117.18
16-Feb-02	Arabian Gulf	28.75	-50.30	17-Apr-02	West Pac	6.03	-90.27	16-Jun-02	In Homeport	32.72	117.18
17-Feb-02	Arabian Gulf	27.90	-50.33	18-Apr-02	West Pac	3.18	-92.01	17-Jun-02	In Homeport	32.72	117.18
18-Feb-02	Arabian Gulf	26.18	-52.95	19-Apr-02	West Pac	-0.49	-91.22	18-Jun-02	In Homeport	32.72	117.18
19-Feb-02	Arabian Gulf	26.66	-51.30	20-Apr-02	West Pac	-0.44	-91.01	19-Jun-02	In Homeport	32.72	117.18
20-Feb-02	Arabian Gulf	28.85	-49.00	21-Apr-02	West Pac	-6.23	-94.04	20-Jun-02	In Homeport	32.72	117.18
21-Feb-02	Arabian Gulf	26.18	-52.95	22-Apr-02	West Pac	-0.84	-98.12	21-Jun-02	In Homeport	32.72	117.18
22-Feb-02	Arabian Gulf	27.11	-52.00	23-Apr-02	West Pac	-11.15	-102.16	22-Jun-02	In Homeport	32.72	117.18
23-Feb-02	Arabian Gulf	26.66	-51.30	24-Apr-02	West Pac	-13.29	-105.19	23-Jun-02	In Homeport	32.72	117.18
24-Feb-02	Arabian Gulf	26.18	-52.95	25-Apr-02	West Pac	-17.20	-107.45	24-Jun-02	In Homeport	32.72	117.18
25-Feb-02	Arabian Gulf	27.90	-50.33	26-Apr-02	West Pac	-21.20	-109.06	25-Jun-02	In Homeport	32.72	117.18
26-Feb-02	Arabian Gulf	26.66	-51.30	27-Apr-02	West Pac	-25.47	-110.01	26-Jun-02	In Homeport	32.72	117.18
27-Feb-02	Arabian Gulf	28.85	-49.00	28-Apr-02	West Pac	-27.28	-110.27	27-Jun-02	In Homeport	32.72	117.18
28-Feb-02	Arabian Gulf	26.18	-52.95	29-Apr-02	West Pac	-30.32	-111.31	28-Jun-02	In Homeport	32.72	117.18
1-Mar-02	Arabian Gulf	27.11	-52.00	30-Apr-02	West Pac	-33.10	-112.57	29-Jun-02	In Homeport	32.72	117.18
								30-Jun-02	In Homeport	32.72	117.18

B. BATTLE GROUP 02 (BG02)

Battle Group 02 Carrier Strike Group (CSG) from Norfolk USS Theodore Roosevelt (CVN); USS Leyte Gulf (CG); USS Mahan (DDG); USS McFaul (DDG); USNS Supply (T-AOE)											
Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	Arabian Gulf	26.18	-52.95	2-Mar-02	Red Sea	18.36	-58.39	1-May-02	In Homeport	36.85	76.30
2-Jan-02	Arabian Gulf	27.90	-50.33	3-Mar-02	Red Sea	14.55	-53.19	2-May-02	In Homeport	36.85	76.30
3-Jan-02	Arabian Gulf	27.11	-52.00	4-Mar-02	Red Sea	12.34	-47.11	3-May-02	In Homeport	36.85	76.30
4-Jan-02	Arabian Gulf	28.85	-49.00	5-Mar-02	Red Sea	14.12	-42.21	4-May-02	In Homeport	36.85	76.30
5-Jan-02	Arabian Gulf	26.66	-51.30	6-Mar-02	Red Sea	19.47	-38.58	5-May-02	In Homeport	36.85	76.30
6-Jan-02	Arabian Gulf	27.11	-52.00	7-Mar-02	Red Sea	25.17	-35.26	6-May-02	In Homeport	36.85	76.30
7-Jan-02	Arabian Gulf	28.75	-50.30	8-Mar-02	Suez	29.93	-32.57	7-May-02	In Homeport	36.85	76.30
8-Jan-02	Arabian Gulf	27.90	-50.33	9-Mar-02	Med	33.47	-30.13	8-May-02	In Homeport	36.85	76.30
9-Jan-02	Arabian Gulf	27.11	-52.00	10-Mar-02	Med	34.18	-22.32	9-May-02	In Homeport	36.85	76.30
10-Jan-02	Arabian Gulf	26.66	-51.30	11-Mar-02	Med	35.20	-14.54	10-May-02	In Homeport	36.85	76.30
11-Jan-02	Arabian Gulf	26.18	-52.95	12-Mar-02	Med	38.05	-7.59	11-May-02	In Homeport	36.85	76.30
12-Jan-02	Arabian Gulf	27.90	-50.33	13-Mar-02	Marseilles	41.54	-3.47	12-May-02	In Homeport	36.85	76.30
13-Jan-02	Arabian Gulf	27.11	-52.00	14-Mar-02	Marseilles	41.54	-3.47	13-May-02	In Homeport	36.85	76.30
14-Jan-02	Arabian Gulf	28.85	-49.00	15-Mar-02	Marseilles	41.54	-3.47	14-May-02	In Homeport	36.85	76.30
15-Jan-02	Arabian Gulf	26.66	-51.30	16-Mar-02	Med	36.40	0.23	15-May-02	In Homeport	36.85	76.30
16-Jan-02	Arabian Gulf	27.11	-52.00	17-Mar-02	Gibraltar	35.95	5.75	16-May-02	In Homeport	36.85	76.30
17-Jan-02	Arabian Gulf	28.75	-50.30	18-Mar-02	Atlantic	38.12	13.05	17-May-02	In Homeport	36.85	76.30
18-Jan-02	Arabian Gulf	27.90	-50.33	19-Mar-02	Atlantic	40.02	21.01	18-May-02	In Homeport	36.85	76.30
19-Jan-02	Arabian Gulf	26.18	-52.95	20-Mar-02	Atlantic	41.18	29.17	19-May-02	In Homeport	36.85	76.30
20-Jan-02	Arabian Gulf	26.66	-51.30	21-Mar-02	Atlantic	41.58	37.45	20-May-02	In Homeport	36.85	76.30
21-Jan-02	Arabian Gulf	28.85	-49.00	22-Mar-02	Atlantic	41.58	46.22	21-May-02	In Homeport	36.85	76.30
22-Jan-02	Arabian Gulf	26.18	-52.95	23-Mar-02	Atlantic	41.23	54.57	22-May-02	In Homeport	36.85	76.30
23-Jan-02	Arabian Gulf	27.11	-52.00	24-Mar-02	Atlantic	40.11	63.19	23-May-02	In Homeport	36.85	76.30
24-Jan-02	Arabian Gulf	26.66	-51.30	25-Mar-02	Atlantic	38.29	70.58	24-May-02	In Homeport	36.85	76.30
25-Jan-02	Arabian Gulf	26.18	-52.95	26-Mar-02	Atlantic	37.01	76.02	25-May-02	In Homeport	36.85	76.30
26-Jan-02	Arabian Gulf	27.90	-50.33	27-Mar-02	In Homeport	36.85	76.30	26-May-02	In Homeport	36.85	76.30
27-Jan-02	Arabian Gulf	26.66	-51.30	28-Mar-02	In Homeport	36.85	76.30	27-May-02	In Homeport	36.85	76.30
28-Jan-02	Arabian Gulf	28.85	-49.00	29-Mar-02	In Homeport	36.85	76.30	28-May-02	In Homeport	36.85	76.30
29-Jan-02	Arabian Gulf	26.18	-52.95	30-Mar-02	In Homeport	36.85	76.30	29-May-02	In Homeport	36.85	76.30
30-Jan-02	Arabian Gulf	27.11	-52.00	31-Mar-02	In Homeport	36.85	76.30	30-May-02	In Homeport	36.85	76.30
31-Jan-02	Arabian Gulf	26.66	-51.30	1-Apr-02	In Homeport	36.85	76.30	31-May-02	In Homeport	36.85	76.30
1-Feb-02	Arabian Gulf	26.18	-52.95	2-Apr-02	In Homeport	36.85	76.30	1-Jun-02	In Homeport	36.85	76.30
2-Feb-02	Arabian Gulf	27.90	-50.33	3-Apr-02	In Homeport	36.85	76.30	2-Jun-02	In Homeport	36.85	76.30
3-Feb-02	Arabian Gulf	27.11	-52.00	4-Apr-02	In Homeport	36.85	76.30	3-Jun-02	In Homeport	36.85	76.30
4-Feb-02	Arabian Gulf	28.85	-49.00	5-Apr-02	In Homeport	36.85	76.30	4-Jun-02	In Homeport	36.85	76.30
5-Feb-02	Arabian Gulf	26.66	-51.30	6-Apr-02	In Homeport	36.85	76.30	5-Jun-02	In Homeport	36.85	76.30
6-Feb-02	Arabian Gulf	27.11	-52.00	7-Apr-02	In Homeport	36.85	76.30	6-Jun-02	In Homeport	36.85	76.30
7-Feb-02	Arabian Gulf	28.75	-50.30	8-Apr-02	In Homeport	36.85	76.30	7-Jun-02	In Homeport	36.85	76.30
8-Feb-02	Arabian Gulf	27.90	-50.33	9-Apr-02	In Homeport	36.85	76.30	8-Jun-02	In Homeport	36.85	76.30
9-Feb-02	Arabian Gulf	26.18	-52.95	10-Apr-02	In Homeport	36.85	76.30	9-Jun-02	In Homeport	36.85	76.30
10-Feb-02	Arabian Gulf	26.66	-51.30	11-Apr-02	In Homeport	36.85	76.30	10-Jun-02	In Homeport	36.85	76.30
11-Feb-02	Arabian Gulf	28.85	-49.00	12-Apr-02	In Homeport	36.85	76.30	11-Jun-02	In Homeport	36.85	76.30
12-Feb-02	Arabian Gulf	26.18	-52.95	13-Apr-02	In Homeport	36.85	76.30	12-Jun-02	In Homeport	36.85	76.30
13-Feb-02	Arabian Gulf	27.11	-52.00	14-Apr-02	In Homeport	36.85	76.30	13-Jun-02	In Homeport	36.85	76.30
14-Feb-02	Arabian Gulf	26.66	-51.30	15-Apr-02	In Homeport	36.85	76.30	14-Jun-02	In Homeport	36.85	76.30
15-Feb-02	Arabian Gulf	26.18	-52.95	16-Apr-02	In Homeport	36.85	76.30	15-Jun-02	In Homeport	36.85	76.30
16-Feb-02	Arabian Gulf	27.90	-50.33	17-Apr-02	In Homeport	36.85	76.30	16-Jun-02	In Homeport	36.85	76.30
17-Feb-02	Arabian Gulf	27.11	-52.00	18-Apr-02	In Homeport	36.85	76.30	17-Jun-02	In Homeport	36.85	76.30
18-Feb-02	Arabian Gulf	28.85	-49.00	19-Apr-02	In Homeport	36.85	76.30	18-Jun-02	In Homeport	36.85	76.30
19-Feb-02	Arabian Gulf	26.66	-51.30	20-Apr-02	In Homeport	36.85	76.30	19-Jun-02	In Homeport	36.85	76.30
20-Feb-02	Arabian Gulf	27.11	-52.00	21-Apr-02	In Homeport	36.85	76.30	20-Jun-02	In Homeport	36.85	76.30
21-Feb-02	Arabian Gulf	28.75	-50.30	22-Apr-02	In Homeport	36.85	76.30	21-Jun-02	In Homeport	36.85	76.30
22-Feb-02	Arabian Gulf	27.90	-50.33	23-Apr-02	In Homeport	36.85	76.30	22-Jun-02	In Homeport	36.85	76.30
23-Feb-02	Arabian Gulf	26.18	-52.95	24-Apr-02	In Homeport	36.85	76.30	23-Jun-02	In Homeport	36.85	76.30
24-Feb-02	Arabian Gulf	26.66	-51.30	25-Apr-02	In Homeport	36.85	76.30	24-Jun-02	In Homeport	36.85	76.30
25-Feb-02	Arabian Gulf	28.85	-49.00	26-Apr-02	In Homeport	36.85	76.30	25-Jun-02	In Homeport	36.85	76.30
26-Feb-02	Arabian Gulf	26.18	-52.95	27-Apr-02	In Homeport	36.85	76.30	26-Jun-02	In Homeport	36.85	76.30
27-Feb-02	Arabian Gulf	25.85	-54.00	28-Apr-02	In Homeport	36.85	76.30	27-Jun-02	In Homeport	36.85	76.30
28-Feb-02	Hormuz	26.57	-56.25	29-Apr-02	In Homeport	36.85	76.30	28-Jun-02	In Homeport	36.85	76.30
1-Mar-02	Red Sea	24.22	-59.18	30-Apr-02	In Homeport	36.85	76.30	29-Jun-02	In Homeport	36.85	76.30
								30-Jun-02	In Homeport	36.85	76.30

C. BATTLE GROUP 03 (BG03)

Battle Group 03
Carrier Strike Group (CSG) from Norfolk/Mayport
USS Dwight D. Eisenhower (CVN); USS Hue City (CG); USS Laboon (DDG); USS Porter (DDG); USNS Arctic (T-AOE)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	36.85	76.30	2-Mar-02	Med	33.48	-29.29	1-May-02	Arabian Gulf	27.11	-52.00
2-Jan-02	In Homeport	36.85	76.30	3-Mar-02	Med	32.01	-31.56	2-May-02	Arabian Gulf	28.85	-49.00
3-Jan-02	In Homeport	36.85	76.30	4-Mar-02	Suez	29.93	-32.57	3-May-02	Arabian Gulf	26.66	-51.30
4-Jan-02	In Homeport	36.85	76.30	5-Mar-02	Red Sea	25.17	-35.26	4-May-02	Arabian Gulf	27.11	-52.00
5-Jan-02	In Homeport	36.85	76.30	6-Mar-02	Red Sea	19.47	-38.58	5-May-02	Arabian Gulf	28.75	-50.30
6-Jan-02	In Homeport	36.85	76.30	7-Mar-02	Red Sea	14.12	-42.21	6-May-02	Arabian Gulf	27.11	-52.00
7-Jan-02	In Homeport	36.85	76.30	8-Mar-02	Arabian Sea	12.34	-47.11	7-May-02	Arabian Gulf	28.75	-50.30
8-Jan-02	In Homeport	36.85	76.30	9-Mar-02	Arabian Sea	14.55	-53.19	8-May-02	Arabian Gulf	27.90	-50.33
9-Jan-02	In Homeport	36.85	76.30	10-Mar-02	Arabian Sea	18.36	-58.39	9-May-02	Arabian Gulf	26.18	-52.95
10-Jan-02	In Homeport	36.85	76.30	11-Mar-02	Arabian Sea	24.22	-59.18	10-May-02	Arabian Gulf	26.66	-51.30
11-Jan-02	In Homeport	36.85	76.30	12-Mar-02	Hormuz	26.57	-56.25	11-May-02	Arabian Gulf	28.85	-49.00
12-Jan-02	In Homeport	36.85	76.30	13-Mar-02	Arabian Gulf	25.85	-54.00	12-May-02	Arabian Gulf	26.18	-52.95
13-Jan-02	In Homeport	36.85	76.30	14-Mar-02	Arabian Gulf	25.15	-53.50	13-May-02	Arabian Gulf	25.85	-54.00
14-Jan-02	In Homeport	36.85	76.30	15-Mar-02	Arabian Gulf	26.18	-52.95	14-May-02	Jebel Ali	25.00	-55.05
15-Jan-02	In Homeport	36.85	76.30	16-Mar-02	Arabian Gulf	27.11	-52.00	15-May-02	Jebel Ali	25.00	-55.05
16-Jan-02	In Homeport	36.85	76.30	17-Mar-02	Arabian Gulf	26.66	-51.30	16-May-02	Jebel Ali	25.00	-55.05
17-Jan-02	In Homeport	36.85	76.30	18-Mar-02	Arabian Gulf	26.18	-52.95	17-May-02	Jebel Ali	25.00	-55.05
18-Jan-02	In Homeport	36.85	76.30	19-Mar-02	Arabian Gulf	27.90	-50.33	18-May-02	Arabian Gulf	25.85	-54.00
19-Jan-02	In Homeport	36.85	76.30	20-Mar-02	Arabian Gulf	27.11	-52.00	19-May-02	Arabian Gulf	26.18	-52.95
20-Jan-02	In Homeport	36.85	76.30	21-Mar-02	Arabian Gulf	28.85	-49.00	20-May-02	Arabian Gulf	26.66	-51.30
21-Jan-02	In Homeport	36.85	76.30	22-Mar-02	Arabian Gulf	26.66	-51.30	21-May-02	Arabian Gulf	27.11	-52.00
22-Jan-02	In Homeport	36.85	76.30	23-Mar-02	Arabian Gulf	27.11	-52.00	22-May-02	Arabian Gulf	28.75	-50.30
23-Jan-02	In Homeport	36.85	76.30	24-Mar-02	Arabian Gulf	28.75	-50.30	23-May-02	Arabian Gulf	27.11	-52.00
24-Jan-02	In Homeport	36.85	76.30	25-Mar-02	Arabian Gulf	27.90	-50.33	24-May-02	Arabian Gulf	28.75	-50.30
25-Jan-02	In Homeport	36.85	76.30	26-Mar-02	Arabian Gulf	26.18	-52.95	25-May-02	Arabian Gulf	27.90	-50.33
26-Jan-02	In Homeport	36.85	76.30	27-Mar-02	Arabian Gulf	26.66	-51.30	26-May-02	Arabian Gulf	26.18	-52.95
27-Jan-02	In Homeport	36.85	76.30	28-Mar-02	Arabian Gulf	28.85	-49.00	27-May-02	Arabian Gulf	26.66	-51.30
28-Jan-02	In Homeport	36.85	76.30	29-Mar-02	Arabian Gulf	26.18	-52.95	28-May-02	Arabian Gulf	26.18	-52.95
29-Jan-02	In Homeport	36.85	76.30	30-Mar-02	Arabian Gulf	27.11	-52.00	29-May-02	Arabian Gulf	27.90	-50.33
30-Jan-02	In Homeport	36.85	76.30	31-Mar-02	Arabian Gulf	26.66	-51.30	30-May-02	Arabian Gulf	27.11	-52.00
31-Jan-02	In Homeport	36.85	76.30	1-Apr-02	Arabian Gulf	26.18	-52.95	31-May-02	Arabian Gulf	28.85	-49.00
1-Feb-02	In Homeport	36.85	76.30	2-Apr-02	Arabian Gulf	27.90	-50.33	1-Jun-02	Arabian Gulf	26.66	-51.30
2-Feb-02	In Homeport	36.85	76.30	3-Apr-02	Arabian Gulf	27.11	-52.00	2-Jun-02	Arabian Gulf	27.11	-52.00
3-Feb-02	In Homeport	36.85	76.30	4-Apr-02	Arabian Gulf	28.85	-49.00	3-Jun-02	Arabian Gulf	28.75	-50.30
4-Feb-02	In Homeport	36.85	76.30	5-Apr-02	Arabian Gulf	26.66	-51.30	4-Jun-02	Arabian Gulf	27.90	-50.33
5-Feb-02	In Homeport	36.85	76.30	6-Apr-02	Arabian Gulf	27.11	-52.00	5-Jun-02	Arabian Gulf	26.18	-52.95
6-Feb-02	In Homeport	36.85	76.30	7-Apr-02	Arabian Gulf	28.75	-50.30	6-Jun-02	Arabian Gulf	26.66	-51.30
7-Feb-02	In Homeport	36.85	76.30	8-Apr-02	Arabian Gulf	27.90	-50.33	7-Jun-02	Arabian Gulf	28.85	-49.00
8-Feb-02	In Homeport	36.85	76.30	9-Apr-02	Arabian Gulf	26.18	-52.95	8-Jun-02	Arabian Gulf	26.18	-52.95
9-Feb-02	In Homeport	36.85	76.30	10-Apr-02	Arabian Gulf	26.66	-51.30	9-Jun-02	Arabian Gulf	27.11	-52.00
10-Feb-02	In Homeport	36.85	76.30	11-Apr-02	Arabian Gulf	28.85	-49.00	10-Jun-02	Arabian Gulf	26.66	-51.30
11-Feb-02	In Homeport	36.85	76.30	12-Apr-02	Arabian Gulf	26.18	-52.95	11-Jun-02	Arabian Gulf	26.18	-52.95
12-Feb-02	In Homeport	36.85	76.30	13-Apr-02	Arabian Gulf	27.11	-52.00	12-Jun-02	Arabian Gulf	27.11	-52.00
13-Feb-02	In Homeport	36.85	76.30	14-Apr-02	Arabian Gulf	26.66	-51.30	13-Jun-02	Arabian Gulf	26.66	-51.30
14-Feb-02	Atlantic	37.01	76.02	15-Apr-02	Arabian Gulf	26.18	-52.95	14-Jun-02	Arabian Gulf	26.18	-52.95
15-Feb-02	Atlantic	38.29	70.58	16-Apr-02	Arabian Gulf	27.90	-50.33	15-Jun-02	Arabian Gulf	27.90	-50.33
16-Feb-02	Atlantic	40.11	63.19	17-Apr-02	Arabian Gulf	27.11	-52.00	16-Jun-02	Arabian Gulf	27.11	-52.00
17-Feb-02	Atlantic	41.23	54.57	18-Apr-02	Arabian Gulf	28.85	-49.00	17-Jun-02	Arabian Gulf	28.85	-49.00
18-Feb-02	Atlantic	41.58	46.22	19-Apr-02	Arabian Gulf	26.66	-51.30	18-Jun-02	Arabian Gulf	26.66	-51.30
19-Feb-02	Atlantic	41.58	37.45	20-Apr-02	Arabian Gulf	27.11	-52.00	19-Jun-02	Arabian Gulf	27.11	-52.00
20-Feb-02	Atlantic	41.18	29.17	21-Apr-02	Arabian Gulf	28.75	-50.30	20-Jun-02	Arabian Gulf	28.75	-50.30
21-Feb-02	Atlantic	40.02	21.01	22-Apr-02	Arabian Gulf	27.90	-50.33	21-Jun-02	Arabian Gulf	27.90	-50.33
22-Feb-02	Atlantic	38.12	13.05	23-Apr-02	Arabian Gulf	26.18	-52.95	22-Jun-02	Arabian Gulf	26.18	-52.95
23-Feb-02	Gibraltar	35.95	5.75	24-Apr-02	Arabian Gulf	26.66	-51.30	23-Jun-02	Arabian Gulf	26.66	-51.30
24-Feb-02	Med	37.17	-2.13	25-Apr-02	Arabian Gulf	28.85	-49.00	24-Jun-02	Arabian Gulf	28.85	-49.00
25-Feb-02	Med	37.33	-10.23	26-Apr-02	Arabian Gulf	26.18	-52.95	25-Jun-02	Arabian Gulf	26.18	-52.95
26-Feb-02	Med	35.35	-18.00	27-Apr-02	Arabian Gulf	27.11	-52.00	26-Jun-02	Arabian Gulf	27.11	-52.00
27-Feb-02	Souda Bay	35.48	-24.18	28-Apr-02	Arabian Gulf	26.66	-51.30	27-Jun-02	Arabian Gulf	28.75	-50.30
28-Feb-02	Souda Bay	35.48	-24.18	29-Apr-02	Arabian Gulf	26.18	-52.95	28-Jun-02	Arabian Gulf	27.90	-50.33
1-Mar-02	Souda Bay	35.48	-24.18	30-Apr-02	Arabian Gulf	27.90	-50.33	29-Jun-02	Arabian Gulf	27.90	-50.33
								30-Jun-02	Arabian Gulf	27.11	-52.00

D. BATTLE GROUP 04 (BG04)

Battle Group 04
Expeditionary Strike Group (ESG) from San Diego
USS Bonhomme Richard (LHD); USS Ogden (LPD); USS Pearl Harbor (LSD); USS Shiloh (CG): USS Higgins (DDG); USS Milius (DDG)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	Singapore	1.27	-103.83	2-Mar-02	Arabian Gulf	26.18	-52.95	1-May-02	Indian Ocean	18.08	-66.54
2-Jan-02	Singapore	1.27	-103.83	3-Mar-02	Arabian Gulf	27.11	-52.00	2-May-02	Indian Ocean	12.53	-70.49
3-Jan-02	Singapore	1.27	-103.83	4-Mar-02	Arabian Gulf	26.66	-51.30	3-May-02	Indian Ocean	7.30	-74.22
4-Jan-02	Singapore	1.27	-103.83	5-Mar-02	Arabian Gulf	26.18	-52.95	4-May-02	Indian Ocean	4.45	-80.12
5-Jan-02	Singapore	1.27	-103.83	6-Mar-02	Arabian Gulf	27.90	-50.33	5-May-02	Indian Ocean	6.42	-92.57
6-Jan-02	Singapore	1.27	-103.83	7-Mar-02	Arabian Gulf	27.11	-52.00	6-May-02	Indian Ocean	7.58	-98.39
7-Jan-02	Malacca	2.50	-101.67	8-Mar-02	Arabian Gulf	28.85	-49.00	7-May-02	Phuket	7.46	-98.19
8-Jan-02	Indian Ocean	7.22	-95.22	9-Mar-02	Arabian Gulf	26.66	-51.30	8-May-02	Phuket	7.46	-98.19
9-Jan-02	Indian Ocean	5.50	-89.11	10-Mar-02	Arabian Gulf	27.11	-52.00	9-May-02	Phuket	7.46	-98.19
10-Jan-02	Indian Ocean	4.49	-82.51	11-Mar-02	Arabian Gulf	28.75	-50.30	10-May-02	Phuket	7.46	-98.19
11-Jan-02	Indian Ocean	5.26	-76.26	12-Mar-02	Arabian Gulf	27.90	-50.33	11-May-02	Phuket	7.46	-98.19
12-Jan-02	Indian Ocean	10.38	-72.35	13-Mar-02	Arabian Gulf	26.18	-52.95	12-May-02	Malacca	2.50	-101.67
13-Jan-02	Indian Ocean	15.49	-68.36	14-Mar-02	Arabian Gulf	26.66	-51.30	13-May-02	Java Sea	-0.43	-106.43
14-Jan-02	Indian Ocean	21.11	-64.45	15-Mar-02	Arabian Gulf	28.85	-49.00	14-May-02	Java Sea	-4.57	-111.31
15-Jan-02	Indian Ocean	24.31	-58.48	16-Mar-02	Arabian Gulf	26.18	-52.95	15-May-02	Java Sea	-6.22	-117.02
16-Jan-02	Hormuz	26.57	-56.25	17-Mar-02	Arabian Gulf	27.11	-52.00	16-May-02	Java Sea	-7.10	-122.01
17-Jan-02	Arabian Gulf	25.85	-54.00	18-Mar-02	Arabian Gulf	26.66	-51.30	17-May-02	Java Sea	-6.38	-127.26
18-Jan-02	Arabian Gulf	25.15	-53.50	19-Mar-02	Arabian Gulf	26.18	-52.95	18-May-02	Java Sea	-9.38	-130.47
19-Jan-02	Arabian Gulf	26.18	-52.95	20-Mar-02	Arabian Gulf	27.90	-50.33	19-May-02	Java Sea	-10.30	-135.33
20-Jan-02	Arabian Gulf	27.11	-52.00	21-Mar-02	Arabian Gulf	27.11	-52.00	20-May-02	Java Sea	-10.06	-138.24
21-Jan-02	Arabian Gulf	26.66	-51.30	22-Mar-02	Arabian Gulf	28.85	-49.00	21-May-02	Java Sea	-10.14	-143.02
22-Jan-02	Arabian Gulf	26.18	-52.95	23-Mar-02	Arabian Gulf	26.66	-51.30	22-May-02	Java Sea	-11.49	-144.23
23-Jan-02	Arabian Gulf	27.90	-50.33	24-Mar-02	Arabian Gulf	27.11	-52.00	23-May-02	Java Sea	-12.25	-144.01
24-Jan-02	Arabian Gulf	27.11	-52.00	25-Mar-02	Arabian Gulf	28.75	-50.30	24-May-02	Cairns	-12.55	-143.33
25-Jan-02	Arabian Gulf	28.85	-49.00	26-Mar-02	Arabian Gulf	27.90	-50.33	25-May-02	Cairns	-12.55	-143.33
26-Jan-02	Arabian Gulf	26.66	-51.30	27-Mar-02	Arabian Gulf	26.18	-52.95	26-May-02	Cairns	-12.55	-143.33
27-Jan-02	Arabian Gulf	27.11	-52.00	28-Mar-02	Arabian Gulf	26.66	-51.30	27-May-02	Cairns	-12.55	-143.33
28-Jan-02	Arabian Gulf	28.75	-50.30	29-Mar-02	Arabian Gulf	28.85	-49.00	28-May-02	Coral Sea	-11.26	-150.05
29-Jan-02	Arabian Gulf	27.90	-50.33	30-Mar-02	Arabian Gulf	26.18	-52.95	29-May-02	Coral Sea	-9.26	-156.29
30-Jan-02	Arabian Gulf	26.18	-52.95	31-Mar-02	Arabian Gulf	27.11	-52.00	30-May-02	Coral Sea	-6.46	-162.11
31-Jan-02	Arabian Gulf	26.66	-51.30	1-Apr-02	Arabian Gulf	26.66	-51.30	31-May-02	Coral Sea	-5.26	-168.10
1-Feb-02	Arabian Gulf	28.85	-49.00	2-Apr-02	Arabian Gulf	26.18	-52.95	1-Jun-02	Coral Sea	-0.03	-171.35
2-Feb-02	Arabian Gulf	26.18	-52.95	3-Apr-02	Arabian Gulf	27.90	-50.33	2-Jun-02	Coral Sea	4.48	-175.42
3-Feb-02	Arabian Gulf	27.11	-52.00	4-Apr-02	Arabian Gulf	27.11	-52.00	3-Jun-02	Mid Pac	9.29	-179.53
4-Feb-02	Arabian Gulf	26.66	-51.30	5-Apr-02	Arabian Gulf	28.85	-49.00	4-Jun-02	Mid Pac	13.43	175.02
5-Feb-02	Arabian Gulf	26.18	-52.95	6-Apr-02	Arabian Gulf	26.66	-51.30	5-Jun-02	Mid Pac	17.44	169.46
6-Feb-02	Arabian Gulf	27.90	-50.33	7-Apr-02	Arabian Gulf	27.11	-52.00	6-Jun-02	Mid Pac	21.10	163.56
7-Feb-02	Arabian Gulf	27.11	-52.00	8-Apr-02	Arabian Gulf	28.75	-50.30	7-Jun-02	Mid Pac	21.15	156.23
8-Feb-02	Arabian Gulf	28.85	-49.00	9-Apr-02	Arabian Gulf	27.90	-50.33	8-Jun-02	Pearl	21.40	158.17
9-Feb-02	Arabian Gulf	26.66	-51.30	10-Apr-02	Arabian Gulf	26.18	-52.95	9-Jun-02	Pearl	21.40	158.17
10-Feb-02	Arabian Gulf	27.11	-52.00	11-Apr-02	Arabian Gulf	26.66	-51.30	10-Jun-02	East Pac	23.14	151.20
11-Feb-02	Arabian Gulf	28.75	-50.30	12-Apr-02	Arabian Gulf	28.85	-49.00	11-Jun-02	East Pac	24.57	144.34
12-Feb-02	Arabian Gulf	27.90	-50.33	13-Apr-02	Arabian Gulf	26.18	-52.95	12-Jun-02	East Pac	26.35	137.39
13-Feb-02	Arabian Gulf	26.18	-52.95	14-Apr-02	Arabian Gulf	27.11	-52.00	13-Jun-02	East Pac	28.44	130.49
14-Feb-02	Arabian Gulf	26.66	-51.30	15-Apr-02	Arabian Gulf	26.66	-51.30	14-Jun-02	East Pac	30.51	123.59
15-Feb-02	Arabian Gulf	28.85	-49.00	16-Apr-02	Arabian Gulf	26.18	-52.95	15-Jun-02	East Pac	32.27	118.34
16-Feb-02	Arabian Gulf	26.18	-52.95	17-Apr-02	Arabian Gulf	27.90	-50.33	16-Jun-02	East Pac	32.37	117.16
17-Feb-02	Arabian Gulf	27.11	-52.00	18-Apr-02	Arabian Gulf	27.11	-52.00	17-Jun-02	In Homeport	32.72	117.18
18-Feb-02	Arabian Gulf	26.66	-51.30	19-Apr-02	Arabian Gulf	28.85	-49.00	18-Jun-02	In Homeport	32.72	117.18
19-Feb-02	Arabian Gulf	26.18	-52.95	20-Apr-02	Arabian Gulf	26.66	-51.30	19-Jun-02	In Homeport	32.72	117.18
20-Feb-02	Arabian Gulf	27.90	-50.33	21-Apr-02	Arabian Gulf	27.11	-52.00	20-Jun-02	In Homeport	32.72	117.18
21-Feb-02	Arabian Gulf	27.11	-52.00	22-Apr-02	Arabian Gulf	28.75	-50.30	21-Jun-02	In Homeport	32.72	117.18
22-Feb-02	Arabian Gulf	28.85	-49.00	23-Apr-02	Arabian Gulf	27.90	-50.33	22-Jun-02	In Homeport	32.72	117.18
23-Feb-02	Arabian Gulf	26.66	-51.30	24-Apr-02	Arabian Gulf	26.18	-52.95	23-Jun-02	In Homeport	32.72	117.18
24-Feb-02	Arabian Gulf	27.11	-52.00	25-Apr-02	Arabian Gulf	26.66	-51.30	24-Jun-02	In Homeport	32.72	117.18
25-Feb-02	Arabian Gulf	28.75	-50.30	26-Apr-02	Arabian Gulf	28.85	-49.00	25-Jun-02	In Homeport	32.72	117.18
26-Feb-02	Arabian Gulf	27.90	-50.33	27-Apr-02	Arabian Gulf	26.18	-52.95	26-Jun-02	In Homeport	32.72	117.18
27-Feb-02	Arabian Gulf	26.18	-52.95	28-Apr-02	Arabian Gulf	25.85	-54.00	27-Jun-02	In Homeport	32.72	117.18
28-Feb-02	Arabian Gulf	26.66	-51.30	29-Apr-02	Hormuz	26.57	-56.25	28-Jun-02	In Homeport	32.72	117.18
1-Mar-02	Arabian Gulf	28.85	-49.00	30-Apr-02	Indian Ocean	22.52	-62.16	29-Jun-02	In Homeport	32.72	117.18
								30-Jun-02	In Homeport	32.72	117.18

E. BATTLE GROUP 05 (BG05)

Battle Group 05 Expeditionary Strike Group (ESG) from San Diego USS Iwo Jima (LHD); USS Denver (LPD); USS Mt. Vernon (LSD); USS Antietam (CG): USS Lassen (DDG); USS John Paul Jones (DDG)											
Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	32.72	117.18	2-Mar-02	In Homeport	32.72	117.18	1-May-02	In Homeport	32.72	117.18
2-Jan-02	In Homeport	32.72	117.18	3-Mar-02	In Homeport	32.72	117.18	2-May-02	In Homeport	32.72	117.18
3-Jan-02	In Homeport	32.72	117.18	4-Mar-02	In Homeport	32.72	117.18	3-May-02	In Homeport	32.72	117.18
4-Jan-02	In Homeport	32.72	117.18	5-Mar-02	In Homeport	32.72	117.18	4-May-02	In Homeport	32.72	117.18
5-Jan-02	In Homeport	32.72	117.18	6-Mar-02	In Homeport	32.72	117.18	5-May-02	In Homeport	32.72	117.18
6-Jan-02	In Homeport	32.72	117.18	7-Mar-02	In Homeport	32.72	117.18	6-May-02	In Homeport	32.72	117.18
7-Jan-02	In Homeport	32.72	117.18	8-Mar-02	In Homeport	32.72	117.18	7-May-02	In Homeport	32.72	117.18
8-Jan-02	In Homeport	32.72	117.18	9-Mar-02	In Homeport	32.72	117.18	8-May-02	In Homeport	32.72	117.18
9-Jan-02	In Homeport	32.72	117.18	10-Mar-02	In Homeport	32.72	117.18	9-May-02	In Homeport	32.72	117.18
10-Jan-02	In Homeport	32.72	117.18	11-Mar-02	In Homeport	32.72	117.18	10-May-02	In Homeport	32.72	117.18
11-Jan-02	In Homeport	32.72	117.18	12-Mar-02	In Homeport	32.72	117.18	11-May-02	In Homeport	32.72	117.18
12-Jan-02	In Homeport	32.72	117.18	13-Mar-02	In Homeport	32.72	117.18	12-May-02	In Homeport	32.72	117.18
13-Jan-02	In Homeport	32.72	117.18	14-Mar-02	In Homeport	32.72	117.18	13-May-02	In Homeport	32.72	117.18
14-Jan-02	In Homeport	32.72	117.18	15-Mar-02	In Homeport	32.72	117.18	14-May-02	In Homeport	32.72	117.18
15-Jan-02	In Homeport	32.72	117.18	16-Mar-02	In Homeport	32.72	117.18	15-May-02	In Homeport	32.72	117.18
16-Jan-02	In Homeport	32.72	117.18	17-Mar-02	In Homeport	32.72	117.18	16-May-02	In Homeport	32.72	117.18
17-Jan-02	In Homeport	32.72	117.18	18-Mar-02	In Homeport	32.72	117.18	17-May-02	In Homeport	32.72	117.18
18-Jan-02	In Homeport	32.72	117.18	19-Mar-02	In Homeport	32.72	117.18	18-May-02	In Homeport	32.72	117.18
19-Jan-02	In Homeport	32.72	117.18	20-Mar-02	In Homeport	32.72	117.18	19-May-02	In Homeport	32.72	117.18
20-Jan-02	In Homeport	32.72	117.18	21-Mar-02	In Homeport	32.72	117.18	20-May-02	In Homeport	32.72	117.18
21-Jan-02	In Homeport	32.72	117.18	22-Mar-02	In Homeport	32.72	117.18	21-May-02	In Homeport	32.72	117.18
22-Jan-02	In Homeport	32.72	117.18	23-Mar-02	In Homeport	32.72	117.18	22-May-02	In Homeport	32.72	117.18
23-Jan-02	In Homeport	32.72	117.18	24-Mar-02	In Homeport	32.72	117.18	23-May-02	In Homeport	32.72	117.18
24-Jan-02	In Homeport	32.72	117.18	25-Mar-02	In Homeport	32.72	117.18	24-May-02	In Homeport	32.72	117.18
25-Jan-02	In Homeport	32.72	117.18	26-Mar-02	In Homeport	32.72	117.18	25-May-02	In Homeport	32.72	117.18
26-Jan-02	In Homeport	32.72	117.18	27-Mar-02	In Homeport	32.72	117.18	26-May-02	In Homeport	32.72	117.18
27-Jan-02	In Homeport	32.72	117.18	28-Mar-02	In Homeport	32.72	117.18	27-May-02	In Homeport	32.72	117.18
28-Jan-02	In Homeport	32.72	117.18	29-Mar-02	In Homeport	32.72	117.18	28-May-02	In Homeport	32.72	117.18
29-Jan-02	In Homeport	32.72	117.18	30-Mar-02	In Homeport	32.72	117.18	29-May-02	In Homeport	32.72	117.18
30-Jan-02	In Homeport	32.72	117.18	31-Mar-02	In Homeport	32.72	117.18	30-May-02	In Homeport	32.72	117.18
31-Jan-02	In Homeport	32.72	117.18	1-Apr-02	In Homeport	32.72	117.18	31-May-02	In Homeport	32.72	117.18
1-Feb-02	In Homeport	32.72	117.18	2-Apr-02	In Homeport	32.72	117.18	1-Jun-02	In Homeport	32.72	117.18
2-Feb-02	In Homeport	32.72	117.18	3-Apr-02	In Homeport	32.72	117.18	2-Jun-02	In Homeport	32.72	117.18
3-Feb-02	In Homeport	32.72	117.18	4-Apr-02	In Homeport	32.72	117.18	3-Jun-02	In Homeport	32.72	117.18
4-Feb-02	In Homeport	32.72	117.18	5-Apr-02	In Homeport	32.72	117.18	4-Jun-02	In Homeport	32.72	117.18
5-Feb-02	In Homeport	32.72	117.18	6-Apr-02	In Homeport	32.72	117.18	5-Jun-02	In Homeport	32.72	117.18
6-Feb-02	In Homeport	32.72	117.18	7-Apr-02	In Homeport	32.72	117.18	6-Jun-02	In Homeport	32.72	117.18
7-Feb-02	In Homeport	32.72	117.18	8-Apr-02	In Homeport	32.72	117.18	7-Jun-02	In Homeport	32.72	117.18
8-Feb-02	In Homeport	32.72	117.18	9-Apr-02	In Homeport	32.72	117.18	8-Jun-02	In Homeport	32.72	117.18
9-Feb-02	In Homeport	32.72	117.18	10-Apr-02	In Homeport	32.72	117.18	9-Jun-02	In Homeport	32.72	117.18
10-Feb-02	In Homeport	32.72	117.18	11-Apr-02	In Homeport	32.72	117.18	10-Jun-02	In Homeport	32.72	117.18
11-Feb-02	In Homeport	32.72	117.18	12-Apr-02	In Homeport	32.72	117.18	11-Jun-02	In Homeport	32.72	117.18
12-Feb-02	In Homeport	32.72	117.18	13-Apr-02	In Homeport	32.72	117.18	12-Jun-02	In Homeport	32.72	117.18
13-Feb-02	In Homeport	32.72	117.18	14-Apr-02	In Homeport	32.72	117.18	13-Jun-02	In Homeport	32.72	117.18
14-Feb-02	In Homeport	32.72	117.18	15-Apr-02	In Homeport	32.72	117.18	14-Jun-02	East Pac	32.37	117.16
15-Feb-02	In Homeport	32.72	117.18	16-Apr-02	In Homeport	32.72	117.18	15-Jun-02	East Pac	32.27	118.34
16-Feb-02	In Homeport	32.72	117.18	17-Apr-02	In Homeport	32.72	117.18	16-Jun-02	East Pac	30.51	123.59
17-Feb-02	In Homeport	32.72	117.18	18-Apr-02	In Homeport	32.72	117.18	17-Jun-02	East Pac	28.44	130.49
18-Feb-02	In Homeport	32.72	117.18	19-Apr-02	In Homeport	32.72	117.18	18-Jun-02	East Pac	26.35	137.39
19-Feb-02	In Homeport	32.72	117.18	20-Apr-02	In Homeport	32.72	117.18	19-Jun-02	East Pac	24.57	144.34
20-Feb-02	In Homeport	32.72	117.18	21-Apr-02	In Homeport	32.72	117.18	20-Jun-02	East Pac	23.14	151.20
21-Feb-02	In Homeport	32.72	117.18	22-Apr-02	In Homeport	32.72	117.18	21-Jun-02	Pearl	21.40	158.17
22-Feb-02	In Homeport	32.72	117.18	23-Apr-02	In Homeport	32.72	117.18	22-Jun-02	Pearl	21.40	158.17
23-Feb-02	In Homeport	32.72	117.18	24-Apr-02	In Homeport	32.72	117.18	23-Jun-02	Pearl	21.40	158.17
24-Feb-02	In Homeport	32.72	117.18	25-Apr-02	In Homeport	32.72	117.18	24-Jun-02	Mid Pac	22.35	160.43
25-Feb-02	In Homeport	32.72	117.18	26-Apr-02	In Homeport	32.72	117.18	25-Jun-02	Mid Pac	24.04	167.27
26-Feb-02	In Homeport	32.72	117.18	27-Apr-02	In Homeport	32.72	117.18	26-Jun-02	Mid Pac	25.19	174.19
27-Feb-02	In Homeport	32.72	117.18	28-Apr-02	In Homeport	32.72	117.18	27-Jun-02	West Pac	26.12	-178.40
28-Feb-02	In Homeport	32.72	117.18	29-Apr-02	In Homeport	32.72	117.18	28-Jun-02	West Pac	26.45	-171.30
1-Mar-02	In Homeport	32.72	117.18	30-Apr-02	In Homeport	32.72	117.18	29-Jun-02	West Pac	26.52	-164.19
								30-Jun-02	West Pac	26.45	-157.07

F. BATTLE GROUP 06 (BG06)

Battle Group 06											
Expeditionary Strike Group (ESG) from Norfolk											
USS Bataan (LHD); USS Shreveport (LPD); USS Whidbey Island (LSD); USS San Jacinto (CG): USS Gonzalez (DDG); USS Nitze (DDG)											
Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	Arabian Gulf	26.66	-51.30	2-Mar-02	Jebel Ali	25.00	-55.05	1-May-02	In Homeport	36.85	76.30
2-Jan-02	Arabian Gulf	27.11	-52.00	3-Mar-02	Jebel Ali	25.00	-55.05	2-May-02	In Homeport	36.85	76.30
3-Jan-02	Arabian Gulf	26.18	-52.95	4-Mar-02	Jebel Ali	25.00	-55.05	3-May-02	In Homeport	36.85	76.30
4-Jan-02	Arabian Gulf	25.15	-53.50	5-Mar-02	Jebel Ali	25.00	-55.05	4-May-02	In Homeport	36.85	76.30
5-Jan-02	Arabian Gulf	26.66	-51.30	6-Mar-02	Jebel Ali	25.00	-55.05	5-May-02	In Homeport	36.85	76.30
6-Jan-02	Arabian Gulf	28.85	-49.00	7-Mar-02	Jebel Ali	25.00	-55.05	6-May-02	In Homeport	36.85	76.30
7-Jan-02	Arabian Gulf	28.75	-50.30	8-Mar-02	Arabian Gulf	25.85	-54.00	7-May-02	In Homeport	36.85	76.30
8-Jan-02	Arabian Gulf	27.90	-50.33	9-Mar-02	Arabian Gulf	26.18	-52.95	8-May-02	In Homeport	36.85	76.30
9-Jan-02	Arabian Gulf	26.66	-51.30	10-Mar-02	Arabian Gulf	27.11	-52.00	9-May-02	In Homeport	36.85	76.30
10-Jan-02	Arabian Gulf	27.11	-52.00	11-Mar-02	Arabian Gulf	26.66	-51.30	10-May-02	In Homeport	36.85	76.30
11-Jan-02	Arabian Gulf	26.18	-52.95	12-Mar-02	Arabian Gulf	26.18	-52.95	11-May-02	In Homeport	36.85	76.30
12-Jan-02	Arabian Gulf	25.15	-53.50	13-Mar-02	Arabian Gulf	25.85	-54.00	12-May-02	In Homeport	36.85	76.30
13-Jan-02	Arabian Gulf	26.66	-51.30	14-Mar-02	Hormuz	26.57	-56.25	13-May-02	In Homeport	36.85	76.30
14-Jan-02	Arabian Gulf	28.85	-49.00	15-Mar-02	Red Sea	24.22	-59.18	14-May-02	In Homeport	36.85	76.30
15-Jan-02	Arabian Gulf	28.75	-50.30	16-Mar-02	Red Sea	18.36	-58.39	15-May-02	In Homeport	36.85	76.30
16-Jan-02	Arabian Gulf	27.90	-50.33	17-Mar-02	Red Sea	14.55	-53.19	16-May-02	In Homeport	36.85	76.30
17-Jan-02	Arabian Gulf	26.66	-51.30	18-Mar-02	Red Sea	12.34	-47.11	17-May-02	In Homeport	36.85	76.30
18-Jan-02	Arabian Gulf	27.11	-52.00	19-Mar-02	Red Sea	14.12	-42.21	18-May-02	In Homeport	36.85	76.30
19-Jan-02	Arabian Gulf	26.18	-52.95	20-Mar-02	Red Sea	19.47	-38.58	19-May-02	In Homeport	36.85	76.30
20-Jan-02	Arabian Gulf	25.15	-53.50	21-Mar-02	Red Sea	25.17	-35.26	20-May-02	In Homeport	36.85	76.30
21-Jan-02	Arabian Gulf	26.66	-51.30	22-Mar-02	Suez	29.93	-32.57	21-May-02	In Homeport	36.85	76.30
22-Jan-02	Arabian Gulf	28.85	-49.00	23-Mar-02	East Med	33.24	-25.58	22-May-02	In Homeport	36.85	76.30
23-Jan-02	Arabian Gulf	28.75	-50.30	24-Mar-02	East Med	34.44	-18.30	23-May-02	In Homeport	36.85	76.30
24-Jan-02	Arabian Gulf	27.90	-50.33	25-Mar-02	East Med	35.17	-15.01	24-May-02	In Homeport	36.85	76.30
25-Jan-02	Arabian Gulf	26.66	-51.30	26-Mar-02	Valletta	35.50	-14.36	25-May-02	In Homeport	36.85	76.30
26-Jan-02	Arabian Gulf	27.11	-52.00	27-Mar-02	Valletta	35.50	-14.36	26-May-02	In Homeport	36.85	76.30
27-Jan-02	Arabian Gulf	26.18	-52.95	28-Mar-02	Valletta	35.50	-14.36	27-May-02	In Homeport	36.85	76.30
28-Jan-02	Arabian Gulf	25.15	-53.50	29-Mar-02	Valletta	35.50	-14.36	28-May-02	In Homeport	36.85	76.30
29-Jan-02	Arabian Gulf	26.66	-51.30	30-Mar-02	Valletta	35.50	-14.36	29-May-02	In Homeport	36.85	76.30
30-Jan-02	Arabian Gulf	28.85	-49.00	31-Mar-02	Adriatic	39.23	-19.04	30-May-02	In Homeport	36.85	76.30
31-Jan-02	Arabian Gulf	28.75	-50.30	1-Apr-02	Adriatic	37.01	-17.53	31-May-02	In Homeport	36.85	76.30
1-Feb-02	Arabian Gulf	27.90	-50.33	2-Apr-02	Med	37.51	-10.24	1-Jun-02	In Homeport	36.85	76.30
2-Feb-02	Arabian Gulf	26.66	-51.30	3-Apr-02	Med	37.35	-3.07	2-Jun-02	In Homeport	36.85	76.30
3-Feb-02	Arabian Gulf	27.11	-52.00	4-Apr-02	Med	36.06	2.39	3-Jun-02	In Homeport	36.85	76.30
4-Feb-02	Arabian Gulf	26.18	-52.95	5-Apr-02	Gibraltar	35.95	5.75	4-Jun-02	In Homeport	36.85	76.30
5-Feb-02	Arabian Gulf	25.15	-53.50	6-Apr-02	Rota	36.62	6.35	5-Jun-02	In Homeport	36.85	76.30
6-Feb-02	Arabian Gulf	26.66	-51.30	7-Apr-02	Rota	36.62	6.35	6-Jun-02	In Homeport	36.85	76.30
7-Feb-02	Arabian Gulf	28.85	-49.00	8-Apr-02	Rota	36.62	6.35	7-Jun-02	In Homeport	36.85	76.30
8-Feb-02	Arabian Gulf	28.75	-50.30	9-Apr-02	Rota	36.62	6.35	8-Jun-02	In Homeport	36.85	76.30
9-Feb-02	Arabian Gulf	27.90	-50.33	10-Apr-02	Atlantic	38.12	13.05	9-Jun-02	In Homeport	36.85	76.30
10-Feb-02	Arabian Gulf	26.66	-51.30	11-Apr-02	Atlantic	40.02	21.01	10-Jun-02	In Homeport	36.85	76.30
11-Feb-02	Arabian Gulf	27.11	-52.00	12-Apr-02	Atlantic	41.18	29.17	11-Jun-02	In Homeport	36.85	76.30
12-Feb-02	Arabian Gulf	26.18	-52.95	13-Apr-02	Atlantic	41.58	37.45	12-Jun-02	In Homeport	36.85	76.30
13-Feb-02	Arabian Gulf	25.15	-53.50	14-Apr-02	Atlantic	41.58	46.22	13-Jun-02	In Homeport	36.85	76.30
14-Feb-02	Arabian Gulf	26.66	-51.30	15-Apr-02	Atlantic	41.23	54.57	14-Jun-02	In Homeport	36.85	76.30
15-Feb-02	Arabian Gulf	28.85	-49.00	16-Apr-02	Atlantic	40.11	63.19	15-Jun-02	In Homeport	36.85	76.30
16-Feb-02	Arabian Gulf	28.75	-50.30	17-Apr-02	Atlantic	38.29	70.58	16-Jun-02	In Homeport	36.85	76.30
17-Feb-02	Arabian Gulf	27.90	-50.33	18-Apr-02	Atlantic	37.01	76.02	17-Jun-02	In Homeport	36.85	76.30
18-Feb-02	Arabian Gulf	26.66	-51.30	19-Apr-02	In Homeport	36.85	76.30	18-Jun-02	In Homeport	36.85	76.30
19-Feb-02	Arabian Gulf	27.11	-52.00	20-Apr-02	In Homeport	36.85	76.30	19-Jun-02	In Homeport	36.85	76.30
20-Feb-02	Arabian Gulf	26.18	-52.95	21-Apr-02	In Homeport	36.85	76.30	20-Jun-02	In Homeport	36.85	76.30
21-Feb-02	Arabian Gulf	25.15	-53.50	22-Apr-02	In Homeport	36.85	76.30	21-Jun-02	In Homeport	36.85	76.30
22-Feb-02	Arabian Gulf	26.66	-51.30	23-Apr-02	In Homeport	36.85	76.30	22-Jun-02	In Homeport	36.85	76.30
23-Feb-02	Arabian Gulf	28.85	-49.00	24-Apr-02	In Homeport	36.85	76.30	23-Jun-02	In Homeport	36.85	76.30
24-Feb-02	Arabian Gulf	28.75	-50.30	25-Apr-02	In Homeport	36.85	76.30	24-Jun-02	In Homeport	36.85	76.30
25-Feb-02	Arabian Gulf	27.90	-50.33	26-Apr-02	In Homeport	36.85	76.30	25-Jun-02	In Homeport	36.85	76.30
26-Feb-02	Arabian Gulf	26.66	-51.30	27-Apr-02	In Homeport	36.85	76.30	26-Jun-02	In Homeport	36.85	76.30
27-Feb-02	Arabian Gulf	27.11	-52.00	28-Apr-02	In Homeport	36.85	76.30	27-Jun-02	In Homeport	36.85	76.30
28-Feb-02	Arabian Gulf	26.18	-52.95	29-Apr-02	In Homeport	36.85	76.30	28-Jun-02	In Homeport	36.85	76.30
1-Mar-02	Arabian Gulf	25.85	-54.00	30-Apr-02	In Homeport	36.85	76.30	29-Jun-02	In Homeport	36.85	76.30
								30-Jun-02	In Homeport	36.85	76.30

G. BATTLE GROUP 07 (BG07)

Battle Group 07
Expeditionary Strike Group (ESG) from Norfolk
USS Wasp (LHD); USS Trenton (LPD); USS Oak Hill (LSD); USS Vella Gulf (CG): USS Laboon (DDG); USS Bainbridge (DDG)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	36.85	76.30	2-Mar-02	Atlantic	38.12	13.05	1-May-02	Arabian Gulf	25.15	-53.50
2-Jan-02	In Homeport	36.85	76.30	3-Mar-02	Gibraltar	35.95	5.75	2-May-02	Arabian Gulf	26.66	-51.30
3-Jan-02	In Homeport	36.85	76.30	4-Mar-02	Med	37.31	-0.46	3-May-02	Arabian Gulf	28.85	-49.00
4-Jan-02	In Homeport	36.85	76.30	5-Mar-02	Med	37.48	-8.53	4-May-02	Arabian Gulf	28.75	-50.30
5-Jan-02	In Homeport	36.85	76.30	6-Mar-02	Med	35.53	-16.28	5-May-02	Arabian Gulf	27.90	-50.33
6-Jan-02	In Homeport	36.85	76.30	7-Mar-02	Med	35.37	-21.38	6-May-02	Arabian Gulf	27.11	-52.00
7-Jan-02	In Homeport	36.85	76.30	8-Mar-02	Souda Bay	35.48	-24.18	7-May-02	Arabian Gulf	26.18	-52.95
8-Jan-02	In Homeport	36.85	76.30	9-Mar-02	Souda Bay	35.48	-24.18	8-May-02	Arabian Gulf	28.75	-50.30
9-Jan-02	In Homeport	36.85	76.30	10-Mar-02	Souda Bay	35.48	-24.18	9-May-02	Arabian Gulf	27.90	-50.33
10-Jan-02	In Homeport	36.85	76.30	11-Mar-02	Souda Bay	35.48	-24.18	10-May-02	Arabian Gulf	27.11	-52.00
11-Jan-02	In Homeport	36.85	76.30	12-Mar-02	Med	33.05	-30.59	11-May-02	Arabian Gulf	26.18	-52.95
12-Jan-02	In Homeport	36.85	76.30	13-Mar-02	Suez	29.93	-32.57	12-May-02	Arabian Gulf	28.75	-50.30
13-Jan-02	In Homeport	36.85	76.30	14-Mar-02	Red Sea	25.17	-35.26	13-May-02	Arabian Gulf	26.66	-51.30
14-Jan-02	In Homeport	36.85	76.30	15-Mar-02	Red Sea	19.47	-38.58	14-May-02	Arabian Gulf	28.85	-49.00
15-Jan-02	In Homeport	36.85	76.30	16-Mar-02	Red Sea	14.12	-42.21	15-May-02	Arabian Gulf	28.75	-50.30
16-Jan-02	In Homeport	36.85	76.30	17-Mar-02	Red Sea	12.34	-47.11	16-May-02	Arabian Gulf	27.90	-50.33
17-Jan-02	In Homeport	36.85	76.30	18-Mar-02	Red Sea	11.43	-52.25	17-May-02	Arabian Gulf	27.11	-52.00
18-Jan-02	In Homeport	36.85	76.30	19-Mar-02	HOA	7.18	-52.27	18-May-02	Arabian Gulf	26.18	-52.95
19-Jan-02	In Homeport	36.85	76.30	20-Mar-02	HOA	3.18	-51.23	19-May-02	Arabian Gulf	25.15	-53.50
20-Jan-02	In Homeport	36.85	76.30	21-Mar-02	HOA	0.18	-50.43	20-May-02	Arabian Gulf	26.66	-51.30
21-Jan-02	In Homeport	36.85	76.30	22-Mar-02	HOA	0.40	-54.14	21-May-02	Arabian Gulf	28.85	-49.00
22-Jan-02	In Homeport	36.85	76.30	23-Mar-02	HOA	3.42	-54.01	22-May-02	Arabian Gulf	28.75	-50.30
23-Jan-02	In Homeport	36.85	76.30	24-Mar-02	HOA	4.47	-55.29	23-May-02	Arabian Gulf	27.90	-50.33
24-Jan-02	In Homeport	36.85	76.30	25-Mar-02	HOA	5.55	-58.45	24-May-02	Arabian Gulf	27.11	-52.00
25-Jan-02	In Homeport	36.85	76.30	26-Mar-02	HOA	7.58	-58.33	25-May-02	Arabian Gulf	26.18	-52.95
26-Jan-02	In Homeport	36.85	76.30	27-Mar-02	HOA	11.13	-59.03	26-May-02	Arabian Gulf	28.75	-50.30
27-Jan-02	In Homeport	36.85	76.30	28-Mar-02	HOA	16.21	-59.32	27-May-02	Arabian Gulf	27.90	-50.33
28-Jan-02	In Homeport	36.85	76.30	29-Mar-02	HOA	20.10	-61.17	28-May-02	Arabian Gulf	27.11	-52.00
29-Jan-02	In Homeport	36.85	76.30	30-Mar-02	HOA	23.59	-60.15	29-May-02	Arabian Gulf	26.18	-52.95
30-Jan-02	In Homeport	36.85	76.30	31-Mar-02	HOA	24.54	-57.09	30-May-02	Arabian Gulf	28.75	-50.30
31-Jan-02	In Homeport	36.85	76.30	1-Apr-02	Hormuz	26.57	-56.25	31-May-02	Arabian Gulf	26.66	-51.30
1-Feb-02	In Homeport	36.85	76.30	2-Apr-02	Arabian Gulf	25.85	-54.00	1-Jun-02	Arabian Gulf	28.85	-49.00
2-Feb-02	In Homeport	36.85	76.30	3-Apr-02	Arabian Gulf	25.15	-53.50	2-Jun-02	Arabian Gulf	28.75	-50.30
3-Feb-02	In Homeport	36.85	76.30	4-Apr-02	Arabian Gulf	26.66	-51.30	3-Jun-02	Arabian Gulf	27.90	-50.33
4-Feb-02	In Homeport	36.85	76.30	5-Apr-02	Arabian Gulf	28.85	-49.00	4-Jun-02	Arabian Gulf	27.11	-52.00
5-Feb-02	In Homeport	36.85	76.30	6-Apr-02	Arabian Gulf	28.75	-50.30	5-Jun-02	Arabian Gulf	26.18	-52.95
6-Feb-02	In Homeport	36.85	76.30	7-Apr-02	Arabian Gulf	27.90	-50.33	6-Jun-02	Arabian Gulf	25.15	-53.50
7-Feb-02	In Homeport	36.85	76.30	8-Apr-02	Arabian Gulf	27.11	-52.00	7-Jun-02	Arabian Gulf	26.66	-51.30
8-Feb-02	In Homeport	36.85	76.30	9-Apr-02	Arabian Gulf	26.18	-52.95	8-Jun-02	Arabian Gulf	28.85	-49.00
9-Feb-02	In Homeport	36.85	76.30	10-Apr-02	Arabian Gulf	25.15	-53.50	9-Jun-02	Arabian Gulf	28.75	-50.30
10-Feb-02	In Homeport	36.85	76.30	11-Apr-02	Arabian Gulf	26.66	-51.30	10-Jun-02	Arabian Gulf	27.90	-50.33
11-Feb-02	In Homeport	36.85	76.30	12-Apr-02	Arabian Gulf	28.85	-49.00	11-Jun-02	Arabian Gulf	27.11	-52.00
12-Feb-02	In Homeport	36.85	76.30	13-Apr-02	Arabian Gulf	28.75	-50.30	12-Jun-02	Arabian Gulf	26.18	-52.95
13-Feb-02	In Homeport	36.85	76.30	14-Apr-02	Arabian Gulf	27.90	-50.33	13-Jun-02	Arabian Gulf	28.75	-50.30
14-Feb-02	In Homeport	36.85	76.30	15-Apr-02	Arabian Gulf	27.11	-52.00	14-Jun-02	Arabian Gulf	27.90	-50.33
15-Feb-02	In Homeport	36.85	76.30	16-Apr-02	Arabian Gulf	26.18	-52.95	15-Jun-02	Arabian Gulf	27.11	-52.00
16-Feb-02	In Homeport	36.85	76.30	17-Apr-02	Arabian Gulf	28.75	-50.30	16-Jun-02	Arabian Gulf	26.18	-52.95
17-Feb-02	In Homeport	36.85	76.30	18-Apr-02	Arabian Gulf	27.90	-50.33	17-Jun-02	Arabian Gulf	28.75	-50.30
18-Feb-02	In Homeport	36.85	76.30	19-Apr-02	Arabian Gulf	27.11	-52.00	18-Jun-02	Arabian Gulf	28.75	-50.30
19-Feb-02	In Homeport	36.85	76.30	20-Apr-02	Arabian Gulf	26.18	-52.95	19-Jun-02	Arabian Gulf	27.90	-50.33
20-Feb-02	In Homeport	36.85	76.30	21-Apr-02	Arabian Gulf	28.75	-50.30	20-Jun-02	Arabian Gulf	27.11	-52.00
21-Feb-02	In Homeport	36.85	76.30	22-Apr-02	Arabian Gulf	27.90	-50.33	21-Jun-02	Arabian Gulf	26.18	-52.95
22-Feb-02	Atlantic	37.01	76.02	23-Apr-02	Arabian Gulf	27.11	-52.00	22-Jun-02	Arabian Gulf	28.75	-50.30
23-Feb-02	Atlantic	38.29	70.58	24-Apr-02	Arabian Gulf	26.18	-52.95	23-Jun-02	Arabian Gulf	27.90	-50.33
24-Feb-02	Atlantic	40.11	63.19	25-Apr-02	Arabian Gulf	26.66	-51.30	24-Jun-02	Arabian Gulf	27.11	-52.00
25-Feb-02	Atlantic	41.23	54.57	26-Apr-02	Arabian Gulf	28.85	-49.00	25-Jun-02	Arabian Gulf	26.18	-52.95
26-Feb-02	Atlantic	41.58	46.22	27-Apr-02	Arabian Gulf	28.75	-50.30	26-Jun-02	Arabian Gulf	28.75	-50.30
27-Feb-02	Atlantic	41.58	37.45	28-Apr-02	Arabian Gulf	27.90	-50.33	27-Jun-02	Arabian Gulf	28.75	-50.30
28-Feb-02	Atlantic	41.18	29.17	29-Apr-02	Arabian Gulf	27.11	-52.00	28-Jun-02	Arabian Gulf	27.90	-50.33
1-Mar-02	Atlantic	40.02	21.01	30-Apr-02	Arabian Gulf	26.18	-52.95	29-Jun-02	Arabian Gulf	27.11	-52.00
								30-Jun-02	Arabian Gulf	27.90	-50.33

H. BATTLE GROUP 08 (BG08)

Battle Group 08 Surface Strike Group (SSG) from Yokosuka USS Cowpens (CG); USS Hopper (DDG); USS John S. McCain (DDG)											
Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	35.29	-139.66	2-Mar-02	In Homeport	35.29	-139.66	1-May-02	Indian Ocean	10.38	-72.35
2-Jan-02	In Homeport	35.29	-139.66	3-Mar-02	In Homeport	35.29	-139.66	2-May-02	Indian Ocean	15.49	-68.36
3-Jan-02	In Homeport	35.29	-139.66	4-Mar-02	In Homeport	35.29	-139.66	3-May-02	Indian Ocean	21.11	-64.45
4-Jan-02	In Homeport	35.29	-139.66	5-Mar-02	In Homeport	35.29	-139.66	4-May-02	Indian Ocean	24.31	-58.48
5-Jan-02	In Homeport	35.29	-139.66	6-Mar-02	In Homeport	35.29	-139.66	5-May-02	Homuz	26.57	-56.25
6-Jan-02	In Homeport	35.29	-139.66	7-Mar-02	In Homeport	35.29	-139.66	6-May-02	Arabian Gulf	25.85	-54.00
7-Jan-02	In Homeport	35.29	-139.66	8-Mar-02	In Homeport	35.29	-139.66	7-May-02	Arabian Gulf	25.15	-53.50
8-Jan-02	In Homeport	35.29	-139.66	9-Mar-02	In Homeport	35.29	-139.66	8-May-02	Arabian Gulf	26.66	-51.30
9-Jan-02	In Homeport	35.29	-139.66	10-Mar-02	In Homeport	35.29	-139.66	9-May-02	Arabian Gulf	28.85	-49.00
10-Jan-02	In Homeport	35.29	-139.66	11-Mar-02	In Homeport	35.29	-139.66	10-May-02	Arabian Gulf	28.75	-50.30
11-Jan-02	In Homeport	35.29	-139.66	12-Mar-02	In Homeport	35.29	-139.66	11-May-02	Arabian Gulf	27.90	-50.33
12-Jan-02	In Homeport	35.29	-139.66	13-Mar-02	In Homeport	35.29	-139.66	12-May-02	Arabian Gulf	27.11	-52.00
13-Jan-02	In Homeport	35.29	-139.66	14-Mar-02	In Homeport	35.29	-139.66	13-May-02	Arabian Gulf	26.18	-52.95
14-Jan-02	In Homeport	35.29	-139.66	15-Mar-02	In Homeport	35.29	-139.66	14-May-02	Arabian Gulf	25.15	-53.50
15-Jan-02	In Homeport	35.29	-139.66	16-Mar-02	In Homeport	35.29	-139.66	15-May-02	Arabian Gulf	26.66	-51.30
16-Jan-02	In Homeport	35.29	-139.66	17-Mar-02	In Homeport	35.29	-139.66	16-May-02	Arabian Gulf	28.85	-49.00
17-Jan-02	In Homeport	35.29	-139.66	18-Mar-02	In Homeport	35.29	-139.66	17-May-02	Arabian Gulf	28.75	-50.30
18-Jan-02	In Homeport	35.29	-139.66	19-Mar-02	In Homeport	35.29	-139.66	18-May-02	Arabian Gulf	27.90	-50.33
19-Jan-02	In Homeport	35.29	-139.66	20-Mar-02	In Homeport	35.29	-139.66	19-May-02	Arabian Gulf	27.11	-52.00
20-Jan-02	In Homeport	35.29	-139.66	21-Mar-02	In Homeport	35.29	-139.66	20-May-02	Arabian Gulf	26.18	-52.95
21-Jan-02	In Homeport	35.29	-139.66	22-Mar-02	In Homeport	35.29	-139.66	21-May-02	Arabian Gulf	25.15	-53.50
22-Jan-02	In Homeport	35.29	-139.66	23-Mar-02	In Homeport	35.29	-139.66	22-May-02	Arabian Gulf	26.66	-51.30
23-Jan-02	In Homeport	35.29	-139.66	24-Mar-02	In Homeport	35.29	-139.66	23-May-02	Arabian Gulf	28.85	-49.00
24-Jan-02	In Homeport	35.29	-139.66	25-Mar-02	In Homeport	35.29	-139.66	24-May-02	Arabian Gulf	28.75	-50.30
25-Jan-02	In Homeport	35.29	-139.66	26-Mar-02	In Homeport	35.29	-139.66	25-May-02	Arabian Gulf	27.90	-50.33
26-Jan-02	In Homeport	35.29	-139.66	27-Mar-02	In Homeport	35.29	-139.66	26-May-02	Arabian Gulf	27.11	-52.00
27-Jan-02	In Homeport	35.29	-139.66	28-Mar-02	In Homeport	35.29	-139.66	27-May-02	Arabian Gulf	26.18	-52.95
28-Jan-02	In Homeport	35.29	-139.66	29-Mar-02	In Homeport	35.29	-139.66	28-May-02	Arabian Gulf	25.15	-53.50
29-Jan-02	In Homeport	35.29	-139.66	30-Mar-02	In Homeport	35.29	-139.66	29-May-02	Arabian Gulf	26.66	-51.30
30-Jan-02	In Homeport	35.29	-139.66	31-Mar-02	In Homeport	35.29	-139.66	30-May-02	Arabian Gulf	28.85	-49.00
31-Jan-02	In Homeport	35.29	-139.66	1-Apr-02	In Homeport	35.29	-139.66	31-May-02	Arabian Gulf	28.75	-50.30
1-Feb-02	In Homeport	35.29	-139.66	2-Apr-02	In Homeport	35.29	-139.66	1-Jun-02	Arabian Gulf	27.90	-50.33
2-Feb-02	In Homeport	35.29	-139.66	3-Apr-02	In Homeport	35.29	-139.66	2-Jun-02	Arabian Gulf	27.11	-52.00
3-Feb-02	In Homeport	35.29	-139.66	4-Apr-02	In Homeport	35.29	-139.66	3-Jun-02	Arabian Gulf	26.18	-52.95
4-Feb-02	In Homeport	35.29	-139.66	5-Apr-02	In Homeport	35.29	-139.66	4-Jun-02	Arabian Gulf	25.15	-53.50
5-Feb-02	In Homeport	35.29	-139.66	6-Apr-02	In Homeport	35.29	-139.66	5-Jun-02	Arabian Gulf	26.66	-51.30
6-Feb-02	In Homeport	35.29	-139.66	7-Apr-02	In Homeport	35.29	-139.66	6-Jun-02	Arabian Gulf	28.85	-49.00
7-Feb-02	In Homeport	35.29	-139.66	8-Apr-02	In Homeport	35.29	-139.66	7-Jun-02	Arabian Gulf	28.75	-50.30
8-Feb-02	In Homeport	35.29	-139.66	9-Apr-02	In Homeport	35.29	-139.66	8-Jun-02	Arabian Gulf	27.90	-50.33
9-Feb-02	In Homeport	35.29	-139.66	10-Apr-02	In Homeport	35.29	-139.66	9-Jun-02	Arabian Gulf	27.11	-52.00
10-Feb-02	In Homeport	35.29	-139.66	11-Apr-02	In Homeport	35.29	-139.66	10-Jun-02	Arabian Gulf	26.18	-52.95
11-Feb-02	In Homeport	35.29	-139.66	12-Apr-02	In Homeport	35.29	-139.66	11-Jun-02	Arabian Gulf	25.15	-53.50
12-Feb-02	In Homeport	35.29	-139.66	13-Apr-02	In Homeport	35.29	-139.66	12-Jun-02	Arabian Gulf	26.66	-51.30
13-Feb-02	In Homeport	35.29	-139.66	14-Apr-02	In Homeport	35.29	-139.66	13-Jun-02	Arabian Gulf	28.85	-49.00
14-Feb-02	In Homeport	35.29	-139.66	15-Apr-02	Depart YK	34.41	-139.46	14-Jun-02	Arabian Gulf	28.75	-50.30
15-Feb-02	In Homeport	35.29	-139.66	16-Apr-02	West Pac	30.18	-134.21	15-Jun-02	Arabian Gulf	27.90	-50.33
16-Feb-02	In Homeport	35.29	-139.66	17-Apr-02	West Pac	26.01	-128.57	16-Jun-02	Arabian Gulf	27.11	-52.00
17-Feb-02	In Homeport	35.29	-139.66	18-Apr-02	West Pac	22.01	-123.24	17-Jun-02	Arabian Gulf	26.18	-52.95
18-Feb-02	In Homeport	35.29	-139.66	19-Apr-02	West Pac	18.36	-117.33	18-Jun-02	Arabian Gulf	25.15	-53.50
19-Feb-02	In Homeport	35.29	-139.66	20-Apr-02	China Sea	13.33	-113.30	19-Jun-02	Arabian Gulf	26.66	-51.30
20-Feb-02	In Homeport	35.29	-139.66	21-Apr-02	China Sea	8.04	-110.09	20-Jun-02	Arabian Gulf	28.85	-49.00
21-Feb-02	In Homeport	35.29	-139.66	22-Apr-02	China Sea	3.10	-106.10	21-Jun-02	Arabian Gulf	28.75	-50.30
22-Feb-02	In Homeport	35.29	-139.66	23-Apr-02	Singapore	1.27	-103.83	22-Jun-02	Arabian Gulf	27.90	-50.33
23-Feb-02	In Homeport	35.29	-139.66	24-Apr-02	Singapore	1.27	-103.83	23-Jun-02	Arabian Gulf	27.11	-52.00
24-Feb-02	In Homeport	35.29	-139.66	25-Apr-02	Singapore	1.27	-103.83	24-Jun-02	Arabian Gulf	26.18	-52.95
25-Feb-02	In Homeport	35.29	-139.66	26-Apr-02	Malacca	2.50	-101.67	25-Jun-02	Arabian Gulf	26.66	-51.30
26-Feb-02	In Homeport	35.29	-139.66	27-Apr-02	Indian Ocean	7.22	-95.22	26-Jun-02	Arabian Gulf	28.85	-49.00
27-Feb-02	In Homeport	35.29	-139.66	28-Apr-02	Indian Ocean	5.50	-89.11	27-Jun-02	Arabian Gulf	28.75	-50.30
28-Feb-02	In Homeport	35.29	-139.66	29-Apr-02	Indian Ocean	4.49	-82.51	28-Jun-02	Arabian Gulf	27.90	-50.33
1-Mar-02	In Homeport	35.29	-139.66	30-Apr-02	Indian Ocean	5.26	-76.26	29-Jun-02	Arabian Gulf	27.11	-52.00
								30-Jun-02	Arabian Gulf	26.18	-52.95

I. BATTLE GROUP 09 (BG09)

Battle Group 09
Surface Strike Group (SSG) from Norfolk
USS Anzio (CG); USS Cole (DDG); USS Mason (DDG)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	West Med	32.17	-32.44	2-Mar-02	East Med	34.59	-17.17	1-May-02	Cagliari	39.11	-9.14
2-Jan-02	West Med	33.45	-30.19	3-Mar-02	East Med	33.52	-23.07	2-May-02	Central Med	38.14	-7.49
3-Jan-02	West Med	32.58	-25.37	4-Mar-02	East Med	32.38	-28.19	3-May-02	Central Med	38.18	-6.10
4-Jan-02	West Med	34.29	-21.25	5-Mar-02	East Med	34.09	-28.02	4-May-02	Central Med	38.28	-4.43
5-Jan-02	West Med	35.52	-13.48	6-Mar-02	East Med	34.19	-29.40	5-May-02	Central Med	38.33	-3.03
6-Jan-02	West Med	39.04	-6.49	7-Mar-02	East Med	34.49	-28.28	6-May-02	Central Med	37.26	-1.26
7-Jan-02	West Med	42.38	-6.15	8-Mar-02	East Med	34.59	-29.57	7-May-02	Valencia	39.26	0.17
8-Jan-02	Toulon	42.56	-6.15	9-Mar-02	East Med	36.05	-28.40	8-May-02	Valencia	39.26	0.17
9-Jan-02	Toulon	42.56	-6.15	10-Mar-02	Marmaris	36.46	-28.30	9-May-02	Valencia	39.26	0.17
10-Jan-02	Toulon	42.56	-6.15	11-Mar-02	Marmaris	36.46	-28.30	10-May-02	Valencia	39.26	0.17
11-Jan-02	West Med	37.48	-10.14	12-Mar-02	Marmaris	36.46	-28.30	11-May-02	West Med	38.20	-1.06
12-Jan-02	West Med	35.12	-17.34	13-Mar-02	East Med	35.49	-28.58	12-May-02	West Med	38.00	-1.50
13-Jan-02	East Med	36.57	-11.44	14-Mar-02	East Med	34.55	-30.45	13-May-02	West Med	38.56	-4.02
14-Jan-02	East Med	38.33	-7.27	15-Mar-02	East Med	34.11	-31.11	14-May-02	West Med	37.48	-5.03
15-Jan-02	East Med	40.22	-5.49	16-Mar-02	East Med	33.24	-30.17	15-May-02	West Med	37.43	-3.29
16-Jan-02	East Med	38.33	-2.41	17-Mar-02	East Med	33.26	-27.43	16-May-02	West Med	37.24	-0.23
17-Jan-02	East Med	37.23	-0.54	18-Mar-02	East Med	33.52	-22.58	17-May-02	West Med	36.00	2.37
18-Jan-02	East Med	37.39	-3.11	19-Mar-02	East Med	34.22	-20.32	18-May-02	Gibraltar	35.95	5.75
19-Jan-02	East Med	37.29	-11.18	20-Mar-02	East Med	35.34	-20.28	19-May-02	Atlantic	38.12	13.05
20-Jan-02	East Med	35.19	-18.47	21-Mar-02	East Med	35.42	-22.57	20-May-02	Atlantic	40.02	21.01
21-Jan-02	Souda Bay	35.48	-24.18	22-Mar-02	East Med	35.58	-24.53	21-May-02	Atlantic	41.18	29.17
22-Jan-02	Souda Bay	35.48	-24.18	23-Mar-02	Souda Bay	35.48	-24.18	22-May-02	Atlantic	41.58	37.45
23-Jan-02	Souda Bay	35.48	-24.18	24-Mar-02	Souda Bay	35.48	-24.18	23-May-02	Atlantic	41.58	46.22
24-Jan-02	Souda Bay	35.48	-24.18	25-Mar-02	Souda Bay	35.48	-24.18	24-May-02	Atlantic	41.23	54.57
25-Jan-02	Souda Bay	35.48	-24.18	26-Mar-02	Souda Bay	35.48	-24.18	25-May-02	Atlantic	40.11	63.19
26-Jan-02	East Med	37.29	-11.18	27-Mar-02	Souda Bay	35.48	-24.18	26-May-02	Atlantic	38.29	70.58
27-Jan-02	East Med	35.15	-17.25	28-Mar-02	Souda Bay	35.48	-24.18	27-May-02	Atlantic	37.01	76.02
28-Jan-02	East Med	36.05	-13.05	29-Mar-02	East Med	35.57	-22.27	28-May-02	In Homeport	36.85	76.30
29-Jan-02	East Med	38.30	-10.57	30-Mar-02	East Med	35.48	-20.19	29-May-02	In Homeport	36.85	76.30
30-Jan-02	East Med	39.39	-12.56	31-Mar-02	East Med	35.42	-18.00	30-May-02	In Homeport	36.85	76.30
31-Jan-02	East Med	38.23	-9.23	1-Apr-02	East Med	35.32	-14.28	31-May-02	In Homeport	36.85	76.30
1-Feb-02	East Med	38.30	-5.19	2-Apr-02	East Med	34.46	-16.26	1-Jun-02	In Homeport	36.85	76.30
2-Feb-02	East Med	38.01	-9.06	3-Apr-02	East Med	34.22	-13.50	2-Jun-02	In Homeport	36.85	76.30
3-Feb-02	East Med	36.08	-12.48	4-Apr-02	East Med	36.11	-12.35	3-Jun-02	In Homeport	36.85	76.30
4-Feb-02	East Med	36.05	-15.09	5-Apr-02	East Med	36.37	-18.10	4-Jun-02	In Homeport	36.85	76.30
5-Feb-02	Augusta Bay	37.19	-15.22	6-Apr-02	East Med	37.47	-18.19	5-Jun-02	In Homeport	36.85	76.30
6-Feb-02	Augusta Bay	37.19	-15.22	7-Apr-02	East Med	36.55	-18.53	6-Jun-02	In Homeport	36.85	76.30
7-Feb-02	Augusta Bay	37.19	-15.22	8-Apr-02	Central Med	36.19	-12.16	7-Jun-02	In Homeport	36.85	76.30
8-Feb-02	Med	37.55	-7.36	9-Apr-02	Augusta Bay	37.19	-15.22	8-Jun-02	In Homeport	36.85	76.30
9-Feb-02	Med	37.13	-0.24	10-Apr-02	Augusta Bay	37.19	-15.22	9-Jun-02	In Homeport	36.85	76.30
10-Feb-02	Med	35.45	3.31	11-Apr-02	Augusta Bay	37.19	-15.22	10-Jun-02	In Homeport	36.85	76.30
11-Feb-02	Gibraltar	35.95	5.75	12-Apr-02	Central Med	36.13	-13.24	11-Jun-02	In Homeport	36.85	76.30
12-Feb-02	Rota	36.62	6.35	13-Apr-02	East Med	36.29	-16.17	12-Jun-02	In Homeport	36.85	76.30
13-Feb-02	Rota	36.62	6.35	14-Apr-02	East Med	35.43	-20.06	13-Jun-02	In Homeport	36.85	76.30
14-Feb-02	Rota	36.62	6.35	15-Apr-02	East Med	34.32	-22.35	14-Jun-02	In Homeport	36.85	76.30
15-Feb-02	Atlantic	34.12	8.51	16-Apr-02	East Med	34.22	-25.28	15-Jun-02	In Homeport	36.85	76.30
16-Feb-02	Atlantic	35.15	7.55	17-Apr-02	East Med	34.12	-27.30	16-Jun-02	In Homeport	36.85	76.30
17-Feb-02	Atlantic	35.15	7.55	18-Apr-02	East Med	33.49	-24.50	17-Jun-02	In Homeport	36.85	76.30
18-Feb-02	Atlantic	35.15	7.55	19-Apr-02	East Med	33.52	-18.21	18-Jun-02	In Homeport	36.85	76.30
19-Feb-02	Rota	36.62	6.35	20-Apr-02	East Med	35.05	-17.25	19-Jun-02	In Homeport	36.85	76.30
20-Feb-02	Rota	36.62	6.35	21-Apr-02	East Med	36.11	-13.45	20-Jun-02	In Homeport	36.85	76.30
21-Feb-02	Atlantic	34.12	8.51	22-Apr-02	Central Med	37.42	-11.10	21-Jun-02	In Homeport	36.85	76.30
22-Feb-02	Atlantic	35.15	7.55	23-Apr-02	Central Med	38.58	-11.22	22-Jun-02	In Homeport	36.85	76.30
23-Feb-02	Atlantic	34.12	8.51	24-Apr-02	Central Med	40.10	-11.05	23-Jun-02	In Homeport	36.85	76.30
24-Feb-02	Gibraltar	35.95	5.75	25-Apr-02	Central Med	39.45	-12.39	24-Jun-02	In Homeport	36.85	76.30
25-Feb-02	Med	36.21	2.05	26-Apr-02	Central Med	38.17	-7.55	25-Jun-02	In Homeport	36.85	76.30
26-Feb-02	Med	37.26	0.33	27-Apr-02	Central Med	39.20	-6.23	26-Jun-02	In Homeport	36.85	76.30
27-Feb-02	Med	38.04	-3.24	28-Apr-02	Central Med	38.10	-7.38	27-Jun-02	In Homeport	36.85	76.30
28-Feb-02	East Med	38.07	-8.31	29-Apr-02	Central Med	37.19	-11.14	28-Jun-02	In Homeport	36.85	76.30
1-Mar-02	East Med	36.28	-13.26	30-Apr-02	Cagliari	39.11	-9.14	29-Jun-02	In Homeport	36.85	76.30
								30-Jun-02	In Homeport	36.85	76.30

J. BATTLE GROUP 10 (BG10)

Battle Group 10
Surface Strike Group (SSG) from Norfolk
USS Monterey (CG); USS Ramage (DDG); USS Ross (DDG)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	36.85	76.30	2-Mar-02	In Homeport	36.85	76.30	1-May-02	Atlantic	37.01	76.02
2-Jan-02	In Homeport	36.85	76.30	3-Mar-02	In Homeport	36.85	76.30	2-May-02	Atlantic	38.29	70.58
3-Jan-02	In Homeport	36.85	76.30	4-Mar-02	In Homeport	36.85	76.30	3-May-02	Atlantic	40.11	63.19
4-Jan-02	In Homeport	36.85	76.30	5-Mar-02	In Homeport	36.85	76.30	4-May-02	Atlantic	41.23	54.57
5-Jan-02	In Homeport	36.85	76.30	6-Mar-02	In Homeport	36.85	76.30	5-May-02	Atlantic	41.58	46.22
6-Jan-02	In Homeport	36.85	76.30	7-Mar-02	In Homeport	36.85	76.30	6-May-02	Atlantic	41.58	37.45
7-Jan-02	In Homeport	36.85	76.30	8-Mar-02	In Homeport	36.85	76.30	7-May-02	Atlantic	41.18	29.17
8-Jan-02	In Homeport	36.85	76.30	9-Mar-02	In Homeport	36.85	76.30	8-May-02	Atlantic	40.02	21.01
9-Jan-02	In Homeport	36.85	76.30	10-Mar-02	In Homeport	36.85	76.30	9-May-02	Atlantic	38.12	13.05
10-Jan-02	In Homeport	36.85	76.30	11-Mar-02	In Homeport	36.85	76.30	10-May-02	Gibraltar	35.95	5.75
11-Jan-02	In Homeport	36.85	76.30	12-Mar-02	In Homeport	36.85	76.30	11-May-02	Med	36.31	1.27
12-Jan-02	In Homeport	36.85	76.30	13-Mar-02	In Homeport	36.85	76.30	12-May-02	Med	38.04	-0.12
13-Jan-02	In Homeport	36.85	76.30	14-Mar-02	In Homeport	36.85	76.30	13-May-02	Med	39.48	-1.20
14-Jan-02	In Homeport	36.85	76.30	15-Mar-02	In Homeport	36.85	76.30	14-May-02	Med	41.38	-4.15
15-Jan-02	In Homeport	36.85	76.30	16-Mar-02	In Homeport	36.85	76.30	15-May-02	Med	41.59	-6.45
16-Jan-02	In Homeport	36.85	76.30	17-Mar-02	In Homeport	36.85	76.30	16-May-02	Med	40.28	-7.15
17-Jan-02	In Homeport	36.85	76.30	18-Mar-02	In Homeport	36.85	76.30	17-May-02	Med	38.20	-7.36
18-Jan-02	In Homeport	36.85	76.30	19-Mar-02	In Homeport	36.85	76.30	18-May-02	Med	39.57	-6.19
19-Jan-02	In Homeport	36.85	76.30	20-Mar-02	In Homeport	36.85	76.30	19-May-02	Med	41.05	-4.41
20-Jan-02	In Homeport	36.85	76.30	21-Mar-02	In Homeport	36.85	76.30	20-May-02	Med	39.14	-5.15
21-Jan-02	In Homeport	36.85	76.30	22-Mar-02	In Homeport	36.85	76.30	21-May-02	Med	38.01	-3.11
22-Jan-02	In Homeport	36.85	76.30	23-Mar-02	In Homeport	36.85	76.30	22-May-02	Med	37.00	0.23
23-Jan-02	In Homeport	36.85	76.30	24-Mar-02	In Homeport	36.85	76.30	23-May-02	Med	35.52	2.56
24-Jan-02	In Homeport	36.85	76.30	25-Mar-02	In Homeport	36.85	76.30	24-May-02	Gibraltar	35.95	5.75
25-Jan-02	In Homeport	36.85	76.30	26-Mar-02	In Homeport	36.85	76.30	25-May-02	Atlantic	38.14	12.07
26-Jan-02	In Homeport	36.85	76.30	27-Mar-02	In Homeport	36.85	76.30	26-May-02	Atlantic	39.51	18.45
27-Jan-02	In Homeport	36.85	76.30	28-Mar-02	In Homeport	36.85	76.30	27-May-02	Atlantic	44.44	17.58
28-Jan-02	In Homeport	36.85	76.30	29-Mar-02	In Homeport	36.85	76.30	28-May-02	Atlantic	43.52	13.07
29-Jan-02	In Homeport	36.85	76.30	30-Mar-02	In Homeport	36.85	76.30	29-May-02	Atlantic	46.06	9.29
30-Jan-02	In Homeport	36.85	76.30	31-Mar-02	In Homeport	36.85	76.30	30-May-02	Atlantic	46.56	5.47
31-Jan-02	In Homeport	36.85	76.30	1-Apr-02	In Homeport	36.85	76.30	31-May-02	Atlantic	45.18	3.52
1-Feb-02	In Homeport	36.85	76.30	2-Apr-02	In Homeport	36.85	76.30	1-Jun-02	Atlantic	44.53	6.56
2-Feb-02	In Homeport	36.85	76.30	3-Apr-02	In Homeport	36.85	76.30	2-Jun-02	Atlantic	42.32	10.42
3-Feb-02	In Homeport	36.85	76.30	4-Apr-02	In Homeport	36.85	76.30	3-Jun-02	Atlantic	39.26	10.25
4-Feb-02	In Homeport	36.85	76.30	5-Apr-02	In Homeport	36.85	76.30	4-Jun-02	Atlantic	37.19	11.50
5-Feb-02	In Homeport	36.85	76.30	6-Apr-02	In Homeport	36.85	76.30	5-Jun-02	Atlantic	31.12	16.11
6-Feb-02	In Homeport	36.85	76.30	7-Apr-02	In Homeport	36.85	76.30	6-Jun-02	Atlantic	26.14	20.23
7-Feb-02	In Homeport	36.85	76.30	8-Apr-02	In Homeport	36.85	76.30	7-Jun-02	Atlantic	33.05	19.49
8-Feb-02	In Homeport	36.85	76.30	9-Apr-02	In Homeport	36.85	76.30	8-Jun-02	Atlantic	37.03	13.50
9-Feb-02	In Homeport	36.85	76.30	10-Apr-02	In Homeport	36.85	76.30	9-Jun-02	Atlantic	39.51	10.38
10-Feb-02	In Homeport	36.85	76.30	11-Apr-02	In Homeport	36.85	76.30	10-Jun-02	Atlantic	43.05	10.04
11-Feb-02	In Homeport	36.85	76.30	12-Apr-02	In Homeport	36.85	76.30	11-Jun-02	Atlantic	45.15	7.13
12-Feb-02	In Homeport	36.85	76.30	13-Apr-02	In Homeport	36.85	76.30	12-Jun-02	Atlantic	41.23	11.59
13-Feb-02	In Homeport	36.85	76.30	14-Apr-02	In Homeport	36.85	76.30	13-Jun-02	Atlantic	36.15	11.20
14-Feb-02	In Homeport	36.85	76.30	15-Apr-02	In Homeport	36.85	76.30	14-Jun-02	Gibraltar	35.95	5.75
15-Feb-02	In Homeport	36.85	76.30	16-Apr-02	In Homeport	36.85	76.30	15-Jun-02	Med	36.31	1.22
16-Feb-02	In Homeport	36.85	76.30	17-Apr-02	In Homeport	36.85	76.30	16-Jun-02	Med	38.01	-2.16
17-Feb-02	In Homeport	36.85	76.30	18-Apr-02	In Homeport	36.85	76.30	17-Jun-02	Med	38.07	-5.53
18-Feb-02	In Homeport	36.85	76.30	19-Apr-02	In Homeport	36.85	76.30	18-Jun-02	Med	40.25	-4.49
19-Feb-02	In Homeport	36.85	76.30	20-Apr-02	In Homeport	36.85	76.30	19-Jun-02	Med	39.48	-6.40
20-Feb-02	In Homeport	36.85	76.30	21-Apr-02	In Homeport	36.85	76.30	20-Jun-02	Med	38.07	-8.19
21-Feb-02	In Homeport	36.85	76.30	22-Apr-02	In Homeport	36.85	76.30	21-Jun-02	Med	37.35	-11.14
22-Feb-02	In Homeport	36.85	76.30	23-Apr-02	In Homeport	36.85	76.30	22-Jun-02	Med	35.32	-13.09
23-Feb-02	In Homeport	36.85	76.30	24-Apr-02	In Homeport	36.85	76.30	23-Jun-02	Med	33.52	-19.59
24-Feb-02	In Homeport	36.85	76.30	25-Apr-02	In Homeport	36.85	76.30	24-Jun-02	Med	32.58	-25.45
25-Feb-02	In Homeport	36.85	76.30	26-Apr-02	In Homeport	36.85	76.30	25-Jun-02	Med	33.42	-28.45
26-Feb-02	In Homeport	36.85	76.30	27-Apr-02	In Homeport	36.85	76.30	26-Jun-02	Med	33.42	-31.10
27-Feb-02	In Homeport	36.85	76.30	28-Apr-02	In Homeport	36.85	76.30	27-Jun-02	Med	34.02	-27.19
28-Feb-02	In Homeport	36.85	76.30	29-Apr-02	In Homeport	36.85	76.30	28-Jun-02	Med	34.02	-23.46
1-Mar-02	In Homeport	36.85	76.30	30-Apr-02	In Homeport	36.85	76.30	29-Jun-02	Med	36.24	-19.34
								30-Jun-02	Med	35.35	-17.00

K. BATTLE GROUP 11 (BG11)

Battle Group 11
Baltic Operations (BALTOPS) from Norfolk
USS Oscar Austin (DDG); USS Donald Cook (DDG); USS Hawes (FFG)

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	36.85	76.30	2-Mar-02	Baltic Sea	54.38	-15.11	1-May-02	In Homeport	36.85	76.30
2-Jan-02	In Homeport	36.85	76.30	3-Mar-02	Baltic Sea	55.46	-16.45	2-May-02	In Homeport	36.85	76.30
3-Jan-02	In Homeport	36.85	76.30	4-Mar-02	Baltic Sea	55.54	-19.19	3-May-02	In Homeport	36.85	76.30
4-Jan-02	In Homeport	36.85	76.30	5-Mar-02	Baltic Sea	56.17	-18.36	4-May-02	In Homeport	36.85	76.30
5-Jan-02	In Homeport	36.85	76.30	6-Mar-02	Baltic Sea	55.28	-20.06	5-May-02	In Homeport	36.85	76.30
6-Jan-02	In Homeport	36.85	76.30	7-Mar-02	Goynia	54.34	-18.38	6-May-02	In Homeport	36.85	76.30
7-Jan-02	In Homeport	36.85	76.30	8-Mar-02	Goynia	54.34	-18.38	7-May-02	In Homeport	36.85	76.30
8-Jan-02	In Homeport	36.85	76.30	9-Mar-02	Baltic Sea	55.14	-19.57	8-May-02	In Homeport	36.85	76.30
9-Jan-02	In Homeport	36.85	76.30	10-Mar-02	Baltic Sea	57.00	-20.19	9-May-02	In Homeport	36.85	76.30
10-Jan-02	In Homeport	36.85	76.30	11-Mar-02	Baltic Sea	56.28	-17.34	10-May-02	In Homeport	36.85	76.30
11-Jan-02	In Homeport	36.85	76.30	12-Mar-02	Baltic Sea	56.04	-18.51	11-May-02	In Homeport	36.85	76.30
12-Jan-02	In Homeport	36.85	76.30	13-Mar-02	Baltic Sea	55.08	-16.32	12-May-02	In Homeport	36.85	76.30
13-Jan-02	In Homeport	36.85	76.30	14-Mar-02	Baltic Sea	54.39	-15.39	13-May-02	In Homeport	36.85	76.30
14-Jan-02	In Homeport	36.85	76.30	15-Mar-02	Baltic Sea	55.41	-15.00	14-May-02	In Homeport	36.85	76.30
15-Jan-02	In Homeport	36.85	76.30	16-Mar-02	Baltic Sea	55.56	-18.00	15-May-02	In Homeport	36.85	76.30
16-Jan-02	In Homeport	36.85	76.30	17-Mar-02	Baltic Sea	54.39	-15.39	16-May-02	In Homeport	36.85	76.30
17-Jan-02	In Homeport	36.85	76.30	18-Mar-02	Baltic Sea	55.07	-12.52	17-May-02	In Homeport	36.85	76.30
18-Jan-02	In Homeport	36.85	76.30	19-Mar-02	Copenhagen	55.46	-12.41	18-May-02	In Homeport	36.85	76.30
19-Jan-02	In Homeport	36.85	76.30	20-Mar-02	Copenhagen	55.46	-12.41	19-May-02	In Homeport	36.85	76.30
20-Jan-02	In Homeport	36.85	76.30	21-Mar-02	Copenhagen	55.46	-12.41	20-May-02	In Homeport	36.85	76.30
21-Jan-02	In Homeport	36.85	76.30	22-Mar-02	Copenhagen	55.46	-12.41	21-May-02	In Homeport	36.85	76.30
22-Jan-02	In Homeport	36.85	76.30	23-Mar-02	North Sea	56.23	-11.56	22-May-02	In Homeport	36.85	76.30
23-Jan-02	In Homeport	36.85	76.30	24-Mar-02	North Sea	56.42	-6.02	23-May-02	In Homeport	36.85	76.30
24-Jan-02	In Homeport	36.85	76.30	25-Mar-02	North Sea	54.51	-4.22	24-May-02	In Homeport	36.85	76.30
25-Jan-02	In Homeport	36.85	76.30	26-Mar-02	North Sea	53.43	-3.22	25-May-02	In Homeport	36.85	76.30
26-Jan-02	In Homeport	36.85	76.30	27-Mar-02	North Sea	52.01	-3.07	26-May-02	In Homeport	36.85	76.30
27-Jan-02	In Homeport	36.85	76.30	28-Mar-02	Rotterdam	51.95	-4.45	27-May-02	In Homeport	36.85	76.30
28-Jan-02	In Homeport	36.85	76.30	29-Mar-02	Rotterdam	51.95	-4.45	28-May-02	In Homeport	36.85	76.30
29-Jan-02	In Homeport	36.85	76.30	30-Mar-02	Rotterdam	51.95	-4.45	29-May-02	In Homeport	36.85	76.30
30-Jan-02	In Homeport	36.85	76.30	31-Mar-02	Rotterdam	51.95	-4.45	30-May-02	In Homeport	36.85	76.30
31-Jan-02	In Homeport	36.85	76.30	1-Apr-02	Atlantic	48.54	5.02	31-May-02	In Homeport	36.85	76.30
1-Feb-02	In Homeport	36.85	76.30	2-Apr-02	Atlantic	43.40	10.12	1-Jun-02	In Homeport	36.85	76.30
2-Feb-02	In Homeport	36.85	76.30	3-Apr-02	Lisbon	38.20	8.51	2-Jun-02	In Homeport	36.85	76.30
3-Feb-02	In Homeport	36.85	76.30	4-Apr-02	Lisbon	38.20	8.51	3-Jun-02	In Homeport	36.85	76.30
4-Feb-02	In Homeport	36.85	76.30	5-Apr-02	Lisbon	38.20	8.51	4-Jun-02	In Homeport	36.85	76.30
5-Feb-02	In Homeport	36.85	76.30	6-Apr-02	Atlantic	40.03	15.58	5-Jun-02	In Homeport	36.85	76.30
6-Feb-02	In Homeport	36.85	76.30	7-Apr-02	Atlantic	41.20	23.14	6-Jun-02	In Homeport	36.85	76.30
7-Feb-02	In Homeport	36.85	76.30	8-Apr-02	Atlantic	42.11	31.25	7-Jun-02	In Homeport	36.85	76.30
8-Feb-02	In Homeport	36.85	76.30	9-Apr-02	Atlantic	42.32	40.02	8-Jun-02	In Homeport	36.85	76.30
9-Feb-02	Atlantic	37.01	76.02	10-Apr-02	Atlantic	42.11	48.39	9-Jun-02	In Homeport	36.85	76.30
10-Feb-02	Atlantic	40.24	69.07	11-Apr-02	Atlantic	41.11	57.07	10-Jun-02	In Homeport	36.85	76.30
11-Feb-02	Atlantic	43.48	61.43	12-Apr-02	Atlantic	39.39	65.06	11-Jun-02	In Homeport	36.85	76.30
12-Feb-02	Atlantic	46.27	53.23	13-Apr-02	Atlantic	37.32	72.47	12-Jun-02	In Homeport	36.85	76.30
13-Feb-02	Atlantic	48.44	44.29	14-Apr-02	Atlantic	36.47	75.13	13-Jun-02	In Homeport	36.85	76.30
14-Feb-02	Atlantic	50.08	34.48	15-Apr-02	Atlantic	36.53	75.52	14-Jun-02	In Homeport	36.85	76.30
15-Feb-02	Atlantic	50.44	24.46	16-Apr-02	In Homeport	36.85	76.30	15-Jun-02	In Homeport	36.85	76.30
16-Feb-02	Atlantic	50.29	15.30	17-Apr-02	In Homeport	36.85	76.30	16-Jun-02	In Homeport	36.85	76.30
17-Feb-02	Atlantic	49.42	7.40	18-Apr-02	In Homeport	36.85	76.30	17-Jun-02	In Homeport	36.85	76.30
18-Feb-02	Atlantic	50.10	1.07	19-Apr-02	In Homeport	36.85	76.30	18-Jun-02	In Homeport	36.85	76.30
19-Feb-02	Atlantic	51.27	-2.35	20-Apr-02	In Homeport	36.85	76.30	19-Jun-02	In Homeport	36.85	76.30
20-Feb-02	Atlantic	56.02	-5.32	21-Apr-02	In Homeport	36.85	76.30	20-Jun-02	In Homeport	36.85	76.30
21-Feb-02	Atlantic	57.08	-8.08	22-Apr-02	In Homeport	36.85	76.30	21-Jun-02	In Homeport	36.85	76.30
22-Feb-02	Atlantic	56.57	-11.14	23-Apr-02	In Homeport	36.85	76.30	22-Jun-02	In Homeport	36.85	76.30
23-Feb-02	A/No UNREP	55.22	-10.42	24-Apr-02	In Homeport	36.85	76.30	23-Jun-02	In Homeport	36.85	76.30
24-Feb-02	Kiel	54.23	-10.44	25-Apr-02	In Homeport	36.85	76.30	24-Jun-02	In Homeport	36.85	76.30
25-Feb-02	Kiel	54.23	-10.44	26-Apr-02	In Homeport	36.85	76.30	25-Jun-02	In Homeport	36.85	76.30
26-Feb-02	Kiel	54.23	-10.44	27-Apr-02	In Homeport	36.85	76.30	26-Jun-02	In Homeport	36.85	76.30
27-Feb-02	Kiel	54.23	-10.44	28-Apr-02	In Homeport	36.85	76.30	27-Jun-02	In Homeport	36.85	76.30
28-Feb-02	Baltic Sea	54.26	-12.01	29-Apr-02	In Homeport	36.85	76.30	28-Jun-02	In Homeport	36.85	76.30
1-Mar-02	Baltic Sea	55.01	-13.48	30-Apr-02	In Homeport	36.85	76.30	29-Jun-02	In Homeport	36.85	76.30
								30-Jun-02	In Homeport	36.85	76.30

L. BATTLE GROUP 12 (BG12)

Battle Group 12 Cooperation Afloat Readiness and Training (CARAT) from San Diego USS Vincennes (CG); USS Rushmore ((LSD); USS George Philip (FFG)											
Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	32.72	117.18	2-Mar-02	In Homeport	32.72	117.18	1-May-02	Enr Brunei	12.52	-116.17
2-Jan-02	In Homeport	32.72	117.18	3-Mar-02	In Homeport	32.72	117.18	2-May-02	Enr Brunei	9.34	-113.18
3-Jan-02	In Homeport	32.72	117.18	4-Mar-02	In Homeport	32.72	117.18	3-May-02	Enr Brunei	6.13	-112.27
4-Jan-02	In Homeport	32.72	117.18	5-Mar-02	In Homeport	32.72	117.18	4-May-02	Enr Brunei	4.55	-114.28
5-Jan-02	In Homeport	32.72	117.18	6-Mar-02	In Homeport	32.72	117.18	5-May-02	Brunei	4.55	-114.28
6-Jan-02	In Homeport	32.72	117.18	7-Mar-02	In Homeport	32.72	117.18	6-May-02	Brunei	4.55	-114.28
7-Jan-02	In Homeport	32.72	117.18	8-Mar-02	In Homeport	32.72	117.18	7-May-02	Brunei	4.55	-114.28
8-Jan-02	In Homeport	32.72	117.18	9-Mar-02	In Homeport	32.72	117.18	8-May-02	Brunei	4.55	-114.28
9-Jan-02	In Homeport	32.72	117.18	10-Mar-02	In Homeport	32.72	117.18	9-May-02	South China Sea	9.32	-112.10
10-Jan-02	In Homeport	32.72	117.18	11-Mar-02	In Homeport	32.72	117.18	10-May-02	Brunei	4.55	-114.28
11-Jan-02	In Homeport	32.72	117.18	12-Mar-02	In Homeport	32.72	117.18	11-May-02	Brunei	4.55	-114.28
12-Jan-02	In Homeport	32.72	117.18	13-Mar-02	In Homeport	32.72	117.18	12-May-02	Brunei	4.55	-114.28
13-Jan-02	In Homeport	32.72	117.18	14-Mar-02	In Homeport	32.72	117.18	13-May-02	Enr Bali	3.10	-110.10
14-Jan-02	In Homeport	32.72	117.18	15-Mar-02	In Homeport	32.72	117.18	14-May-02	Enr Bali	-1.11	-108.34
15-Jan-02	In Homeport	32.72	117.18	16-Mar-02	In Homeport	32.72	117.18	15-May-02	Enr Bali	-4.19	-110.36
16-Jan-02	In Homeport	32.72	117.18	17-Mar-02	In Homeport	32.72	117.18	16-May-02	Enr Bali	-5.49	-113.44
17-Jan-02	In Homeport	32.72	117.18	18-Mar-02	In Homeport	32.72	117.18	17-May-02	Enr Bali	-7.14	-116.15
18-Jan-02	In Homeport	32.72	117.18	19-Mar-02	In Homeport	32.72	117.18	18-May-02	Bali	-8.46	-115.09
19-Jan-02	In Homeport	32.72	117.18	20-Mar-02	In Homeport	32.72	117.18	19-May-02	Bali	-8.46	-115.09
20-Jan-02	In Homeport	32.72	117.18	21-Mar-02	In Homeport	32.72	117.18	20-May-02	Bali	-8.46	-115.09
21-Jan-02	In Homeport	32.72	117.18	22-Mar-02	In Homeport	32.72	117.18	21-May-02	Bali	-8.46	-115.09
22-Jan-02	In Homeport	32.72	117.18	23-Mar-02	In Homeport	32.72	117.18	22-May-02	Bali	-8.46	-115.09
23-Jan-02	In Homeport	32.72	117.18	24-Mar-02	In Homeport	32.72	117.18	23-May-02	Enr Surbaya	-7.06	-115.26
24-Jan-02	In Homeport	32.72	117.18	25-Mar-02	In Homeport	32.72	117.18	24-May-02	Surbaya	-7.26	-112.57
25-Jan-02	In Homeport	32.72	117.18	26-Mar-02	In Homeport	32.72	117.18	25-May-02	Surbaya	-7.26	-112.57
26-Jan-02	In Homeport	32.72	117.18	27-Mar-02	In Homeport	32.72	117.18	26-May-02	Surbaya	-7.26	-112.57
27-Jan-02	In Homeport	32.72	117.18	28-Mar-02	In Homeport	32.72	117.18	27-May-02	Surbaya	-7.26	-112.57
28-Jan-02	In Homeport	32.72	117.18	29-Mar-02	In Homeport	32.72	117.18	28-May-02	Surbaya	-7.26	-112.57
29-Jan-02	In Homeport	32.72	117.18	30-Mar-02	In Homeport	32.72	117.18	29-May-02	Surbaya	-7.26	-112.57
30-Jan-02	In Homeport	32.72	117.18	31-Mar-02	In Homeport	32.72	117.18	30-May-02	Java Sea	-3.50	-110.16
31-Jan-02	In Homeport	32.72	117.18	1-Apr-02	In Homeport	32.72	117.18	31-May-02	Java Sea	-0.02	-107.32
1-Feb-02	In Homeport	32.72	117.18	2-Apr-02	In Homeport	32.72	117.18	1-Jun-02	Java Sea	3.08	-105.58
2-Feb-02	In Homeport	32.72	117.18	3-Apr-02	In Homeport	32.72	117.18	2-Jun-02	Enr Sattahip	4.51	-105.05
3-Feb-02	In Homeport	32.72	117.18	4-Apr-02	In Homeport	32.72	117.18	3-Jun-02	Enr Sattahip	6.46	-103.03
4-Feb-02	In Homeport	32.72	117.18	5-Apr-02	In Homeport	32.72	117.18	4-Jun-02	Enr Sattahip	8.42	-101.59
5-Feb-02	In Homeport	32.72	117.18	6-Apr-02	East Pac	32.37	118.00	5-Jun-02	Enr Sattahip	10.29	-101.12
6-Feb-02	In Homeport	32.72	117.18	7-Apr-02	East Pac	32.27	118.34	6-Jun-02	Enr Sattahip	11.57	-100.38
7-Feb-02	In Homeport	32.72	117.18	8-Apr-02	East Pac	30.51	123.59	7-Jun-02	Enr Sattahip	12.36	-100.50
8-Feb-02	In Homeport	32.72	117.18	9-Apr-02	East Pac	28.44	130.49	8-Jun-02	Sattahip	12.40	-100.50
9-Feb-02	In Homeport	32.72	117.18	10-Apr-02	East Pac	26.35	137.39	9-Jun-02	Sattahip	12.40	-100.50
10-Feb-02	In Homeport	32.72	117.18	11-Apr-02	East Pac	24.57	144.34	10-Jun-02	Sattahip	12.40	-100.50
11-Feb-02	In Homeport	32.72	117.18	12-Apr-02	East Pac	23.14	151.20	11-Jun-02	Sattahip	12.40	-100.50
12-Feb-02	In Homeport	32.72	117.18	13-Apr-02	Pearl	21.40	158.17	12-Jun-02	Sattahip	12.40	-100.50
13-Feb-02	In Homeport	32.72	117.18	14-Apr-02	Pearl	21.40	158.17	13-Jun-02	Gulf of Thailand	11.07	-100.46
14-Feb-02	In Homeport	32.72	117.18	15-Apr-02	Pearl	21.40	158.17	14-Jun-02	Gulf of Thailand	8.52	-100.52
15-Feb-02	In Homeport	32.72	117.18	16-Apr-02	West Pac	23.23	164.14	15-Jun-02	Gulf of Thailand	6.09	-106.43
16-Feb-02	In Homeport	32.72	117.18	17-Apr-02	West Pac	25.14	171.03	16-Jun-02	Gulf of Thailand	5.21	-107.23
17-Feb-02	In Homeport	32.72	117.18	18-Apr-02	West Pac	26.45	177.57	17-Jun-02	Enr Kuantan	4.31	-109.25
18-Feb-02	In Homeport	32.72	117.18	19-Apr-02	Enr Okinawa	27.53	-174.55	18-Jun-02	Enr Kuantan	3.28	-106.34
19-Feb-02	In Homeport	32.72	117.18	20-Apr-02	Enr Okinawa	28.43	-167.40	19-Jun-02	Enr Kuantan	3.52	-103.31
20-Feb-02	In Homeport	32.72	117.18	21-Apr-02	Enr Okinawa	29.08	-160.50	20-Jun-02	Kuantan	3.52	-103.31
21-Feb-02	In Homeport	32.72	117.18	22-Apr-02	Enr Okinawa	29.11	-153.25	21-Jun-02	Kuantan	3.52	-103.31
22-Feb-02	In Homeport	32.72	117.18	23-Apr-02	Enr Okinawa	28.47	-146.18	22-Jun-02	Kuantan	3.52	-103.31
23-Feb-02	In Homeport	32.72	117.18	24-Apr-02	Enr Okinawa	28.18	-139.45	23-Jun-02	Kuantan	3.52	-103.31
24-Feb-02	In Homeport	32.72	117.18	25-Apr-02	Enr Okinawa	27.21	-133.20	24-Jun-02	Kuantan	3.52	-103.31
25-Feb-02	In Homeport	32.72	117.18	26-Apr-02	Enr Okinawa	26.14	-128.00	25-Jun-02	South China Sea	1.57	-105.13
26-Feb-02	In Homeport	32.72	117.18	27-Apr-02	Okinawa	26.10	-127.51	26-Jun-02	South China Sea	0.20	-106.06
27-Feb-02	In Homeport	32.72	117.18	28-Apr-02	Okinawa	26.10	-127.51	27-Jun-02	South China Sea	-0.45	-106.56
28-Feb-02	In Homeport	32.72	117.18	29-Apr-02	Enr Brunei	21.37	-123.59	28-Jun-02	South China Sea	2.30	-108.08
1-Mar-02	In Homeport	32.72	117.18	30-Apr-02	Enr Brunei	18.35	-118.43	29-Jun-02	South China Sea	0.04	-105.45
								30-Jun-02	South China Sea	2.30	-108.08

M. BATTLE GROUP 13 (BG13)

Battle Group 13
Littoral Combat Ship (LCS) Squadron from Norfolk
LCS#1; LCS#2; LCS#3

Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON	Calendar	Geographic	LAT	LON
1-Jan-02	In Homeport	36.85	76.30	2-Mar-02	Rota	36.62	6.35	1-May-02	East Atlantic	35.15	8.49
2-Jan-02	In Homeport	36.85	76.30	3-Mar-02	Gibraltar	35.95	5.75	2-May-02	East Atlantic	32.07	14.56
3-Jan-02	In Homeport	36.85	76.30	4-Mar-02	Med	37.17	-2.13	3-May-02	East Atlantic	27.26	18.30
4-Jan-02	In Homeport	36.85	76.30	5-Mar-02	Med	37.33	-10.23	4-May-02	East Atlantic	25.49	19.08
5-Jan-02	In Homeport	36.85	76.30	6-Mar-02	Med	35.35	-18.00	5-May-02	East Atlantic	21.10	19.25
6-Jan-02	In Homeport	36.85	76.30	7-Mar-02	Souda Bay	35.48	-24.18	6-May-02	East Atlantic	15.52	19.25
7-Jan-02	In Homeport	36.85	76.30	8-Mar-02	Souda Bay	35.48	-24.18	7-May-02	East Atlantic	11.09	18.26
8-Jan-02	In Homeport	36.85	76.30	9-Mar-02	Souda Bay	35.48	-24.18	8-May-02	East Atlantic	7.32	15.20
9-Jan-02	In Homeport	36.85	76.30	10-Mar-02	East Med	35.57	-22.27	9-May-02	East Atlantic	3.58	12.16
10-Jan-02	Atlantic	37.01	76.02	11-Mar-02	East Med	35.48	-20.19	10-May-02	East Atlantic	2.48	6.51
11-Jan-02	Atlantic	38.29	70.58	12-Mar-02	East Med	35.42	-18.00	11-May-02	East Atlantic	3.16	0.59
12-Jan-02	Atlantic	40.11	63.19	13-Mar-02	East Med	35.32	-14.28	12-May-02	East Atlantic	2.20	-4.41
13-Jan-02	Atlantic	41.23	54.57	14-Mar-02	East Med	34.46	-16.26	13-May-02	East Atlantic	2.34	-2.30
14-Jan-02	Atlantic	41.58	46.22	15-Mar-02	East Med	34.22	-13.50	14-May-02	East Atlantic	0.24	-2.54
15-Jan-02	Atlantic	41.58	37.45	16-Mar-02	East Med	36.11	-12.35	15-May-02	East Atlantic	2.22	-2.22
16-Jan-02	Atlantic	41.18	29.17	17-Mar-02	East Med	36.37	-18.10	16-May-02	East Atlantic	3.04	-3.35
17-Jan-02	Atlantic	40.02	21.01	18-Mar-02	East Med	37.47	-18.19	17-May-02	East Atlantic	1.35	-4.37
18-Jan-02	Atlantic	38.12	13.05	19-Mar-02	East Med	36.55	-18.53	18-May-02	East Atlantic	-0.01	-5.43
19-Jan-02	Rota	36.62	6.35	20-Mar-02	Central Med	36.19	-12.16	19-May-02	East Atlantic	-1.49	-5.49
20-Jan-02	Rota	36.62	6.35	21-Mar-02	Augusta Bay	37.19	-15.22	20-May-02	East Atlantic	-3.06	-4.37
21-Jan-02	Rota	36.62	6.35	22-Mar-02	Augusta Bay	37.19	-15.22	21-May-02	East Atlantic	-4.45	-8.44
22-Jan-02	East Atlantic	35.22	8.13	23-Mar-02	Augusta Bay	37.19	-15.22	22-May-02	East Atlantic	-2.20	-6.53
23-Jan-02	East Atlantic	32.46	11.25	24-Mar-02	Central Med	36.13	-13.24	23-May-02	East Atlantic	0.26	-6.17
24-Jan-02	East Atlantic	30.25	15.41	25-Mar-02	East Med	36.29	-16.17	24-May-02	East Atlantic	0.32	-3.41
25-Jan-02	East Atlantic	26.59	19.40	26-Mar-02	East Med	35.43	-20.06	25-May-02	East Atlantic	2.54	-3.45
26-Jan-02	East Atlantic	26.43	16.52	27-Mar-02	East Med	34.32	-22.35	26-May-02	East Atlantic	2.15	-6.04
27-Jan-02	East Atlantic	22.18	18.43	28-Mar-02	East Med	34.22	-25.28	27-May-02	East Atlantic	2.24	-2.05
28-Jan-02	East Atlantic	16.12	19.00	29-Mar-02	East Med	34.12	-27.30	28-May-02	East Atlantic	2.24	4.11
29-Jan-02	East Atlantic	10.26	18.00	30-Mar-02	East Med	33.49	-24.50	29-May-02	East Atlantic	3.12	9.36
30-Jan-02	East Atlantic	5.53	14.09	31-Mar-02	East Med	33.52	-18.21	30-May-02	East Atlantic	5.53	14.09
31-Jan-02	East Atlantic	3.12	9.36	1-Apr-02	East Med	35.05	-17.25	31-May-02	East Atlantic	10.26	18.00
1-Feb-02	East Atlantic	2.24	4.11	2-Apr-02	East Med	36.11	-13.45	1-Jun-02	East Atlantic	16.12	19.00
2-Feb-02	East Atlantic	2.24	-2.05	3-Apr-02	Central Med	37.42	-11.10	2-Jun-02	East Atlantic	22.18	18.43
3-Feb-02	East Atlantic	2.15	-6.04	4-Apr-02	Central Med	38.58	-11.22	3-Jun-02	East Atlantic	26.43	16.52
4-Feb-02	East Atlantic	2.54	-3.45	5-Apr-02	Central Med	40.10	-11.05	4-Jun-02	East Atlantic	26.59	19.40
5-Feb-02	East Atlantic	0.32	-3.41	6-Apr-02	Central Med	39.45	-12.39	5-Jun-02	East Atlantic	30.25	15.41
6-Feb-02	East Atlantic	0.26	-6.17	7-Apr-02	Central Med	38.17	-7.55	6-Jun-02	East Atlantic	32.46	11.25
7-Feb-02	East Atlantic	-2.2	-6.53	8-Apr-02	Central Med	39.20	-6.23	7-Jun-02	East Atlantic	35.22	8.13
8-Feb-02	East Atlantic	-4.45	-8.44	9-Apr-02	Central Med	38.10	-7.38	8-Jun-02	Rota	36.62	6.35
9-Feb-02	East Atlantic	-3.06	-4.37	10-Apr-02	Central Med	37.19	-11.14	9-Jun-02	Rota	36.62	6.35
10-Feb-02	East Atlantic	-1.49	-5.49	11-Apr-02	Cagliari	39.11	-9.14	10-Jun-02	Atlantic	38.12	13.05
11-Feb-02	East Atlantic	-0.01	-5.43	12-Apr-02	Cagliari	39.11	-9.14	11-Jun-02	Atlantic	40.02	21.01
12-Feb-02	East Atlantic	1.35	-4.37	13-Apr-02	Central Med	38.14	-7.49	12-Jun-02	Atlantic	41.18	29.17
13-Feb-02	East Atlantic	3.04	-3.35	14-Apr-02	Central Med	38.18	-6.10	13-Jun-02	Atlantic	41.58	37.45
14-Feb-02	East Atlantic	2.22	-2.22	15-Apr-02	Central Med	38.28	-4.43	14-Jun-02	Atlantic	41.58	46.22
15-Feb-02	East Atlantic	0.24	-2.54	16-Apr-02	Central Med	38.33	-3.03	15-Jun-02	Atlantic	41.23	54.57
16-Feb-02	East Atlantic	2.34	-2.30	17-Apr-02	Central Med	37.26	-1.26	16-Jun-02	Atlantic	40.11	63.19
17-Feb-02	East Atlantic	2.2	-4.41	18-Apr-02	Valencia	39.26	0.17	17-Jun-02	Atlantic	38.29	70.58
18-Feb-02	East Atlantic	3.16	0.59	19-Apr-02	Valencia	39.26	0.17	18-Jun-02	Atlantic	37.01	76.02
19-Feb-02	East Atlantic	2.48	6.51	20-Apr-02	Valencia	39.26	0.17	19-Jun-02	In Homeport	36.85	76.30
20-Feb-02	East Atlantic	3.58	12.16	21-Apr-02	Valencia	39.26	0.17	20-Jun-02	In Homeport	36.85	76.30
21-Feb-02	East Atlantic	7.32	15.20	22-Apr-02	West Med	38.20	-1.06	21-Jun-02	In Homeport	36.85	76.30
22-Feb-02	East Atlantic	11.09	18.26	23-Apr-02	West Med	38.00	-1.50	22-Jun-02	In Homeport	36.85	76.30
23-Feb-02	East Atlantic	15.52	19.25	24-Apr-02	West Med	38.56	-4.02	23-Jun-02	In Homeport	36.85	76.30
24-Feb-02	East Atlantic	21.1	19.25	25-Apr-02	West Med	37.48	-5.03	24-Jun-02	In Homeport	36.85	76.30
25-Feb-02	East Atlantic	25.49	19.08	26-Apr-02	West Med	37.43	-3.29	25-Jun-02	In Homeport	36.85	76.30
26-Feb-02	East Atlantic	27.26	18.30	27-Apr-02	West Med	37.24	-0.23	26-Jun-02	In Homeport	36.85	76.30
27-Feb-02	East Atlantic	32.07	14.56	28-Apr-02	West Med	36.00	2.37	27-Jun-02	In Homeport	36.85	76.30
28-Feb-02	East Atlantic	35.15	8.49	29-Apr-02	Gibraltar	35.95	5.75	28-Jun-02	In Homeport	36.85	76.30
1-Mar-02	Rota	36.62	6.35	30-Apr-02	Rota	36.62	6.35	29-Jun-02	In Homeport	36.85	76.30
								30-Jun-02	In Homeport	36.85	76.30

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