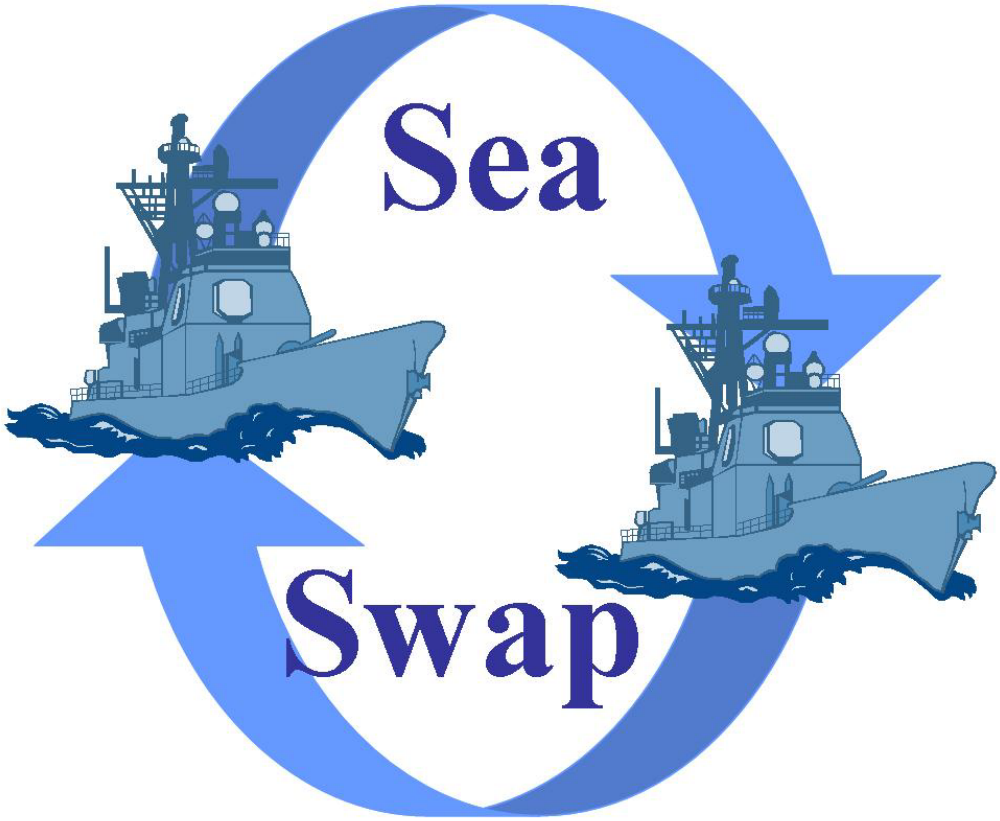

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June 2003

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Executive Summary

In early 2001, the Vice Chief of Naval Operations established a series of task forces to look at various challenges facing the Navy, one of those task forces, dubbed Task Force Sierra, was asked to examine how the Navy should structure itself to ensure it remained an effective forward-deployed force. These were pre-9/11 days and it appeared that defense budgets would remain flat, even without a funding challenge from a new Department of Homeland Security. Flat budgets meant a serious reduction in force structure which, in turn, meant a likely and significant decrease in forward presence. The Navy wanted to ensure this wouldn't happen.

One of the touchstones used by Task Force Sierra was a statement issued by the Chief of Naval Operations. "The possible solution set to this dilemma is small," he wrote, "an increase to our budget top line, a procurement strategy that invests maximum combat capability, acceptance of the operational and strategic implications that flow from a potentially smaller Navy, or some combination of the above." We looked at options for maintaining current levels of presence with a reduced force or increasing forward presence using a stable force. Since then, the CNO has raised the bar and called for a fleet of 375 ships (using a high/low mix). The war on Iraq, during which the Navy and Marine Corps deployed half their forces, resulted in a “reconstitution” dilemma (and transformation opportunity) that has kept the idea of Sea Swap alive. The current Sea Swap experiment is “Sea Swap” in name only. It ignores almost all recommendations made in this report as well as the lessons learned from the past.

Learning from the past

Given the short timeframe we had to develop ideas for Task Force Sierra, we borrowed from the old proverb, "if you want a new idea read an old book." We opted to revisit alternative deployment schemes proposed in the past to find out why they had been rejected and to see if there were ways of overcoming those objections. We started with an examination of possible deployment options by dividing available options into four strategies defined by a two-by-two matrix whose axes represent **when** forces deploy forward (either periodically or permanently) and **where** they spend most of their time (either stateside or forward). See Figure 1.

The upper right sector represents forces that deploy forward periodically (such as for routine, cyclical operations). The upper left quadrant represents forces that can are deployed forward for extended periods (returning only periodically to stateside bases). The set of options considered in this sector focused on crew rotation schemes. The lower right quadrant represents forces permanently homeported overseas (like those in Japan). The lower left quadrant represents forces permanently based stateside that surge forward when required.

Sea Swap recommendations were intended for conventionally-powered, surface combatants for three reasons. First, Sea Swap recommendations can more easily be implemented by surface combatants than by either carriers or submarines. Second, nuclear-powered ships have maintenance requirements that make their schedules less flexible than non-nuclear-powered ships. Finally, relatively large platform numbers and medium-sized crews make surface combatants more amenable to experimentation.

The following is an overview of the metrics examined in each quadrant.

Routine Deployments
Several options exist for increasing efficiency during routine deployments. They include:

- Eliminating port calls en route to station
- Taking actions to reduce turnaround ratios
- Reducing the maintenance factor
- Increasing transit speed to and from station
- Increasing deployment lengths

Some of these options are being examined by the CNO's Deep Blue team, including changes to the Navy's Inter-Deployment Training Cycle (IDTC), under a new approach known as the Fleet Response Concept.

Crew Rotations
A number of different crew rotation schemes were examined. The majority of them recommended establishing an imbalanced combination of crews and ships, including:

- 3 crews/2 ships, with the forward deployed ship remaining forward for two years. This scheme was recommended by the Center for Naval Analyses.
- 4 crews/3 ships, another CNA recommendation that improves turnaround ratios for personnel.
- 5 crews/4 ships, was recommended as part of the CNO's Strategic Studies Group *Horizon* concept. Under this scheme the forward ship would remain deployed for three years.
- Sea Swap (2 crews/2 ships) our recommendation. In this scheme, no additional crews are required, since the forward ship double cycles, thus avoiding additional manning costs.

Forward Infrastructure
Homeporting options are briefly discussed under this quadrant. At the time Task Force Sierra analysis was being completed, most options were dismissed as infeasible. These options should be reexamined as part of the reconstitution study following the war on Iraq. The most important point emerging from this examination was the critical importance of maintaining bases in Japan as well as

the support infrastructure on Diego Garcia. Should Japanese bases be lost, a significant increase in force structure would be required to maintain today's level of presence in the Western Pacific. The only homeporting scheme that makes a substantial difference in reducing the number of ships required in the inventory to keep one forward in the Persian Gulf would be homeporting a carrier in theater—a course not recommended by the task force and one that makes even less sense following Secretary of Defense Donald Rumsfeld's announcement that America would be reducing forces in the region. Homeporting ships in countries in Oceania or Southeast Asia would save them about 20 days transit time, but would still require a number of ships available for rotation. Although homeporting doesn't appear to be the silver bullet solution for achieving forward presence efficiencies, fostering arrangements (that is, setting the stage) with a number of countries to support maintenance and crew swap/rotation options makes a great deal of strategic and practical sense.

Surge Operations

Since the objective of Task Force Sierra was to examine ways of increasing the efficiency of forward deployed forces, it did not focus on surge strategies, nor did it recommend pursuing an all-surge force as a preferred course for America. By implementing the recommendations of the task force, however, the number of on-station ship-days can be increased or a number of ships can be freed to respond flexibly to contingencies or other sensitive political tasking. Since these ships would neither be forward deployed nor in the rotation cycle, they would be capable of supporting a limited surge capability in times of extended tension, unless continued budget shortfalls eliminate them from the force. The war in Iraq required the CNO to rethink his position on the Navy's surge capability and tasked the Commander, Fleet Forces Command, and his Deep Blue team to revisit the issue. One of the proposals under consideration by Deep Blue is the Fleet Response Concept, which "calls for Carrier Strike Groups (CSGs) returning from a deployment to go immediately into a maintenance period, bypassing the traditional stand-down period. The groups then spend six months training to deploy and another six months maintaining their readiness with the option to surge, or deploy early, if necessary."[1]

This paper describes the Sea Swap concept as originally briefed to the CNO, VCNO and other senior flag officers at a 2001 3-star conference in Washington, DC.

Compelling reasons to adopt new deployment schemes

Sea Swap is a crew rotation scheme, but different from those proposed in the past. Previous crew rotation schemes did not fare well because they tended to disrupt comfortable patterns and required cultural change. Sea Swap tries to reduce those impediments. Having said that, a good idea poorly executed is hard

[1] *Combat Systems Clips*, 11 April 2003, p. 5 [summary of David Brown, "Changing with the Times," [*Navy Times*, 6 April 2003, p. 18].

to differentiate from a bad idea. We think Sea Swap is a good idea (as we hope to demonstrate), but early experiments with the concept ignore much of the reasoning behind and recommended execution of the concept—only the name and the general “crew swapping” concept have remained the same.

Sea Swap won't be easy to adopt, but there are compelling reasons for experimenting with the concept that did not previously exist. The most compelling of these reasons are that comfortable deployment patterns are already disrupted as a result of the war on Iraq and a continuing budget crisis will likely force the Navy to reduce fleet size. As a result, the Navy must get more out of whatever force it is able to maintain. Two points need stressing. First, there are no silver bullet solutions that meet all challenges, especially with regard to carriers and submarines. A more detailed look at Sea Swap would be necessary to see if it could be adapted for those platforms. Second, the only way to discover unanticipated outcomes is by experimenting with real forces; therefore, we recommend conducting multi-year experiments with the concept **as designed**.

Our research concluded that the single most effective deployment strategy for surface combatants to pursue is crew swapping. By adopting a combination of strategies, as noted below, the Navy can create maneuver room (or organizational slack) that does not currently exist. In an ideal world, for example, for every 10 surface combatants that must be kept forward in the Persian Gulf, up to 35 could be removed from the rotation process while maintaining six-month deployments for crews departing from the West Coast. We recognize that actual savings will be less than the ideal; nevertheless, some number of ships can be made available to increase presence, form a crisis response force, or be retired to free funds for modernization.

There is a risk that the recommendations contained in this report will be used as justification for reducing Navy force structure. Should that happen, it will have a chilling effect on future innovative efforts. The logic of efficiency can only be followed so far before naval warfighting capabilities are diminished. In fact, several task force participants expressed concern about the recommendations believing that they would inevitably lead to a drastically reduced and less-capable force. We have tried to incorporate their concerns in the report. The hope is that these recommendations will help the Navy posture it force in order to maintain both a routine forward presence and a ready surge that can respond to crises.

Introduction

This study reports the findings of TASK FORCE SIERRA. It begins by detailing the task force's charter, followed by a brief discussion of the future strategic environment, which, in turn, is followed by a discussion of deployment options. The latter section forms the bulk of this report. The study concludes with a review of the options and recommended course of action.

TASK FORCE SIERRA focused on **what can be done with current and anticipated force levels to meet combatant commander mission requirements**. Past studies were mined for ideas and lessons learned from historical cases were reviewed for relevance. The goal was to identify factors that adversely affected past concepts and revise them so that alternative deployment schemes are more acceptable.

ASSUMPTIONS

Members of TASK FORCE SIERRA were bounded by three assumptions. First, they assumed that the Navy would have to do more with less. "Neither political party," asserts Andrew Krepinevich, "appears ready to add the resources required to erase [the known funding] shortfall. Consequently, the current defense program cannot avoid substantial trimming, even if transformation is not undertaken."[2] At programmed ship building rates, estimates have the fleet decreasing to as few as 180 ships over the next 30 years.[3] Although the Chief of Naval Operations believes the Navy has consistently understated its requirements, his goal is to forward deploy the right capability, not a particular number of ships.[4] He is nevertheless realistic in his approach to budget shortfalls. "The possible solution set to this dilemma is small," he wrote, "an increase to our budget top line, a procurement strategy that invests maximum combat capability, <u>acceptance of the operational and strategic implications that flow from a potentially smaller Navy</u>, or some combination of the above."[5]

The second working assumption was that creating organizational slack (or maneuver room) is necessary to meet this challenge. The final assumption was that demand for naval forward presence would remain greater than the supply regardless of fleet size. As a Congressional Budget Office (CBO) report noted, "Among the Navy's many missions, sea control and forward presence are paramount: sea control makes performing the Navy's other tasks possible, and

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[2] Steven Kosiak, Andrew Krepinevich, and Michael Vickers, *A Strategy for a Long Peace* (Washington, DC: Center for Strategic and Budgetary Assessment, January 2001), p. ii.
[3] Joseph Antinucci, "U.S. Navy Needs Rapid Increase in Shipbuilding Rate," *Defense News*, 05 Mar 2001, p. 19.
[4] Robert Holzer, "Navy Chief Orders True Tally of Requirements," *Defense News*, 15 Jan 2001, p. 27.
[5] Robert Holzer, "Clark Claims $13 Billion Shortage Looms for U.S. Navy Operations," *Defense News*, 26 Mar 2001, p. 23 (emphasis added).

forward presence makes performing them easier."[6] In this case, you can't have too much of a good thing.

Deployment Options

THE DEPLOYMENT MATRIX

The universe from which deployment options can be drawn is limited as depicted in Figure 2. It shows that forces can either be in home waters of the continental United States (CONUS) and Hawaii or forward deployed, and can be there either periodically or permanently.

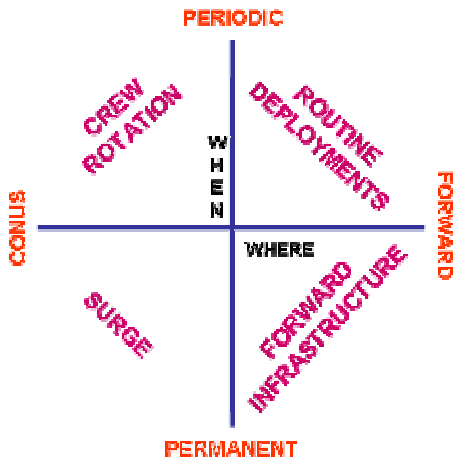

Figure 1. Deployment Matrix

The resulting quadrants identify four idealized solutions for force deployment. Today's Navy primarily operates in the upper right quadrant, periodically deploying forces in forward areas. Coverage in an area may be continuous, but under this scheme rotating forces provide that coverage. The upper left quadrant captures schemes that keep ships forward (only periodically returning them to CONUS for upkeep) and mans those ships by rotating crews. Moving diagonally, the lower right quadrant represents schemes that keep both ships and crews forward permanently (overseas homeporting). Finally, the lower left quadrant eschews forward presence altogether and deploys forces forward only in times of crisis or conflict (a so-called surge strategy). Over the past decade, all these options have been proposed, yet no one of them solves all of the Navy's deployment challenges. That probably won't change. The optimal deployment scheme will undoubtedly involve elements from each quadrant, as discussed below.

[6] *Budgeting for Naval Forces: Structuring Tomorrow's Navy at Today's Funding Level* (Washington, DC: Congressional Budget Office, 2000), p. 3.

Although this two-dimensional matrix captures the **where** and **when** solution sets for forward presence, it misses a critical third dimension that deals with **what** a force brings with it when it arrives. If capabilities didn't matter, managing the Global Navy Forward Presence Policy (GNFPP) would be easy. Combatant commanders rightfully insist that capabilities do matter, which makes the scheduling problem difficult. Questions that need to be answered in order to judge which deployment alternatives best fulfill national requirements include:

- ✓ What capabilities will combatant commanders require in the future?
- ✓ Will the GNFPP be changed to reflect new realities in the Persian Gulf?
- ✓ Will current peacetime operational and personnel tempos be maintained or waived?
- ✓ Will Congress waive current penalties if these policies are exceeded?
- ✓ Is establishing new homeports overseas a viable option?
- ✓ If ships are going to remain forward for long periods of time, can the Navy get legislative relief to conduct more than voyage repairs?

Before looking at possible options, examining some of the factors that shape the availability and deployment patterns of naval ships is required. Some of these factors are subject to manipulation (such as speed of advance and deployment lengths); others (such as, geography) are not.

REQUIREMENTS FOR CONTINUOUS PRESENCE

William Morgan of the Center for Naval Analyses developed a simple mathematical model that explains force structure requirements for continuous presence.[7] The model helps explain why it takes so many ships to keep one forward continuously. The model shows that it takes nearly eight San Diego-based carriers to keep one continuously deployed in the Persian Gulf. Fortunately, not all Persian Gulf carriers have to come from the West Coast. The model highlights the obvious, "the more time spent in transit, the more ships that are needed to keep one ship forward continuously."[8]

$$\textit{Ships needed} = \frac{\textit{Deployment Cycle}}{\textit{Time in the forward area (per deployment)}} (\textit{Maintenance Factor})$$

Time is measured in months, with an average month having 30.4 days.

[7] William F. Morgan, *The Navy's Deployment Arithmetic—Can It Add Up to a Larger Navy?* CRM 94-2 (Alexandria, VA: Center for Naval Analyses, August 1994). More detailed models have been developed, but Morgan's calculations suffice for the purposes of this study.

[8] William F. Morgan, *Let's Talk Deployment Arithmetic*, CAB 94-23 (Alexandria, VA: Center for Naval Analyses, May 1994), p.4.

The *Deployment Cycle* is defined as:

Deployment Cycle = *Home* + *Away* + *Deployed*, where

Home = months in homeport between deployments
Away = months out of homeport between deployments
Deployed = months deployed (portal-to-portal)

Time in the forward area is defined as:

Time in the forward area (per deployment) = *Time deployed* – *Transit time*

As Table 1 shows, transit times can be significant; especially for ships deploying to the Persian Gulf from San Diego. There are only two ways to overcome the tyranny of geography, go faster or deploy from in theater. Both of these options will be discussed later.

Origin	Destination	One-way distance (nautical miles)	Two-way steaming time (months)
Norfolk	Caribbean	1279	0.25
Norfolk	Mediterranean (Naples)	4336	0.85
Norfolk	Persian Gulf	8794	1.72
San Diego	Panama	2843	0.56
San Diego	Western Pacific (Japan)	4917	0.96
San Diego	Singapore	7736	1.51
San Diego	Persian Gulf	10955	2.15
Japan	Persian Gulf	6102	1.19

Table 1. Transit distances and steaming time (at 14 kts)[9]

The objective of this study is to identify how time in the forward area or station keeping time can be maximized. Table 2 shows average times in the forward area under traditional deployment schemes and the number of ships required to keep one forward.

			SHIPS REQUIRED			
Origin	Destination	Time in forward area (months)	CVN M=1.28	LHA M=1.19	CG M=1.10	LPD M=1.00
Norfolk	Caribbean	5.75	5.0	4.7	4.3	3.9
Norfolk	Mediterranean (Naples)	5.15	5.6	5.2	4.8	4.4
Norfolk	Persian Gulf	3.95	7.3	6.8	6.3	5.7
San Diego	Panama	5.44	5.3	4.9	4.5	4.1
San Diego	Western Pacific (Japan)	5.04	5.7	5.3	4.9	4.5
San Diego	Singapore	4.49	6.4	6.0	5.5	5.0
San Diego	Persian Gulf	3.53	8.2	7.6	7.0	6.4
Japan	Persian Gulf	4.48	—	—	—	5.0

[9] Morgan, CRM 94-2, op. cit., p. 17.

Table 2. Ships needed to keep one forward continuously[10]

Table 3 shows how tethers (i.e., the permissible number of transit days away from the operating area) and increased speed of advance affect the number of ships required in rotation to keep one forward. The purpose of exploring the options that will follow is to reduce the number of ships required to keep one forward, especially ships forward in the Persian Gulf area of operations.

	Norfolk – Mediterranean		Norfolk – Persian Gulf		San Diego – Western Pacific		San Diego – Persian Gulf	
Tether (days)	ARG 14 kts	CVBG 20 kts	ARG 14 kts	CVBG 20 kts	ARG 14 kts	CVBG 20 kts	ARG 14 kts	CVBG 20 kts
0	5.0	5.1	6.5	6.1	5.1	5.2	7.4	6.6
2	4.9	5.0	6.3	5.9	5.0	5.0	7.1	6.4
4	4.8	4.8	6.1	5.8	4.9	4.9	6.9	6.2
6	4.7	4.7	5.9	5.6	4.8	4.8	6.6	6.1
8	4.6	4.7	5.7	5.5	4.7.	4.7	6.4	5.9
10	4.5	4.7	5.6	5.4	4.6	4.7	6.2	5.7
12	4.5	4.7	5.4	5.2	4.5	4.7	6.0	5.6
14	4.5	4.7	5.3	5.1	4.5	4.7	5.9	5.4

Table 3. Ships needed to keep one providing continuous coverage[11]

ROUTINE DEPLOYMENT OPTIONS

INCREASE TRANSIT SPEED OF ADVANCE (SOA)

Increasing transit SOA can increase time on station significantly, but it comes with a price. The most obvious price is higher fuel costs. There is also a training cost. Flying time available decreases since maintaining a higher SOA permits fewer turns into and out of the wind and some types of ship training cannot be conducted at all.[12]

Savings (not just efficiencies) do accrue if force reductions are made to offset increased fuel costs. Fleet reduction may occur, but that is not a course of action we recommend. As new ships, with potentially more efficient power plants are commissioned, both savings and efficiencies should be achieved. The greatest payoff for increasing SOA, of course, comes from faster transits between the West Coast and Persian Gulf. According to Morgan, "A 2-knot average increase in transit speeds of advance would produce the same number of additional [ship days on station] as adding four more surface combatants to the force."[13] In other words, it allows you to do more with the same or the same with less. Unfortunately, not all ships are capable of sustaining higher SOAs, such as,

[10] Morgan, CRM 94-2, op. cit., p. 21.
[11] Morgan, CRM 94-2, op. cit., p. 26
[12] It has been counter-argued that skills atrophy less during quicker transits mitigating the need for additional training in the first place. This argument falters if required skills have not been developed and necessary training is delayed to take advantage of transit time.
[13] Morgan, CAB 94-23, p. 8. This represents about a 5% decrease in the required ship rotation pool to maintain sixteen ships forward deployed continuously in the Persian Gulf.

amphibious ships that top out at twenty knots. The bottom line is that flexible SOA policies can provide a portion of the answer. Although there is a limit to how much an increased SOA can buy, it does argue for making *all* new ships capable of sustaining a 20-knot SOA. A lot of discussion has been generated over building faster ships. Table 4 shows the force structure gains that can be made using various SOAs between 12 and 42 knots.[14]

Speed of Advance	Transit Time (months)	Time on station (months)	Number of ships required in rotation
12	2.82	3.18	7.77
14	2.46	3.53	6.98
16	2.20	3.80	6.49
18	1.99	4.01	6.16
20	1.82	4.18	5.91
22	1.69	4.31	5.73
24	1.58	4.42	5.58
26	1.48	4.52	5.46
28	1.40	4.60	5.36
30	1.33	4.67	5.28
32	1.26	4.74	5.21
34	1.21	4.79	5.15
36	1.16	4.84	5.10
38	1.12	4.88	5.05
40	1.08	4.92	5.01
42	1.04	4.96	4.98

Table 4. Effect of increased speed of advance on force structure[15]

Under ideal conditions, an 18 percent gain in time on station is achieved by increasing SOA from 14 to 20 knots. Put another way, using a 14-knot SOA, approximately 42 West Coast ships are necessary to keep six forward deployed in the Persian Gulf. Transiting at 20 knots would decrease by six the number of ships required. A similar gain can be achieved by increasing SOA from 20 to 40 knots (another four ships), but with a significant decrease in fuel efficiency and payload. Since returns diminish quickly above a 20-knot SOA (see Figures 2 and 3), we recommend that 20-knot SOAs serve as the target for future ships. Depending on hull forms, type of propulsion, etc., the figures change, but as a general rule, doubling speed from 20 to 40 knots increases fuel consumption from 5 to 10 ten times per ton mile and decreases payload fraction as cargo is traded for fuel.

[14] This is an idealized table in that it assumes a 6-month deployment, a 2.75 TAR, a 1.09 maintenance factor and 10 days of stops en route.

[15] Figures without a cited source were generated using Excel models constructed by Hank Kamradt based on William Morgan's formulae.

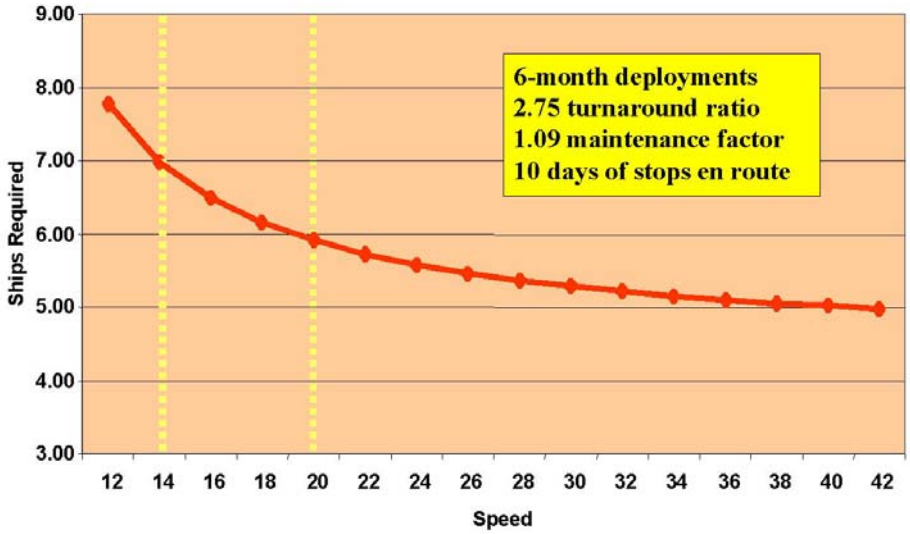

Figure 2. Ships required in rotation for various SOAs (San Diego to Persian Gulf)

As noted above, some critics of the increased SOA option are concerned that it would decrease en route training opportunities and, hence, readiness. Readiness may not suffer quite as dramatically and some may think. According to Morgan, "The carriers sent from the United States to Desert Shield all made 16-knot transits or better and they arrived fully ready to fight."[16] There are undoubtedly similar lessons that were learned from ships that surged in support of the war in Iraq as well. Morgan points out that if readiness becomes an issue, ships could transit to the forward area at 14 knots, permitting completion of training, and could transit home at 16 knots to improve turnaround time — but the benefits of faster SOAs are halved.

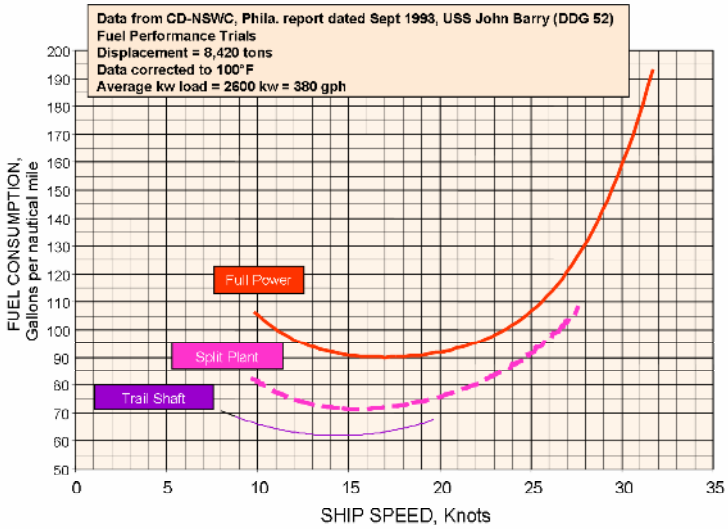

Figure 3. Ship Total Fuel Consumption Curves (DD-51)

[16] Morgan, CAB 94-23, op. cit., p. 7.

ELIMINATING STOPS EN ROUTE

The Navy tries to provide 5 to 10 days in-port time for ships transiting to or from the Persian Gulf. These stops are “overhead” and add from 10 to 20 days of transit time, exacerbating time on station calculations. William Morgan reports, "A five-day stop each way adds one-half ship times the number of ships in the Gulf continuously. With five surface combatants in the Gulf continuously, this means the stops add two to three surface combatants to the force structure."[17]

The decision to eliminate port calls en route to the Persian Gulf would affect a number of other factors besides force structure. Both recruiting and retention, for example, would be adversely affected. The Navy still touts itself as an adventure and its advertisements have traditionally featured sailors touting the ports of call they have made during their deployments. The recruiting command would not likely trumpet the fact that the Navy no longer pulls into ports. Even if recruits could be attracted, retaining them would be more difficult. By eliminating the extra ships needed to cover the extra time, Morgan estimates the Navy could pay "each sailor about $12,000 per deployment in lieu of 'quality port visits' outside the Gulf."[18] He believes, however, that it would cost a lot less than $12,000 per sailor "to hold retention rates constant without the port visits."[19] There have been no indications that the Navy (or Congress) is willing to consider such a compensation package in peacetime.

Morgan goes on to recommend that stops only be made "in ports where the time counts as output, not overhead (in other words, ports within the AOR). All ships assigned to the Central Command can spend as much time in port within the Gulf as desired and that time counts as 'output,' not overhead. … CVBGs and ARGs can use tethers to make other stops."[20] Although in area or tethered port calls are preferable to eliminating them altogether, the regional scarcity of quality "ports that count" make these alternatives only slightly better. There is also an increased force protection issue when port calls are made in on station ports. Although the political climate may change depending on how events unfold in Iraq and Palestine, near-term prospects are that threat levels will remain high in the region.

There are other imponderables to consider besides retention. How would the lack of port calls affect morale, performance, and stress? Because the downside of eliminating port calls appears so much larger than the upside, it is not a recommended course of action.

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[17] Morgan, CAB 94-23, op. cit., p. 12.
[18] Morgan, CAB 94-23, op. cit., p. 13.
[19] Morgan, CAB 94-23, op. cit., p. 13.
[20] Morgan, CAB 94-23, op. cit., p. 13.

CHANGE MAINTENANCE PRACTICES

Morgan notes, "Ships have maintenance cycles as well as deployment cycles."[21] The maintenance factor (noted in earlier calculations) accounts for ships in extended depot overhauls that are, therefore, out of the deployment cycle during that period. When the maintenance factor (M) is larger than 1.0, the Navy needs more ships in the deployment cycle to keep an equal number of ships forward. "Ships maintained under phased maintenance stay in the deployment cycle all the time."[22]

$$\textit{Maintenance factor}\ (M) = \frac{100}{\%\ \text{of time in the deployment cycle}}$$

Morgan likens the maintenance factor to a sales tax. As a general rule, the bigger the ship, the larger the tax. For carriers, especially nuclear-powered carriers, the tax is high, approximately 28 percent. Gregory Cox, in an excellent study that explains why keeping a single carrier forward deployed in the Mediterranean (the best case) requires at least six supporting carriers in the inventory. His calculations detailed the maintenance requirements for carriers that make their maintenance factor so high. The shortest maintenance period — planned incremental availabilities (PIAs) — "last about six months and are conducted by commercial shipworkers under contract to the U.S. Navy. However, every third maintenance period must be conducted in a dry-dock (DPIA, for dry-dock PIA), and these last somewhat longer, about 10.5 months, again performed by commercial shipworkers. Once, about midway through its 50-year lifetime, a nuclear carrier … must undergo a nuclear refueling procedure (RCOH, for refueling complex overhaul), and this process lasts a whopping 32 months."[23] The big tax is generated during the RCOH and there doesn't appear to be any way to avoid it. It will be interesting to see how the Fleet Response Concept deals with this issue.

"Ships maintained under a phased-maintenance concept," Morgan points out, "go into the shipyard more often, but for shorter periods of time than ships getting regular overhauls. The total time in the shipyard is roughly the same. The advantage of phased maintenance is that ships can stay in the deployment cycle all the time."[24] He notes that, with the exception of carriers, "at least one of every ship type listed [FFG-7, LPD, LSD, CLF, DD, CG, DDG, LHA, and LHD] is maintained under the phased maintenance concept [in Japan]. Why not in the United States?"[25] He concludes, "Getting as many ships into phased maintenance as possible is the single most thing the Navy can do to increase the

[21] Morgan, CRM 94-2, op. cit., p. 19.
[22] Morgan, CAB 94-23, op. cit., p. 4.
[23] Gregory V. Cox, *Keeping Aircraft Carriers Forward Deployed: Harder Than it Seems* (Alexandria, VA: Center for Naval Analyses, January 2000), p. 3.
[24] Morgan, CAB 94-23, op. cit., p. 16.
[25] Morgan, CAB 94-23, op. cit., p. 17.

efficiency of the Fleet to produce forward presence."[26] He overstates the case, as we will show, but striving for a 1.0 maintenance factor is a worthwhile goal.

REDUCE TURNAROUND RATIO

Although the calculations that follow treat the turnaround ratio (TAR) as an input variable, in reality it is an output of training requirements, personnel policies, and maintenance schedules. Reducing the TAR is much more difficult than most people imagine. The turnaround ratio is determined by dividing the time between deployments by the time deployed. For example, if a ship was deployed for 6 months and had 12 months between deployments, the turnaround ration would be 2:1.

$$TAR = \frac{Home + Local\ Training}{Deployed} \qquad \text{where Deployed} \leq 6.0$$

"In past years," William Morgan reports, "the Navy's official turnaround ratio (TAR) of 2.5:1 … comes from a 21-month deployment cycle — 6 months deployed, 15 months between deployments. … As the ratio goes up, the percentage of the force forward goes down. As the percentage of the force forward goes down, the cost of keeping a ship forward goes up. … If the change didn't cost much, nobody would notice. … But it is expensive, so they will."[27]

Morgan reports that the turnaround ratio has climbed to over 3:1 for carriers, with the average TAR for an Atlantic Fleet ship being around 2.77:1. ."[28] The 2.77:1 TAR is close to the prediction of 2.75:1 that is drawn "mostly from the mathematical linkage between the fuel budget for ships between deployments and personnel tempo (PERSTEMPO). The fuel budget for ships between deployments is set to equal 29 steaming days per quarter. PERSTEMPO says ships need to be in homeport 50 percent of the time. If you are steaming, you are away from home. If you are away from home 29 days per quarter between deployments, you can't get home half the time unless the interdeployment period is 2.75 times the length of the deployments

By cutting back on non-deployed steaming days per quarter the TAR can be reduced. For example, a reduction of 2 days (to 27 steaming days per quarter) could reduce the TAR to 2.5:1. Morgan cautions against getting mesmerized by the math, especially since it is tied to fuel budgets rather than actual steaming days. The Congressional Budget Office, for example, misunderstood all the other factors that alter the calculations and reported, "A study by the Center for Naval Analyses showed that an 18-month deployment cycle for carriers could generate the same amount of forward presence as a 21-month cycle but with two fewer

[26] Morgan, CAB 94-23, op. cit., p. 17.
[27] Morgan, CAB 94-23, op. cit., pp. 20-21.
[28] Morgan, CAB 94-23, op. cit., p. 22.

carriers."[29] As Greg Cox's analysis demonstrated, 18-month deployment cycles are impossible with the current size of the carrier fleet due to maintenance restrictions. If the calculations represented actual days at sea, the question is raised of whether training and readiness could be maintained at this level. That question needs to be addressed, but is not answered by this study. We know, however, that "Navy officials are studying changes to the Inter-Deployment Training Cycle (IDTC) to enable the fleet to surge its forces and respond to situations in a more timely manner."[30] Figure 11 shows the effect that various non-deployed steaming days has on the turnaround ratio.

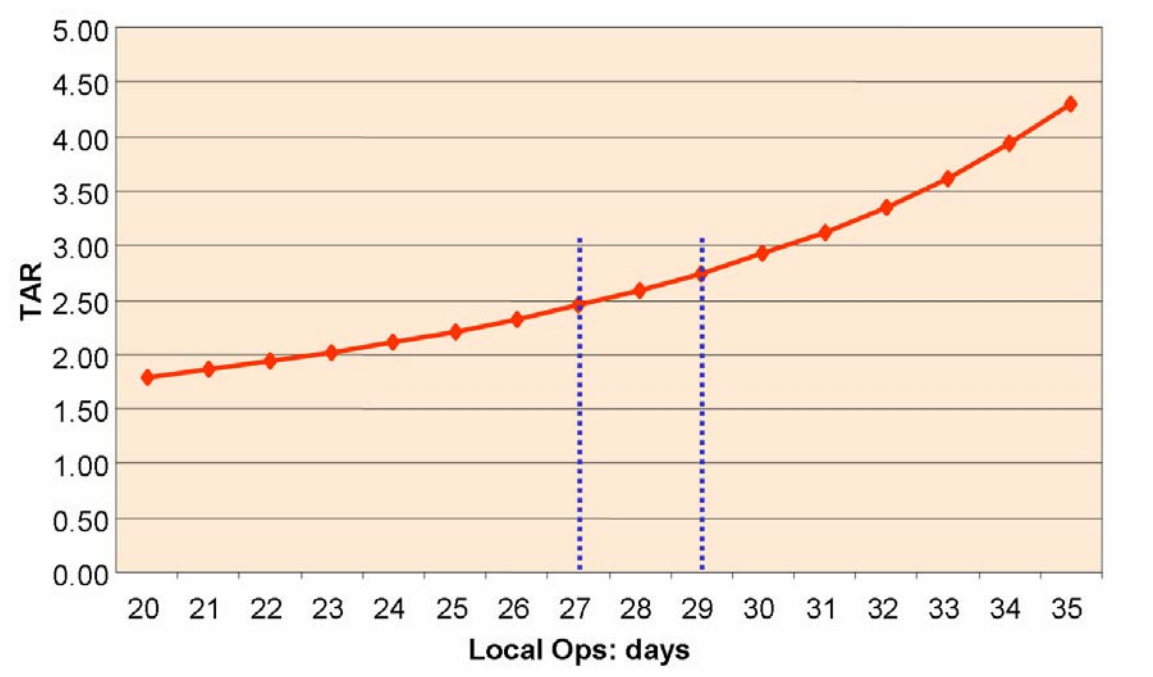

Figure 4. Turnaround ratio versus local operating days/quarter

One way to help maintain readiness and meet all mandated PERSTEMPO policies is to take advantage of simulators. No new ship class should be built without accompanying simulators for in-port training. Although nothing replaces actual steaming or flying time, aviators have used simulators for years to meet their training requirements. Increasingly simulators are also being effectively used to train ship handlers. In fact, they are being used to conduct annual junior officer ship handling contests.[31] Another objective should be conducting more training using actual onboard ship equipment. The Navy appears to be heading this direction with such systems as the Aegis Combat Training System (ACTS). New systems should continue to be designed with built-in simulations so that personnel can train on-the-job both in port and at sea. As new networks are put

[29] CBO, *Budgeting for Naval Forces*, op. cit., p. 8.
[30] *Combat Systems Clips*, 11 April 2003, p. 5 [summary of David Brown, "Changing with the Times," [*Navy Times*, 6 April 2003, p. 18].
[31] Email from Terry McKearney, Kapos Associates, Inc., 07 Mar 2001.

in place, squadron or battlegroup training should use them to conduct training in port, thus saving steaming days. Another oft mentioned alternative is to delay some training until the ship is on station, decreasing TAR and increasing forward presence. Granted, there are risks associated with this strategy and it should be applied selectively.

Other training options under consideration involve combining exercises and training into a single extended pre-deployment period that could improve PERSTEMPO and permit modest turnaround ratio reductions. As new technologies improving maintenance and monitoring systems performance find their way into the fleet, some inspections may be eliminated from the interdeployment cycle.

INCREASE DEPLOYMENT LENGTH

One obvious way to increase time forward is to lengthen deployments. Eight- and nine-month deployments were not uncommon during and just after the Vietnam War, so there is a history to draw on — mostly an unhappy history. The cost of these deployments was felt keenest in morale, retention, and material condition of ships. The most demoralizing aspect of Vietnam era deployments was deployment length uncertainty. As a result, the Navy adopted a six-month portal-to-portal personnel tempo policy beginning in 1986. The Air Force learned this same lesson about deployment uncertainty in the late 1990s and moved to stabilize its deployment patterns. The *USS Abraham Lincoln* returned from the war on Iraq having completed a 10-month deployment, the longest deployment since the Vietnam War. Returning sailors indicated they understood the extraordinary circumstances that required an extended deployment, but none expressed a desire to repeat it routinely.

Since 1986, with rare exceptions like the *Lincoln*, this policy of 6-month deployments has been sacrosanct. Following the war on Iraq, the Commander, U.S. Atlantic Fleet, actually released a trial balloon suggesting that 12-month deployments might be required. The suggestion was not well received.[32] There may, however, be a compromise deployment length somewhere between 6 and 12 months. In previous sections, William Morgan argued that by speeding up transits and eliminating port calls (saving about 8 and 10 days respectively), significant reductions in the number of ships required to keep one forward could be made. If increased deployment length could be substituted for those options, the same savings could be achieved.

As Figure 5 reveals, lengthening cruises by a month (while keeping time between deployments constant — effectively decreasing TAR) requires one fewer ship in the rotation to keep one on station. If the turnaround ratio is held constant, the savings decrease. For example, if TAR is held constant at 2.5:1, time between

[32] *Combat Systems Clips*, 11 April 2003, p. 7 [summary of Jack Dorsey and Dale Eisman, "Next Sailors, Marines to Deploy May Face Longer Missions," [Norfolk *Virginian-Pilot*, 6 April 2003].

deployments increases proportionately to the increase in the deployment's length.

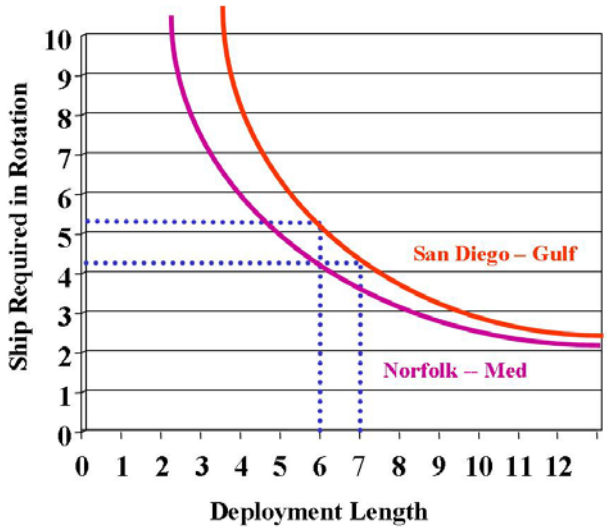

Figure 4. Effect of Cruise Length on Ship Requirements[33]

By reducing force structure (eliminating ships) and turning savings into extended tour bonuses, Morgan suggests the Navy could buy off morale and retention challenges. He estimated that the operating cost of a frigate-sized ship is about $30 million per year. Funds saved by increasing deployment lengths (thus, reducing the number of ships in the rotation) could be made available for bonuses. Based on a notional 2.5 crew deployments per year for each ship required to be on station (and 350 sailors per crew), up to $34,000 could be paid per person in bonuses per deployment. The fact is a bonus of less than a third of that amount ($10,000) would probably suffice. It should be a flat bonus — the same amount regardless of rank — for deploying continuously beyond six months—possibly pro-rated depending on the number of months deployments exceed the norm. That amount could represent the down payment on a new car, the start of a personal or child's college fund, or the difference between owning and renting a house. If Congress could be convinced of the wisdom of this move and passed legislation making bonuses and wages earned during the seventh month tax free, lengthening deployments might occasionally be welcomed.

Calculations show that by lengthening cruises the Navy would save over $21 million per year for every forward deployed ship, provided that the ships no longer needed were retired. If eleven ships, for example, were required in the Persian Gulf, the Navy could anticipate a savings of nearly $230 million per year that could be put towards modernization.[34] As crew sizes decrease, savings

[33] Morgan, CRM 94-2, op. cit., p. 49.
[34] We realize that money comes in different "colors" and that the Navy staff would have to work with Congress to shift the money into the right pots.

increase. If, for example, DD(X) deploys with a crew of 150, over $5 million more could be saved per forward deployed ship per year. The savings for a Littoral Combat Ship would be even greater. Lengthening deployments would increase station-keeping time and still allow personnel to make port calls en route to and from station. The importance of *quality* port calls on recruiting, retention, and morale should not be underestimated. After all, it's not just a job — it's an adventure!

Carriers present the Navy with its biggest challenge. This challenge could be exacerbated if those calling for a reduction in the carrier fleet get their way. Should this happen, we recommend extending carrier cruises to seven months and having them transit to and from station at 20 knots. These two complementary actions could help restore some of the lost presence that would result from a reduction in the carrier force (see Figure 5). Since other recommendations contained in this report necessitate breaking battle group integrity, treating carriers differently than other ships does not further exacerbate this problem.

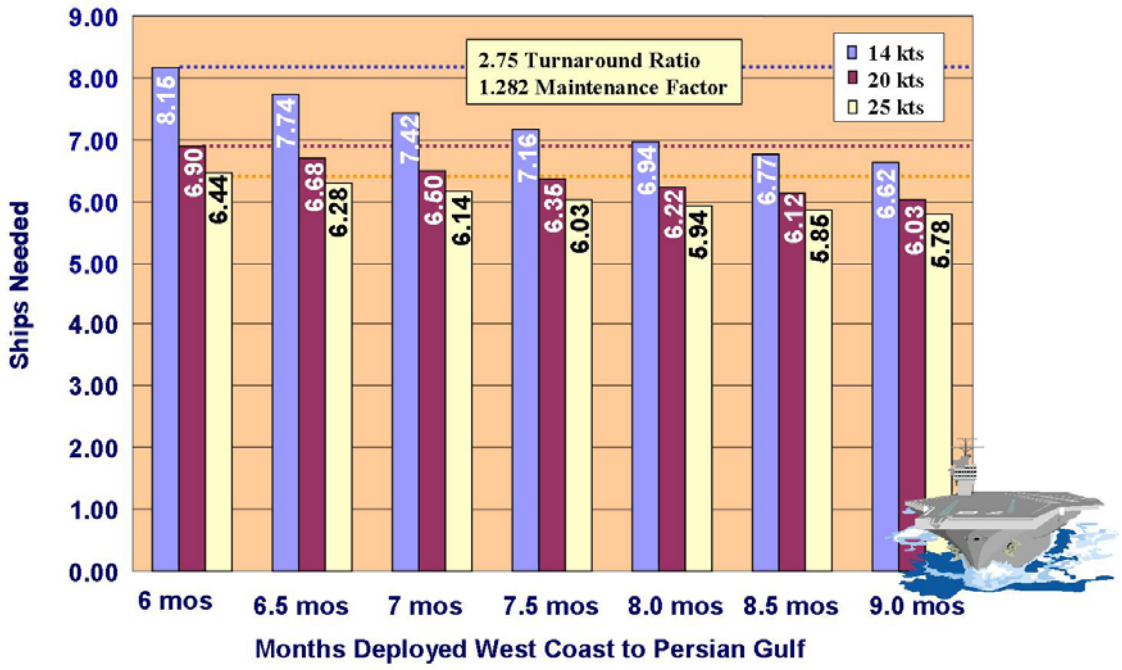

Figure 5. Carriers required vs deployment length and transit speed

CREW ROTATIONS

Most crew rotation schemes recommend an increased crew to ship ratio, such as the 2:1 (Blue/Gold) crew ratio used on ballistic missile submarines. In this section, we examine four different alternatives. The first, proposed by the Center for Naval Analyses, is a 3:2 scheme (3 crews/2 ships). The second option, also proposed by CNA, is a 4:3 scheme. The third option, proposed by the CNO's Strategic Study Group, is called the "Horizon" concept and rotates 5 crews

among 4 ships. The final option is a crew swapping arrangement that maintains a 1:1 crew ratio we call Sea Swap. Although some analysts have recommended crew rotations for all ships, including carriers and attack submarines, we have limited our review to surface combatants.[35] The exclusion of CVNs and SSNs is based in part on their nuclear propulsion systems. One "potential difficulty with shuttling crews," reports the CBO, "is that reactor personnel, once they become qualified, are allowed to operate only a specific ship's reactors."[36] It proposes several alternatives to overcome this challenge, including qualifying personnel on more than one reactor, extending reactor crews on station, and manning ships with multiple reactor crews. The CSBA believes that because the Navy will operate, for a time, an all Nimitz-class carrier fleet, it will "facilitate the rotation of crews."[37] The second major challenge for carrier crew rotations is the size of the crew and accompanying air wing. Since this is primarily a scoping exercise to determine whether promising options should be further evaluated and experimented with, surface combatants are the logical place to start.

3:2 CREW ROTATION

The Center for Naval Analyses examined a 3:2 crew rotation scheme in order to improve the quality of life for deployed sailors and their families and to free up ships to respond to unexpected crises or important political commitments or exercises.[38] As a base case, the report considered how many ships it would take to keep 5 forward in the Persian Gulf. Under current practice, it takes 12 Atlantic Fleet ships to keep 2 forward and 20 Pacific Fleet ships to keep the additional 3 forward. CNA's rotational scheme reduces the number of ships required by about 17-19 ships and 12-17 crews. The basic concept is simple (see Figure 6); each two ships are manned with three crews. "Crews are formed and train ashore for six months. Then they move to a ship in their homeport for six months of at-sea training. At the end of this at-sea training period, they fly overseas, the [relieved] crew returns to their homeport. Some would then transfer to shore-duty or leave the Navy, new members would report, and the cycle would start over again."[39]

Although the report doesn't posit "exactly how long a ship would remain overseas. [Its] best guess is two years."[40] By keeping a third ship in either extended repair or on inactive status, the 3:2 scheme can be accomplished without an increase in personnel endstrength, but achieves no savings through force structure reduction. Although savings can be achieved through operational tempo reductions, a General Accounting Office report asserts, "The greatest

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[35] For example, see *Improving the Efficiency of Forward Presence by Aircraft Carriers* (Washington, DC: Congressional Budget Office, August 1996) and Kosiak et al., op. cit.
[36] CBO, *Improving the Efficiency …*, op. cit., p. 22.
[37] Kosiak et al., op. cit., p. 39.
[38] William Morgan, *Rotate Crews, Not Ships*, CAB 94-40 (Alexandria, VA: Center for Naval Analyses, June 1994), p. 3.
[39] Morgan, CAB 94-40, op. cit., p. 5.
[40] Morgan, CAB 94-40, op. cit., p. 5.

potential for realizing cost savings is by reducing forces rather than reducing OPTEMPO."[41]

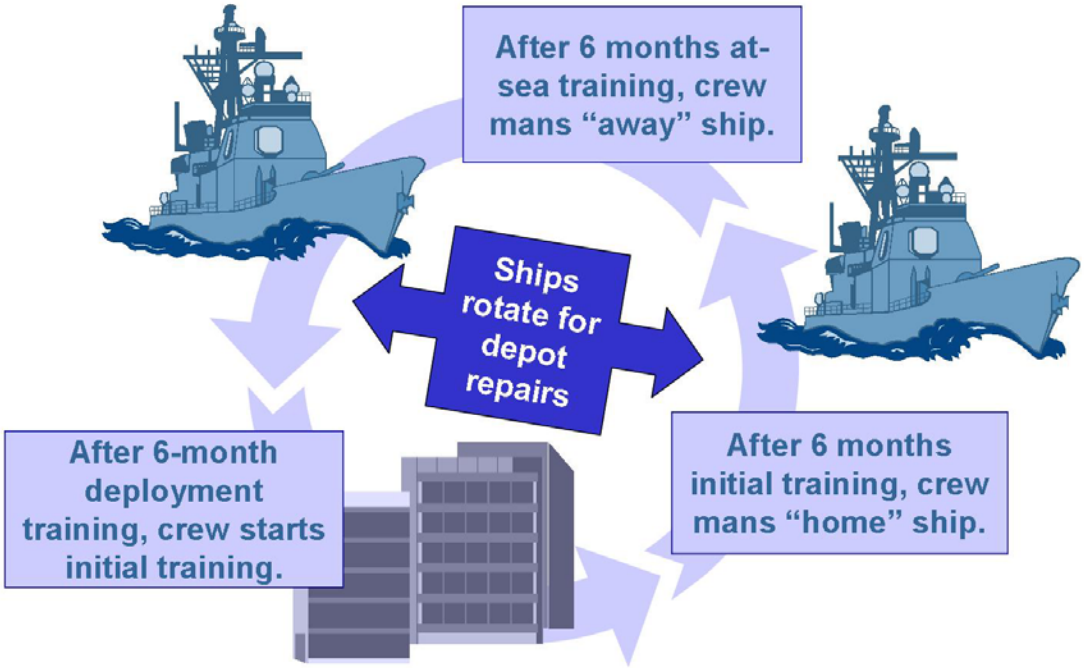

Figure 6. 3:2 rotation concept.

The CNA report notes that there are many variations of this scheme. For example, a "higher fraction of ships can be kept forward with six crews and five ships. With one ship in repair or inactive, we can create two sets of three crews and two active ships. With this arrangement, two of the five ships can be kept forward. … By adjusting the concept to include four crews, the turnaround ratio, the time in homeport, and, more importantly, time at home can be improved substantially."[42] William Morgan, author of the report, describes how shore billets could be manipulated to create the fourth crew, but such manipulations are not cost free.

4:3 CONCEPT

Under the CNA 4:3 concept, "crews are formed and train for six months, move to a ship in their homeport for six months of at-sea training, then deploy overseas for six months (see Figure 7). After six months overseas, the crew returns to their homeport. At this point, some crew members would go home on leave — up to six months — or to schools to gain additional skills and advancement. In either case, they would join new members at the shore-training site six-months later

[41] *Navy Carrier Battle Groups: The Structure and Affordability of the Future Force*, GAO/NSIAD-93-74 (Washington, DC: United States General Accounting Office, 1993), p. 54.
[42] Morgan, CAB 94-40, op. cit., p. 7.

and the cycle would start over again. Careerists who stay with the concept would enjoy a turnaround ratio of 3:1, be ashore half the time, and keep sea pay while ashore and afloat. (Groups of five ships with seven crews would operate on a 2.5:1 turnaround ratio. Home leave would be three months. Five-ship groups can keep two ships forward.)"[43]

For schemes that dramatically increase crew time at home, it has been recommended that crewmembers join (in fact, make up the majority of) administrative shore staffs. CNA analysts believe the benefits of such a scheme would be to make shore staffs more sympathetic to the needs of those deployed and would provide increase the operational expertise of the staff since those filling the billets would have the most recent experience available.

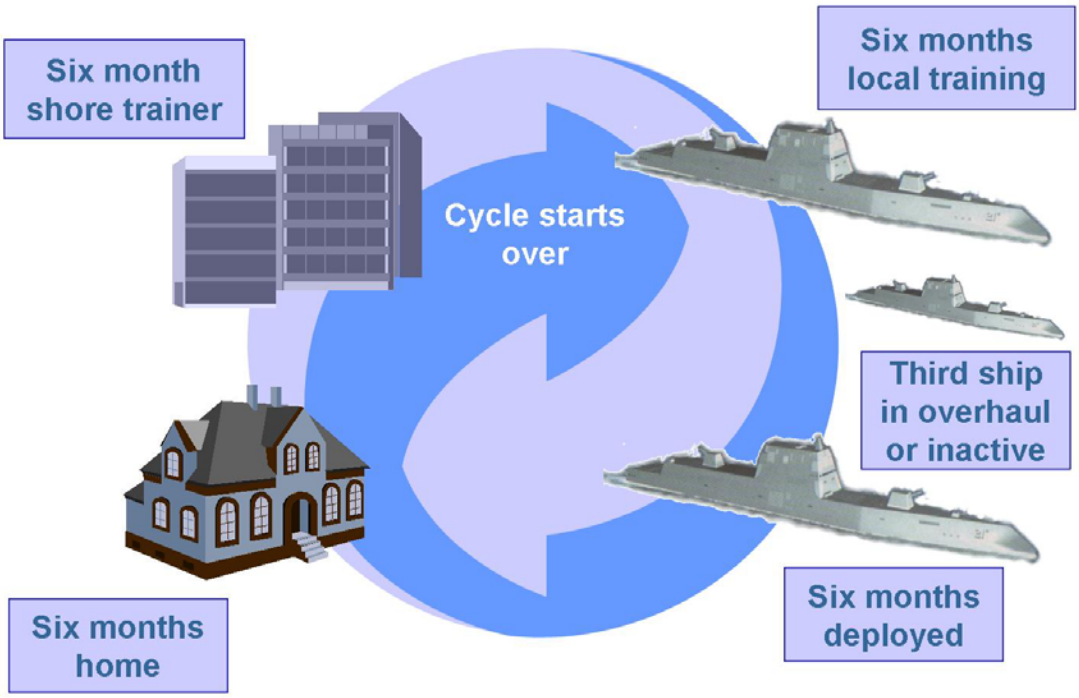

Figure 7. CNA 4 crews/3 ships rotation.

Morgan estimates that ships would be on a six-year maintenance cycle — two years deployed, two years in depot repairs/inactive, and two years in local operations. Required maintenance while the ship is in local waters would be performed by ship intermediate maintenance activities and by tenders (or foreign contractors) while overseas. This scheme, as with most other rotational

[43] Morgan, CAB 94-40, op. cit., p. 8.

schemes, will require the Navy to reconsider the importance of tenders. Morgan admitted that his scheme would put "a premium on a tender in the Gulf."[44]

HORIZON CONCEPT

The CNO Strategic Studies Group's "Horizon" concept was never intended to be implemented by today's fleet, but was designed to take advantage of some of the new technologies that will be introduced with the DD(X)-class destroyer. Proponents of Horizon claim that it "offers a totally new operational approach that will enable the Navy to meet forward presence requirements while providing a robust crisis response and surge capability to perform all other operations. It will eliminate cyclic readiness by maintaining platforms and people in continuous ready status. … It will also improve the quality of life (QOL) of sailors and their families."[45] Despite the fact that Horizon was intended for implementation in tomorrows' fleet, it has clearly affected current thinking about how the fleet maintains its readiness between deployments.

Horizon encompasses four key assumptions:

1. "Platforms will be capable of remaining forward deployed for up to three years. This will provide continual maritime presence and, at the same time, more ready platforms for crisis response on demand.

2. "Fully trained and ready sailors will rotate to the forward deployed platforms and the impact on overall unit readiness and operational effectiveness will be imperceptible. … The rotation cycle will provide our sailors a much more predictable deployment schedule and improved stability in their home life.

3. "Operationally and professionally focused shore billets will prescribe significant organizational changes in the infrastructure. Horizon seeks to make 80% of our people available for deployment in operational duty status. In contrast, less than 50% of the Navy's personnel are in deployable billets today.

4. "A new organizational structure, centered in fleet concentration areas, will train, maintain, and operate the force. Fleet Readiness Centers — like San Diego and Norfolk — will provide centralized support for Readiness Units that are organized by aircraft type and ship class. The majority of sailors in operational duty are assigned to Fleet Readiness Centers or Units, either training or working in a shore facility or serving in an operational platform."[46]

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[44] Morgan, CAB 94-40, op. cit., p.12.

[45] D.F. "Rick" Miller, Dorothy E. Schott, Lutrelle F. Parker, Daniel J. Franken, William H. Cameron, Karl J. Van Deusen, and Richard S. Hager, *Horizon: Executive Summary* (Newport, RI: CNO Strategic Studies Group XVI, June 1997), p. VIII-2.

[46] Miller et al., op. cit., p. VIII-3.

Horizon uses a notional four-ship grouping, with one of the ships forward deployed up to three years while the remaining three ships remain in homeport, ready, fully-manned, and available for whatever need arises (see Figure 8). The four-ship option was selected because it reduces significantly the number of transits, eliminates gaps in the three major hubs, and maintains two of the three non-deployed ships in a continuous ready status. Relying on new training and inspection regimes, the Navy can "move away from cyclic readiness towards sustained readiness."[47]

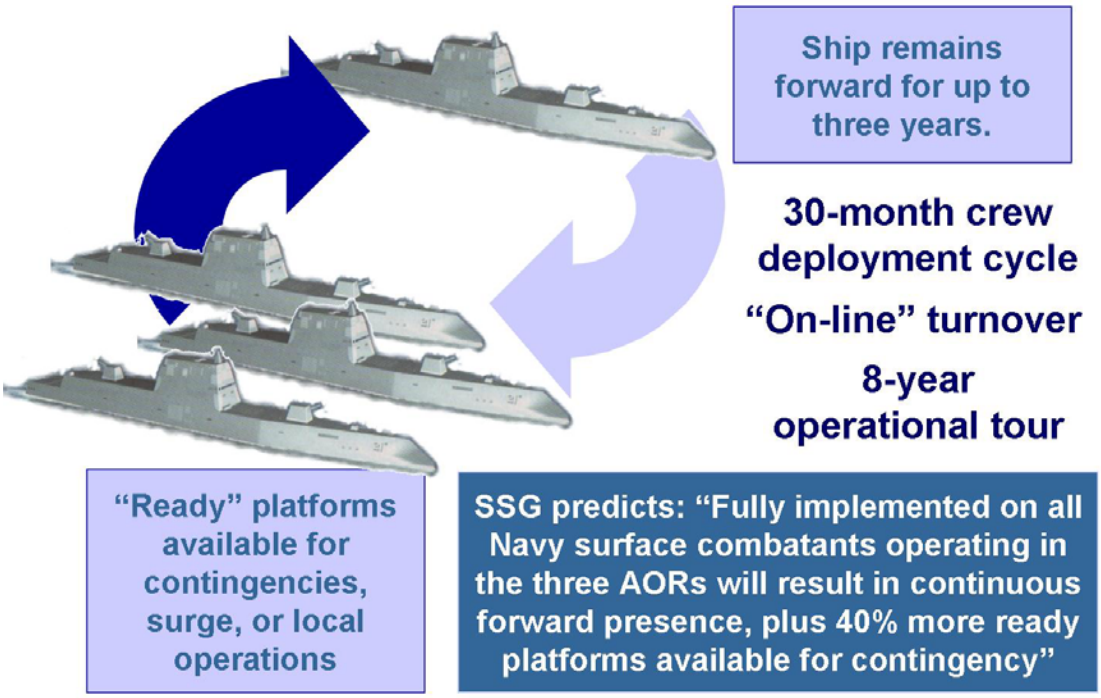

Figure 8. Notional Horizon concept.

If Horizon is applied to all ship types, its proponents claim it "accommodates the possibility that no platforms are homeported overseas."[48] They also calculate that 40 percent more ready platforms can be made available for contingency operations or force reduction. The Horizon concept assumes that sailors serve an eight-year operational tour of duty and will move through the following cycle three times during that period (see Figure 9). Even though the ships may not be "homeported" overseas, there are undoubtedly requirements for some forward infrastructure support to be put in place. As discussed later, there are some countries ready to step up to that kind of arrangement. Here is how SSG perceives crew rotation under the Horizon scheme.

[47] Miller et al., op. cit., p. VIII-4.
[48] Miller et al., op. cit., p. VIII-4.

- Readiness Center facility (7-9 months). Individuals may be instructors, receive advanced in-rate training, or work in a specialty-related billet. On-line training will involve personnel in all phases of the deployment cycle.

- Readiness Unit (12-15 months). Individuals train both in port and underway on one of the Readiness Unit platforms. A high level of readiness is maintained through state-of-the-art collaborative training technologies and techniques, replacing the current inter-deployment training cycle.

- "On-line" turnover (2 weeks). Crews conduct an intense "on-line" turnover. Deploying crews virtually join the forward crew through shared operating pictures on identical tactical displays and in similar work center environments.

- Forward deployment (6 months). Following the deployment, crews return to the Readiness Center and once again enter the cycle.

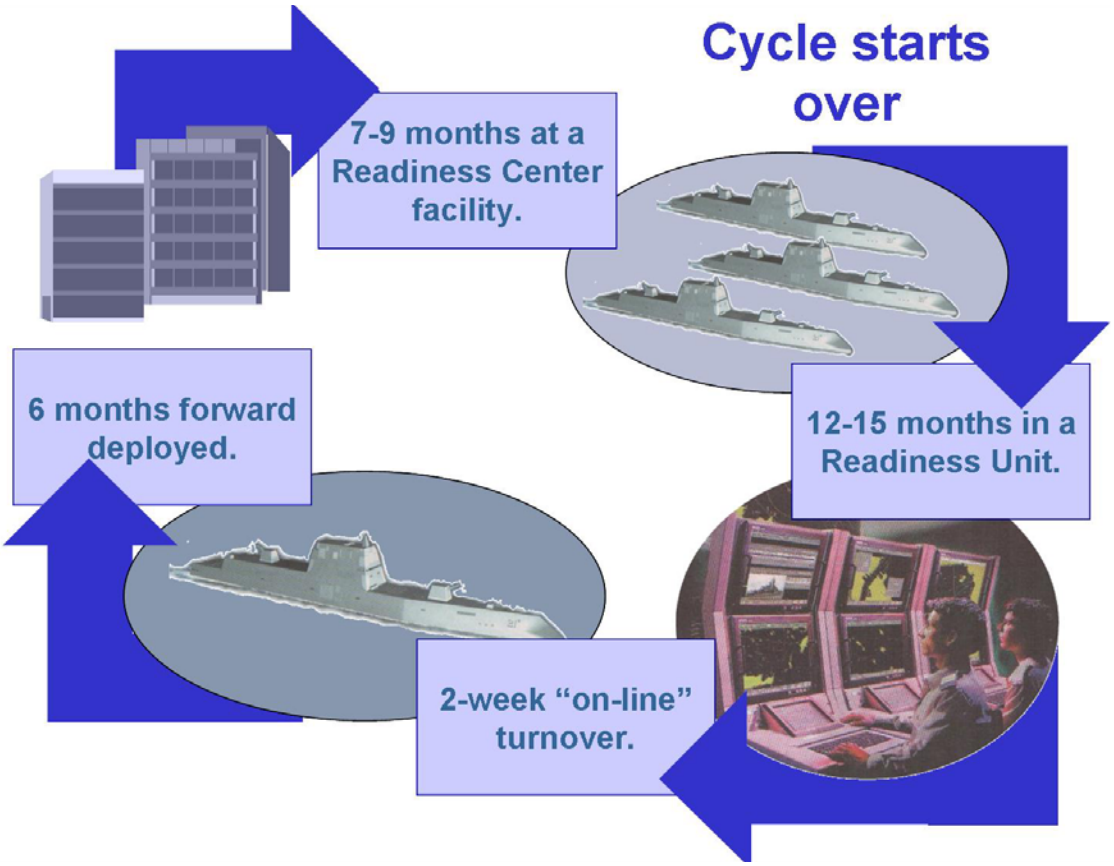

Figure 9. Horizon deployment cycle.

Proponents claim Horizon can produce a 4:1 turnaround ratio, keep sailors home 62 percent of the time, and decrease operational tempo from 29 to 20 days per quarter.

SEA SWAP

This concept was developed at the Naval War College following extensive examination of other crew rotation schemes. It was vetted through a 3- and 4-star oversight group, briefed to the CNO, VCNO, and other senior officials at a 3-star conference in Washington, DC. That group voted to conduct an experiment with the concept. Although an experiment using the Sea Swap name is being conducted, it differs significantly from the concept discussed below.

Extending **ship** deployment length while swapping crews in mid deployment appears to offer tremendous potential for improving on-station time without increasing either OPTEMPO, PERSTEMPO or, to a great extent, ship wear and tear. Crew swapping is a variation on the multi-crewing schemes suggested by the Strategic Studies Group, CNA, and others. The primary difference being that Sea Swap requires no orphaned crews, whereas most multi-crewing options involve more crews than ships; for example 3 for 2 (CNA), 5 for 4 (Horizon), 2 for 1 (SSBN), or several for 2 (MCM-1). The basic unit for this crew swapping concept is an "operational pair" of ships, that are similarly configured ships and whose crews are two identically trained (see Figure 10).

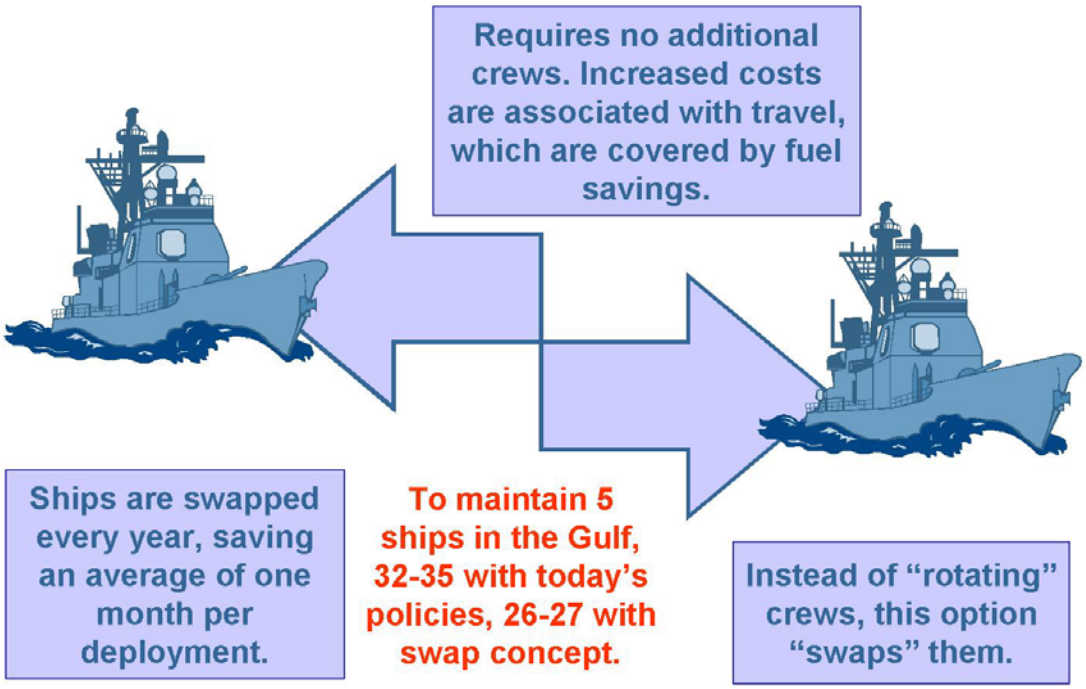

Figure 10. Sea Swap deployment cycle

The crew-swapping scheme would extend individual ship deployments from 6 months to a nominal 11.5 months while holding crew deployments at 6 months.[49] At the 5.5-month point in the cruise, a relief crew from the sister ship in the operational pair is flown into theater to man the deployed ship. After approximately two weeks of turnover, the relieved crew is flown back to CONUS where it mans the non-deployed unit of the operational pair. The deployed unit remains deployed for 11.5 months before being relieved on station in traditional fashion with a vessel from a different operational pair. Essentially, crew swapping eliminates every other ship transit and replaces it with an airlift carrying the relief crew. In the case of deployments from the West Coast to the Persian Gulf, eliminating every other transit provides an additional 2 to 2.5 months of on-station time for each pair of ships without changing turnaround ratio or OPTEMPO for either crew or ship.[50] Looked at from a different perspective, crew swapping reduces the number of ships required to keep one in the Gulf from about 7 to about 5.25.

Crew swapping offers the following potential advantages:

- Significantly improves efficiency in meeting combatant commander requirements for forward deployed units;
- Pairs of similarly configured ships should be easier to maintain than larger "matched" sets;
- No crew is without a ship and no ship without a crew — this should improve training opportunities and contingency surge capability;
- Crews stay with the same ship for approximately 2 years and with same operational pair throughout their sea tour, providing an improved sense of ownership;
- Ships return to CONUS often enough to reduce or eliminate the need to do major maintenance overseas;
- The capability to do major maintenance and upgrades (without disrupting deployment schedules) improves because ships enjoy longer periods in CONUS between cruises;
- Modest forward support infrastructure is required to support crew turnover.

Potential disadvantages:

- Requires secure forward location with sufficient lodging and easy access to air transport;
- Works best with smaller crews: probably impractical for CV/CVN;
- May require some shifting of ships between fleets or squadrons to form appropriate operational pairs;

[49] An 11.5-month ship deployment allows for a 2-week crew turnover without exceeding the 6-month PERSTEMPO limit for either crew.

[50] Given a TAR of 2.75, crews would still deploy for 6 months out of every 22 to 23 months while ships would deploy for twice as long but only half as often — 11.5 out of every 43 months.

- Will require a cultural mindset shift in the surface community.

Since this report focuses on Sea Swap, let's examine the reasoning behind it and how Sea Swap deals with the challenges presented by crew rotation schemes.

FOSTERING A SENSE OF OWNERSHIP

There are two aspects to having a sense of ownership for a specific ship—pride and familiarity. Let's first look at pride. Large cities learned during their experiments with government-owned housing projects, that people who own their residences take better care of them. The Navy has always tried to instill crews with a sense of ownership for their ships because it results in better material upkeep of it. Critics are concerned that rotating crews will result in a loss of ownership; thus, decreasing both fleet readiness (because ship material condition will suffer) and individual pride. Their concerns are backed by historical examples. Foremost among them was the crew rotation scheme for forward deployed Avenger-class mine sweepers beginning in the mid-1990s. "Most of the downside of crew rotation," avers a 1998 CNA report, "stems from the lack of ownership. … This lack of same ship continuity detracts from pride in ownership and reportedly affects crew morale and ship material condition. … Replacement crews typically blame their predecessors for neglecting the material condition of the ship."[51] The report also indicates that sailors felt belonging to a rotating crew was not career enhancing.

Despite past experience, crew rotation can be a viable concept and can be adopted without abandoning the "sense of ownership" philosophy. Under the Sea Swap concept, as mentioned earlier, crews remain with a ship for roughly two years following a swap. That means that they will remain on the same ship for most of their tour. In addition, the Sea Swap scheme recommends pairing ships. Pride can be engendered for a "sister ship" in the same way cities take pride in the achievements of "sister cities."

Another option is to engender a sense of ownership in something other than a ship (although that is not an imperative with Sea Swap). For those who argue this is not possible, we offer the analogy of car owners, who have no difficulty taking pride in all of their cars, no matter which one is driven. By shifting allegiance from a ship to a squadron (or a pair of ships), this same sense of pride and ownership can be maintained without a decrease in ship condition. The CNA study recommends engendering this pride through professional and social inter-squadron competition, "such as softball and bowling leagues."[52] We believe it must go much deeper and that squadrons need to establish unsurpassed professional reputations and hold their crews responsible for maintaining them.

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[51] David L. Dittmer and James E. Grogan, *Crew Rotation: The MCM-1 Experience* (Alexandria, VA: Center for Naval Analyses, May 1998), pp. 14-15.
[52] Dittmer and Grogan, op. cit., p. 28.

Perhaps the best example of this is Destroyer Squadron 23, better known as the "Little Beavers."[53] Under the leadership of then-Captain Arleigh Burke, the squadron earned a sterling reputation. "The men of the eight Little Beaver ships, after Burke's assumption of command, quickly began identifying with the Squadron, the larger unit, rather than with their respective ships. This was new and surprising. Traditionally, in the Navy, the sailor identifies with his particular ship and his shipmates, and battles in which beer bottles flew have been fought in consequence. But in the Little Beavers under Burke it was different. Not only did the men identify with the Squadron but they gave it an intense loyalty beyond that customarily observed and, in time, they were to force the whole Navy to recognize the Little Beaver insigne as an exclusive mark of earned distinction."[54] This phenomenon was not lost on Admiral William Halsey, who wrote about the "rare phenomenon of a spirit which extended beyond the individual ship to create a sense of pride in, and loyalty to, the *entire* squadron. Each ship was good—not only because her men were good, but also because she belonged to DesRon-23! In this, each ship contributed to a higher standard, and each ship strove to live up to the reputation earned by the whole squadron."[55]

It can be argued that Burke developed a cult of personality, rather than unit pride. But that need not be the case. Although shifting allegiance from ships to squadrons (or ship pairs) will require a change in culture, once it occurs pride and ownership shouldn't be a problem. For lots of positive political reasons, ships should continue to receive individual names, and under Sea Swap sailors could change allegiance as they swap ships. A concomitant benefit of this move is the enhanced prestige it would bring to squadron commodores.

MINIMIZING TRAINING CHALLENGES

Familiarity with equipment is a different challenge. "The major problem for modern surface combatants," asserts William Morgan, "isn't engineering, it's the weapon systems. There are major differences among various flights of the same ships class."[56] David Dittmer and James Grogan also found familiarity with equipment a problem in mine sweeper crew rotations. If nuclear-powered ships are eventually brought under the Sea Swap scheme, they face a more daunting challenge in that personnel are currently certified for a specific reactor. Personnel would have to be certified on two plants.

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[53] Little Beaver was Red Ryder's sidekick in the comic strip of the same name.
[54] Ken Jones, *Destroyer Squadron 23: Combat Exploits of Arleigh Burke's Gallant Force* (Philadelphia: Chilton Company, 1959) p. 172.
[55] Jones, op. cit., p. viii.
[56] Morgan, CAB 94-40, op. cit., p. 13.

One reason that we recommended pairing ships for Sea Swap is that it is easier to try and maintain ship configuration control between them than it would be for a larger group of ships. Future constructions should seek for as much commonality as possible and ship alterations should be conducted on a group basis in order to maintain this commonality.

TRANSPORTATION AND OTHER COSTS

Morgan claims that, for a single-crew ship, air transport costs are about the same as ship fuel costs during transit.[57] We believe they could be much less.[58] If force reductions are implemented as a result of crew rotations, transportation costs represent a fraction of what is saved. Either way, transportation costs are not a limitation on crew rotations. Under the Sea Swap concept, the cost of airlift for the swapping crews is offset by the cost of fuel that would have been used had the ships replaced each other and been required to transit both to and from the area of operations.

Conclusions

As noted in the text, deployment efficiencies were primarily examined for surface combatants. The primary reason is that carrying out necessary experiments with deployment schedules, manning, and maintenance options is easier with surface combatants. However, some options could produce savings for all ship types. The greatest challenge for nuclear-powered ships is reducing maintenance time.

Figure 11 shows how much improvement can be made in the ratio of ships required to keep one on station using individual and combined strategies when compared to the baseline case. The individual strategies include:

- Eliminating port calls en route to station (not recommended)
- Reducing turnaround ratios by decreasing steaming days (recommended)
- Reducing the maintenance factor (highly recommended)
- 20-knot transits to and from station (recommended when possible)
- Increase deployment lengths (selectively recommended)
- Crew swapping (highly recommended)

[57] Morgan, CAB 94-40, op. cit., p. 19.

[58] Our rough calculations indicate that it takes about 1.375 million gallons of fuel to a DDG from the West Coast to the Persian Gulf while a 747-400 can fly the same distance on 100,000 gallons of fuel.

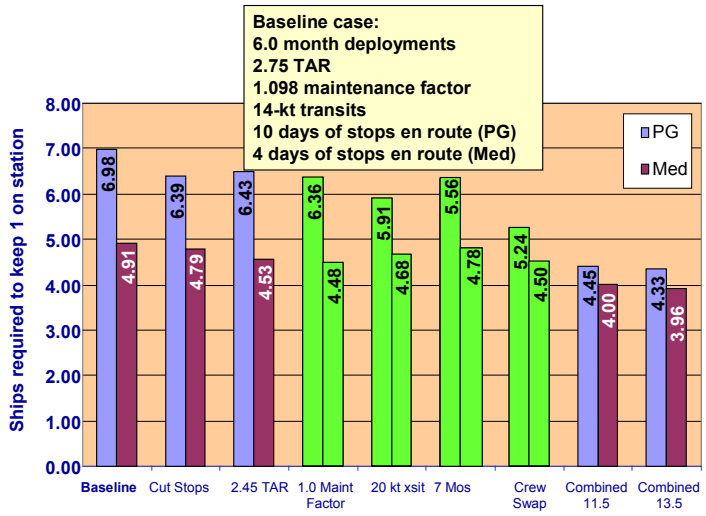

Figure 11. Ships required to keep one on station (options vs baseline)

The columns labeled "Combined 11.5" show the reductions possible by combining phased maintenance, 20-knot transits, and crew swaps, while maintaining 6-month deployments for crews. The columns labeled "Combine 13.5" adds 7-month deployments to that mix. Figure 12 shows additional reductions that can be made if steaming days per quarter are reduced from 29 to 27 days (effectively reducing the turnaround ratio to 2.45).

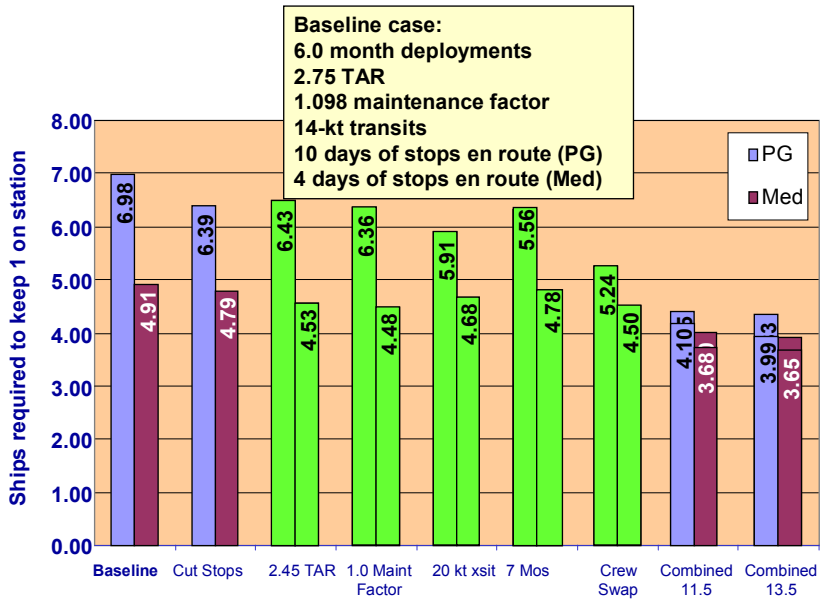

Figure 12. Ships required to keep one on station (affect of TAR reduction)

We don't want to imply that adopting these strategies will be easy. In fact, we know it will be difficult. Since none of these recommendations are entirely new, were adopting them easy, they would have been implemented years ago. There are compelling reasons, however, for experimenting with these options that did

not previously exist. The most compelling of these reasons are predicted insufficient shipbuilding funds to sustain current force size and the disruption of traditional deployment schedules caused by the war on Iraq. The Navy must get more out of whatever fleet size it is able to maintain.

Figures 11 and 12 show that significant force structure savings can be made if options are combined wisely. We recognize that actual savings will be less. Regardless of the savings, some ships could be made available to increase presence, form a crisis response force, or be retired to free funds for modernization. For example, in the best (idealized) case (West Coast to Persian Gulf deployments) up to 35 ships can be removed from the current rotation process, for every 10 ships that must be kept forward, by adopting a combined strategy while maintaining six-month deployments. The single most effective strategy to pursue is crew swapping.

EXPERIMENT

A real Sea Swap experiment should be conducted and designed for success. That means making sure the right ships are selected and paired, and that they are properly manned and supported. Personnel involved should be tracked through the promotion process to ensure participation does not adversely affect their careers.

As noted earlier, crew swapping appears to offer the greatest benefits for creating organizational slack in the Navy. As Figure 13 demonstrates, crew swapping with three pairs of ships can create up to three times more organizational slack than deploying the same six ships sequentially over a four-year period—the recommended length of the experiment.

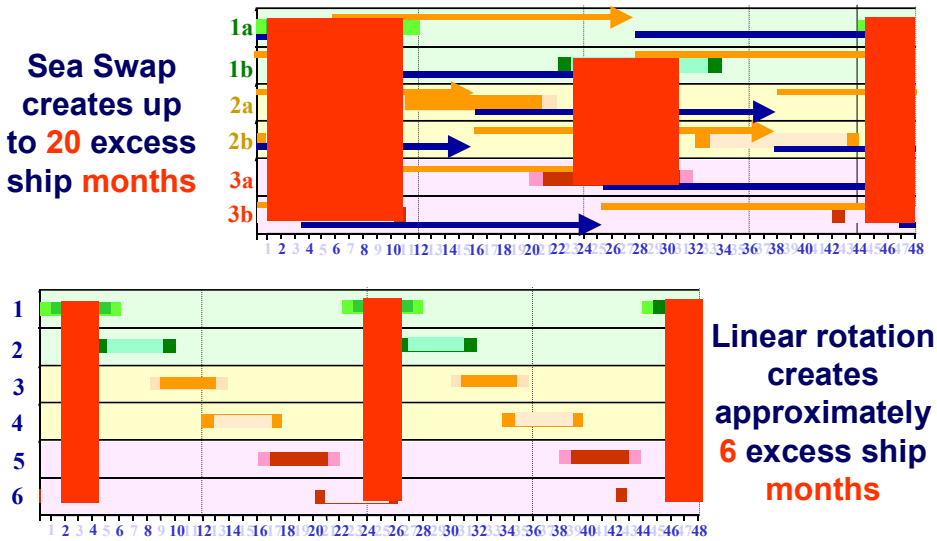

Figure 13. Increase in excess ship months created through crew swaps

One interesting side effect of crew swapping is that it appears to make other options easier to implement. For example, because ships involved in the crew swapping scheme stay forward for a double cycle, they also spend much more time in CONUS, allowing them more easily to undergo repairs and remain in the rotation cycle without a maintenance factor penalty. Crew swapping can also be implemented independently of the availability of forward U.S. bases, although they do require a port with an international airport and adequate hotel space.

Since we introduced the Sea Swap concept, it has received consistent support. David Chu, Undersecretary of Defense for Personnel and Readiness, has "praised the Navy's 'Sea Swap' program, saying it was an innovative solution to doing more with fewer assets."[59] Loren Thompson, a defense analyst with the Lexington Institute, said the Navy "deserves credit for breaking with tradition."[60] And Ivan Eland, an analyst with the Cato Institute, said, "Sea Swap could improve efficiencies in Navy deployments, as well as reduce stress on crews and ships."[61] As a result we believe Sea Swap is an important scheme to explore correctly. The experiment currently underway using the Sea Swap name has significant differences from the recommended experiment.

A few areas that the current experiment has not addressed include:

- ✓ **Configuration control over time**. Configuration control was simply not addressed in the current experiment.

- ✓ **Pride and ownership**. The long-term affect of crew swapping could not be tested in the current experiment because several of the participating ships were decommissioned.

- ✓ **Maintenance**. Maintenance issues only surface over time. Plans for continuing the experiment long enough to determine what the challenges might be are uncertain. Without hard data, getting Congress to grant overseas repair relief will prove difficult.[62]

- ✓ **Sustainability over time**. Sea Swap is only as useful as it is sustainable. Any experiment with the concept needs to be long-term and keep the same ships in the pool.

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[59] Summary of Nathan Hodge, "Chu: Better Crew Plans Can Save Navy Dollars," *Defense Week*, 2 June 2002, p. 3. [*Combat Systems Clips*, 7 June 2002, p. 3]
[60] Summary of "A Sea Change is Afloat in Navy as U.S. Destroyer Deploys to Gulf," *Los Angeles Times*, 27 January 2003. [*Combat Systems Clips*, 31 January 2003, p. 5]
[61] Ibid.
[62] Congress removed such relief from the 2004 Defense Authorization Bill largely due the lobbying efforts of the Shipbuilders Council of America. See Bill Gertz and Rowan Scarborough, "Domestic Dispute," *The Washington Times*, 30 May 2003, p. A7.

Although some lessons have been learned, the long-term viability of the concept is not yet known. Australia and Singapore have already supported the concept and others may do so as well.[63]

[63] Summary of "Big U.S. Navy Boost for WA," *The Sunday Times* (Western Australia), 24 October 2002 [*Combat Systems Clips*, 8 November 2002, p. 6], and summary of David Castellon, "'Sea Swap' on in Singapore," Navy Times, 28 April 2003, p. 28 [*Combat Systems Clips*, 25 April 2003, p. 7]