United States General Accounting Office

GAO

National Security and International Affairs Division

January 1995

NAVY'S AIRCRAFT CARRIER PROGRAM

Investment Strategy Options

GAO/NSIAD-95-17

Preface

Aircraft carriers are a central part of the nation's defense strategy. The decision on the composition of the aircraft carrier force is essential for planning the defense budget, since new carrier procurement is a significant investment, and a long-term commitment to purchase and sustain associated air wing, escort, and support ships.

In March 1993, the Secretary of Defense initiated the Bottom-Up Review (BUR)—a review of the nation's defense strategy, force structure, modernization, infrastructure, and foundations—because of the dramatic changes that resulted from the end of the Cold War and the dissolution of the Soviet Union. As part of this review, the Department of Defense (DOD) evaluated key modernization programs, including the Navy's aircraft carrier program. The BUR concluded that a force of 10 carriers was adequate to meet war-fighting requirements, but 12 carriers (11 active and 1 reserve/training carrier) were needed for sufficient overseas presence. The BUR recommended that construction of CVN-76 begin in fiscal year 1995 to maintain the 12-carrier force structure, allow flexibility in the carrier force size, avoid cost increases associated with a delay in construction, and preserve the industrial base at Newport News Shipbuilding in Newport News, Virginia.[1]

In fiscal year 1993, the Congress provided $832 million for long-lead procurement items (primarily nuclear components) for CVN-76. Congressional conferees on the Defense Appropriations Act for 1994 stated that $1.2 billion in the National Defense Sealift Fund may be made available for later transfer to the shipbuilding and conversion account for the carrier. In fiscal year 1995, the Congress appropriated about $2.3 billion to cover the remaining construction costs of CVN-76, and $38.3 million in advance procurement funds for the nuclear refueling complex overhaul of the U.S.S. Nimitz (CVN-68), scheduled to begin in fiscal year 1998. The total cost of CVN-76 construction is estimated at $4.3 billion (current dollars for fiscal years 1993-95) and the U.S.S. Nimitz overhaul is estimated at $2.7 billion (current dollars for fiscal years 1993-2002).

Newport News Shipbuilding is the only shipyard that can build nuclear aircraft carriers. It is completing construction work on two new nuclear carriers, the U.S.S. John C. Stennis (CVN-74) and the U.S.S. United States (CVN-75), and the nuclear refueling complex overhaul of the U.S.S. Enterprise (CVN-65). The shipyard is also one of two locations that can

[1]CVN is the designation used for nuclear aircraft carriers. Two other designations used throughout this report are CV for conventional aircraft carriers and CVA for alternative conventional aircraft carriers.

construct nuclear submarines. It is completing work on its last construction contract for SSN-688 class submarines and is the lead design agent for the SSN-21 Seawolf.

According to the BUR, delaying construction of CVN-76 would threaten the viability of the Newport News Shipbuilding shipyard due to the lack of work once existing contracts are completed in the mid-1990s. However, the BUR stated that if CVN-76 construction were delayed beyond fiscal year 1995, the risk to Newport News Shipbuilding could be minimized by rescheduling ship overhauls, delaying delivery of carriers currently being built, and assigning other work to the shipyard.[2] To maintain the BUR force structure and/or critical industrial capabilities, the Navy developed the Navy's Recapitalization Plan. This plan transfers resources from the Navy's infrastructure and savings from a smaller fleet to fund the Navy's protected major procurement accounts, including the carrier program. Under both the BUR and the Navy's Recapitalization Plan, the naval shipbuilding industry will experience drastic declines in employment levels.

The Navy estimates the minimum sustainable employment level at Newport News Shipbuilding to be between 10,000 and 15,000 people. As the employment level decreases within this range, risks to the shipyard's viability and ship affordability increase. The Navy also estimates the minimum economic production of aircraft carriers at Newport News Shipbuilding would consist of (1) new carrier construction in fiscal years 1995 and 2000 followed by a production interval of 3 to 4 years and (2) refueling complex overhauls of the Nimitz-class carriers.

This report supplements our April 1994 testimony before the Subcommittee on Military Acquisition, House Committee on Armed Services, on Navy affordability issues.[3] We testified on the affordability of several carrier force structure investment alternatives to begin building CVN-76 in fiscal year 1995. This report discusses the budget implications of a wide range of options for meeting the BUR force structure requirement for 12 carriers, including the purchase of conventionally powered carriers instead of nuclear-powered carriers. It also discusses each option's effect

[2]Newport News Shipbuilding has previously built major surface combatants and large complex commercial ships and completed refuelings and complex overhauls on nuclear surface ships, attack submarines, and ballistic missile submarines.

[3]Navy Modernization: Alternatives for Achieving a More Affordable Force (GAO/T-NSIAD-94-171, Apr. 26, 1994).

on employment levels at Newport News Shipbuilding. Chapter 2 provides details on each option.

The congressional conferees on the Defense Appropriations Act for 1994 have mandated that we review the cost-effectiveness of conventional versus nuclear carriers and submarines. This review is currently underway with completion scheduled for next year. That report, along with this report on affordability, should assist the Congress in deliberating carrier issues.

Questions concerning this report should be directed to me at (202) 512-3504. Major contributors to this report are listed in appendix IV.

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Director, National Security
Analysis

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Abbreviations

BUR	Bottom-Up Review
DOD	Department of Defense
NNS	Newport News Shipbuilding
OMB	Office of Management and Budget

Overview

Key Findings From Investment Options Analysis

The Navy can maintain a 12-carrier force for less cost than that projected in the Bottom-Up Review (BUR) and the Navy's Recapitalization Plan by using one of several options that consider cost and employment levels. The least expensive investment option that also maintains employment levels at or above minimum levels authorizes building the CVN-76 in fiscal year 1995 and then transitions to a conventional carrier construction program. This option costs approximately 25 percent less than the BUR and the Navy's Recapitalization Plan options.

Building CVN-76 in fiscal year 1995, as proposed by the BUR, the Navy's Recapitalization Plan, and other options in our report (see table 1.1), stops the downward trend in Newport News Shipbuilding employment at about the minimum sustaining level of 10,000 employees. Options to delay building the carrier result in a continuing decline to about 7,500 employees. However, in the long term the employment levels in the BUR and the Navy's Recapitalization Plan also fall below 10,000 employees. In addition, options that include building CVN-76 in fiscal year 1995 require building carriers sooner than they are needed for force structure purposes and therefore incur expenses sooner than necessary. Moreover, the option to build nuclear carriers at the historical rate of one every 3 years maintains stable employment levels but costs about 40 percent more than options in the BUR and the Navy's Recapitalization Plan.

Options for using carriers for their full service lives (options 1A and 1B) are less expensive than those in the BUR and the Navy's Recapitalization Plan, especially if the force transitions to a conventional carrier construction program. However, in the near term, the employment levels fall below the Navy's estimated critical minimum sustaining level of 10,000 employees.

Since affordability of the future force is an important concern, a transition to constructing conventionally powered carriers would save the largest amount of investment resources (see table 1.1). A conventional carrier force structure would require less budget authority funding and fewer outlays than any force structure that continues to require building nuclear aircraft carriers. Costs are lower because all major cost elements—procurement, midlife modernization, and inactivation costs—are lower for a conventional carrier than for a nuclear carrier.

Table 1.1: Effect of Force Structure Options on Outlays, Production Starts and Intervals, Lost Useful Service Life, and Newport News Shipbuilding Employment Levels

Fiscal year 1993 dollars in millions

Carrier option	Outlays			Next carrier (FY)	Building start interval (years)	Useful service life lost[a] (years)	Newport News Shipbuilding employment levels[b]
	FY 95-99	FY 95-15	FY 95-35				
Nuclear							
BUR—Buy CVN-76 in fiscal year 1995	$4,235	$26,005	$56,154	1995	2-7	7	Stays above 10,000 in the near term
Navy's Recapitalization Plan	4,212	26,432	58,600	1995	4	18	Stays above 10,000 in the near term
1A—Replace all carriers at retirement with nuclear carriers	2,116	26,901	55,993	1999	3-10	0	Drops to 7,500 in the near term
2A—Build nuclear carriers at a sustained rate of production[c]	5,137	36,205	79,275	1995	3	83	Stays above 10,000 in the near term; averages 21,500 in the long term
4A—Defer CVN-76 until fiscal year 1998	2,649	25,579	54,667	1998	4-5	3	Drops to 7,500 in the near term
4B—Defer CVN-76 until fiscal year 2000	1,890	26,515	54,317	2000	4-5	3	Drops to 7,500 in the near term
Conventional							
1B—Replace all carriers at retirement with conventional carriers	1,561	18,168	35,410	2000	3-10	0	Drops to 7,500 in the near term
2B—Build conventional carriers at a sustained rate of production[c]	1,561	19,612	44,630	2000	3	40	Drops to 7,500 in near term
3—Buy CVN-76 in fiscal year 1995 but transition to a conventional carrier construction program with CVA-77	4,215	20,363	41,873	1995	4	23	Drops just below 12,000 in the near term
4C—Defer CVA-76 until fiscal year 2002	1,501	17,332	37,393	2002	3-4	9	Drops to 7,500 in the near term

Note: Cost estimates do not include the cost of initial nuclear fueling or refueling.

[a]Projected service life lost totals include those carriers that would be prematurely inactivated so that carriers built in 1995 or later could enter the fleet. Totals do not include early carrier retirements required to reduce the force to 12 carriers.

[b]The Navy estimates the minimum sustainable employment level at Newport News Shipbuilding to be 10,000 to 15,000 people.

[c]Sustaining rate options buy carriers at a sustaining interval based on historical procurement rates.

Nuclear and Conventional Carrier Propulsion Issues

Throughout the 1960s and most of the 1970s, the Navy pursued a goal of creating a fleet of nuclear carrier task forces. The centerpiece of these task forces, the nuclear-powered aircraft carrier, would be escorted by nuclear-powered surface combatants and nuclear-powered submarines. In deciding to build nuclear-powered surface combatants, the Navy believed that the greatest benefit would be achieved when all the combatant ships in the task force were nuclear powered. Nonetheless, the Navy procured the last nuclear-powered surface combatant in 1975 because this vessel was so expensive. More recently, relatively new and highly capable nuclear-powered surface combatants have been decommissioned because of the affordability problems facing the Navy.

Affordability is an important, but not the only, criterion when comparing nuclear and conventional carriers. Important factors also include operational effectiveness, potential utilization, and other intangibles. Flexibility of operations, such as the ability to steam at high speeds for unlimited distances without refueling; increased capacity for aviation fuel; increased capacity for other consumables, such as munitions; and the higher speeds of the advanced nuclear carrier over conventional carriers are some of the factors that need to be considered when evaluating nuclear- and conventionally powered carriers. Other considerations include the availability and location of homeports and nuclear-capable shipyards for maintenance and repairs and other supporting infrastructure, such as for training; the effect of out-of-homeport maintenance on the amount of time personnel are away from their homeport; and the disposal of nuclear materials and radioactively contaminated materials. These issues and others will be addressed in our upcoming review on the cost-effectiveness of conventional versus nuclear carriers and submarines as mandated by the congressional conferees on the Defense Appropriations Act for 1994.

Agency Comments and Our Evaluation

Department of Defense (DOD) officials partially concurred with the results of our report. DOD agreed that affordability is an important, but not the only, criterion when comparing nuclear and conventional carriers. DOD stated that other factors, including operational effectiveness and potential utilization, need to be considered when comparing nuclear and conventional carriers. We agree, and these issues will be examined as part of our upcoming review of the cost-effectiveness of conventional versus nuclear carriers and submarines.

DOD noted that we did not examine the impact of alternative investment strategies on the Newport News Shipbuilding nuclear carrier industrial base, nuclear construction skills and vendors, or the need to preserve the base. We noted those limitations to the report's scope in our draft. Our report does reflect the employment levels resulting from the investment options, and the Navy's comments on the likely effects of those employment curves are in our report.

DOD also noted that our report compares only the investment-related cost of a nuclear-powered carrier with that of a conventionally powered carrier and not the operating and support component of total life-cycle costs, including the fuel cost. DOD stated that the potential requirement to build additional logistics support ships must be considered in the decision to build and operate a conventionally powered carrier force. As we noted in the draft report, our analysis focused on the investment-related costs of alternative procurement profile strategies. Although outside the scope of this review, we have estimated the operating and support costs of a nuclear carrier and a conventional carrier of the general type used in our investment analysis (see table 1.2).

Table 1.2: Annual Operating and Support Costs for Nuclear- and Conventionally Powered Carriers

Fiscal year 1993 dollars in millions

Carrier type	Annual cost
Nimitz-class nuclear carrier	$235.4
Kitty Hawk/John F. Kennedy class conventional carrier	196.3
Additional cost for nuclear-powered ship	**$39.1**

Note: Estimates include the cost of initial nuclear fueling and refueling.

The annualized life-cycle cost of a modern fleet oiler is about $19.6 million. A recent Center for Naval Analyses study suggests that the conventional carrier's incremental support requirements would be less than one fleet oiler per carrier. We have not verified this data. Our upcoming review will examine in greater detail the life-cycle costs of nuclear and conventional carriers, considering the incremental fuel-driven demand of conventional carriers for additional logistics support ships.

Analysis of Aircraft Carrier Investment Strategy Options

Force Structure Option Analyses

The objective of the BUR strategy is to maintain a 12-carrier force, maintain the industrial base at NNS, avoid cost increases associated with a delay in construction, and preserve carrier force size flexibility. Under the BUR, the Navy would purchase CVN-76 in fiscal year 1995 consistent with a sustaining rate strategy but would shift to a replacement rate strategy beginning with CVN-77. The Navy's Recapitalization Plan transfers resources from the Navy's infrastructure and savings from a smaller fleet to fund the Navy's protected major procurement accounts, including the carrier program, in order to maintain the BUR force structure and/or critical industrial capabilities. Under the Navy's recapitalization strategy, the Navy would buy CVN-76 in fiscal year 1995 but would defer CVN-77 until fiscal year 2002 and then shift to a sustaining rate strategy of one carrier every 4 years.

The BUR and the Navy's Recapitalization Plan were analyzed to determine the effects of their strategies on the carrier force structure, financial investment requirements, and the Newport News Shipbuilding total employment level. In addition, we analyzed eight alternatives for structuring a 12-carrier force to achieve one of the following objectives:

1. Maximize budgetary savings through a carrier replacement rate strategy. This approach maximizes the carriers' useful service lives and builds new carriers when actually needed to sustain force levels. (See the analysis and discussion of alternatives 1A and 1B.)

2. Maximize the stability of Newport News Shipbuilding (NNS) employment through a sustained rate construction and refueling/complex overhaul program. This approach requires forgoing useful service life by accelerating inactivations to maintain a sustained rate production program. (See the analysis and discussion of alternatives 2A and 2B.)

3. Optimize budgetary savings and employment level stability. This approach optimizes the service lives of nuclear carriers and provides a stable employment base. (See the analysis and discussion of alternative 3.)

4. Delay building the new carrier to defer near-term outlays and reduce overall carrier program costs. The new starts for a nuclear carrier force were planned for fiscal years 1998 and 2000 and fiscal year 2002 for a conventional carrier force. (See the analysis and discussion of alternatives 4A, 4B, and 4C.)

The following discusses our analyses of DOD's and the Navy's baseline force structure plans and the options we developed based on the four planning objectives and force structure investment strategies. We analyzed each option's impact on force structure and the trade-offs between budgetary requirements and overall employment levels at NNS.

Bottom-Up Review Baseline Force Structure Option

Under the BUR's baseline force structure option to support a 12-carrier force (i.e., 11 active carriers and 1 operational reserve/training carrier), CVN-76 is funded in fiscal year 1995, necessitating the early retirement of the U.S.S. Kitty Hawk (CV-63). After CVN-76 the Navy plans to procure new carriers when needed to maintain force levels. This approach results in fluctuating intervals of 2 to 7 years for the construction of new carriers, but maximizes the notional 50-year service life of current and planned nuclear-powered carriers.[1] To sustain their full 50-year service life, nuclear carriers will be refueled after approximately 23 years of service.[2] (See fig 2.1.)

Figure 2.2 shows that this option halts the rapid decline in employment at NNS at just above the 10,000-employee level— the minimum level needed to sustain the shipyard's viability, according to the Navy. If scheduled CVN construction is delayed, the Navy stated it would, at a minimum, have to expand the number of regular overhauls at NNS and take action to preserve the nuclear component and shipbuilding industrial base.

The BUR option provides a near-term solution to the employment level decline, although it may be difficult for the shipyard to economically administer the drastic shifts in the employment levels at the yard between fiscal years 1998 and 2033. Substantial declines in employment at NNS are projected to bottom out in fiscal years 1998, 2004, 2014, 2024, and 2033. The drastic decline beginning in fiscal year 2010 reduces the workforce by about 13,000, dropping total employment below the minimum level.

Although DOD believes that this option is cost-effective, it totals over $4.2 billion in the short term (fiscal years 1995-99), and its cost over the long term (fiscal years 1995-2035) totals more than $56 billion.[3] Only one option, which reduces the service life of nuclear carriers to 37 years, has larger outlays than the BUR baseline force model (see discussion of alternative 2A).

[1]The U.S.S. Enterprise (CVN-65), which is the only nuclear carrier in the force that is not part of the Nimitz-class, was recently refueled and has a projected 53-year service life.

[2]Unless otherwise noted, references to the nuclear carrier force include those nuclear carriers currently under construction: the U.S.S. John C. Stennis (CVN-74) and the U.S.S. United States (CVN-75).

[3]The cost estimates exclude nuclear fuel expenditures.

Figure 2.1: Force Structure for BUR Option

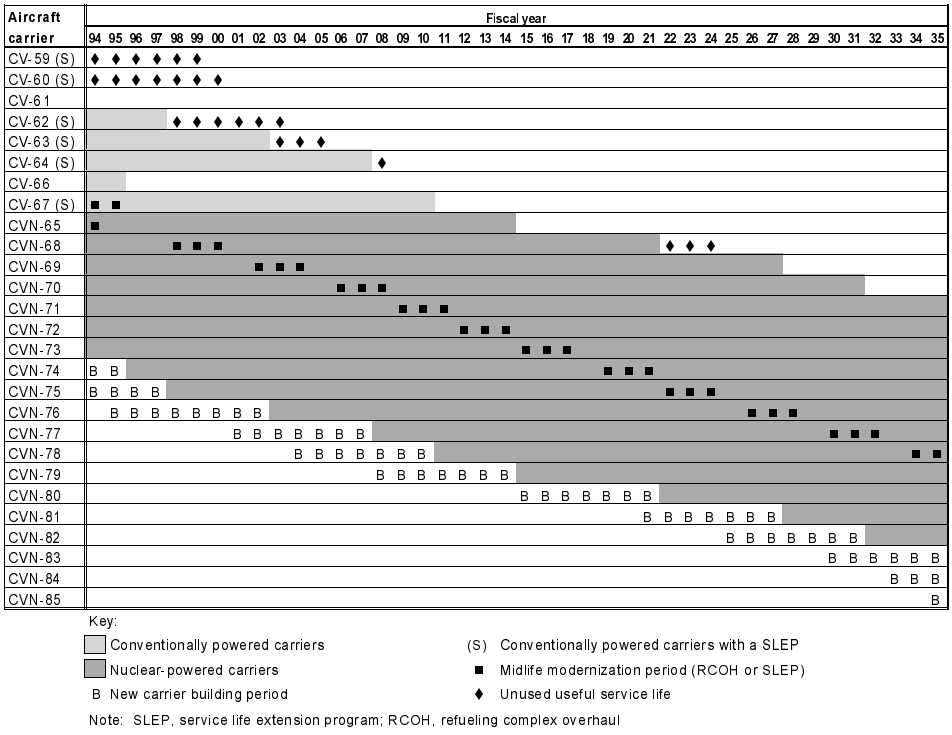
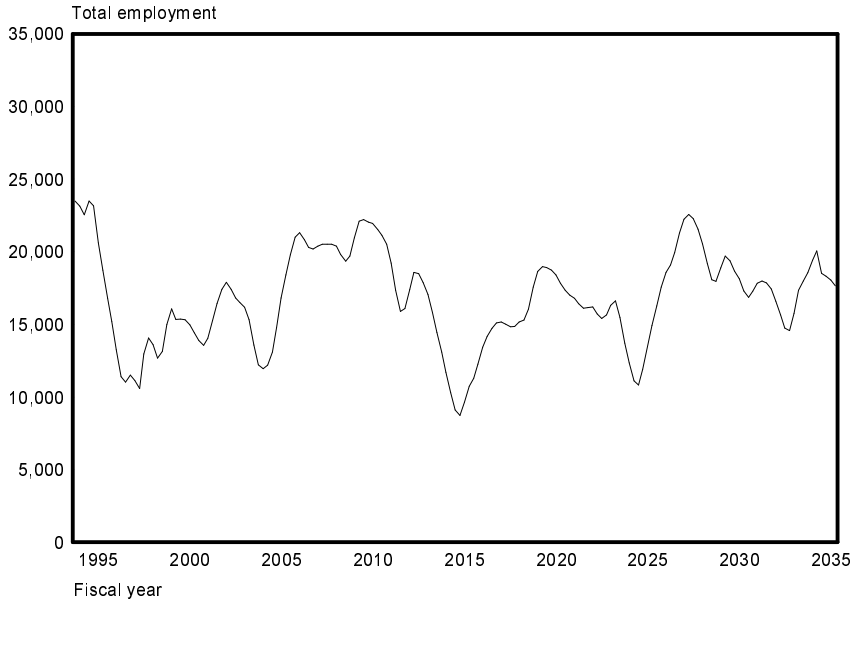


Figure 2.2: Total Employment Level at NNS Under BUR Option



Navy's Recapitalization Plan Option

The Navy's Recapitalization Plan was developed to fulfill the requirements of the BUR. This plan calls for funding CVN-76 in fiscal year 1995 and building new nuclear carriers in 4-year intervals beginning in fiscal year 2002, as shown in figure 2.3. The plan requires that some assets be retired early to buy newer equipment. The U.S.S. Kitty Hawk (CV-63) will be retired 3 years before the end of its projected service life to maintain the 12-carrier force level when CVN-76 enters the fleet. To sustain the 4-year build interval, five other carriers will be retired early: the U.S.S. Enterprise (CVN-65) will be inactivated 2 years early, the U.S.S. Dwight D. Eisenhower (CVN-69) and the U.S.S. Carl Vinson (CVN-70) will be retired 3 years before the end of their projected service lives, and the U.S.S. Nimitz (CVN-68) and the U.S.S. Theodore Roosevelt (CVN-71) will be decommissioned 4 years early. The Navy will prematurely incur large inactivation costs, currently estimated at almost $1 billion each, for the early inactivations of these Nimitz-class carriers.

The plan maintains approximately the same employment level at NNS as the BUR baseline force structure option through fiscal year 2001 (see fig. 2.4). Between fiscal years 2010 and 2034, the plan maintains an average total employment level above the projected level for the BUR option. Except for declines in total employment in fiscal years 2003-5, 2017-18, and 2029-31, this option maintains shipyard employment between 15,000 and 23,000 after fiscal year 2001 due to the consistent 4-year construction interval.

Although the outlays are slightly lower than those in the BUR option in the near term (1995-99) due to a 1-year delay in CVN-77, the outlays for the mid-term (fiscal years 1995-2015) and long term (fiscal years 1995-2035) are higher than those in the BUR option due to the consistent 4-year new construction interval and the additional premature inactivations of Nimitz-class carriers. Total outlays for fiscal years 1995-2035 total almost $59 billion, about $2.5 billion higher than the cost in the BUR option.

Figure 2.3: Force Structure for the Navy's Recapitalization Plan Option

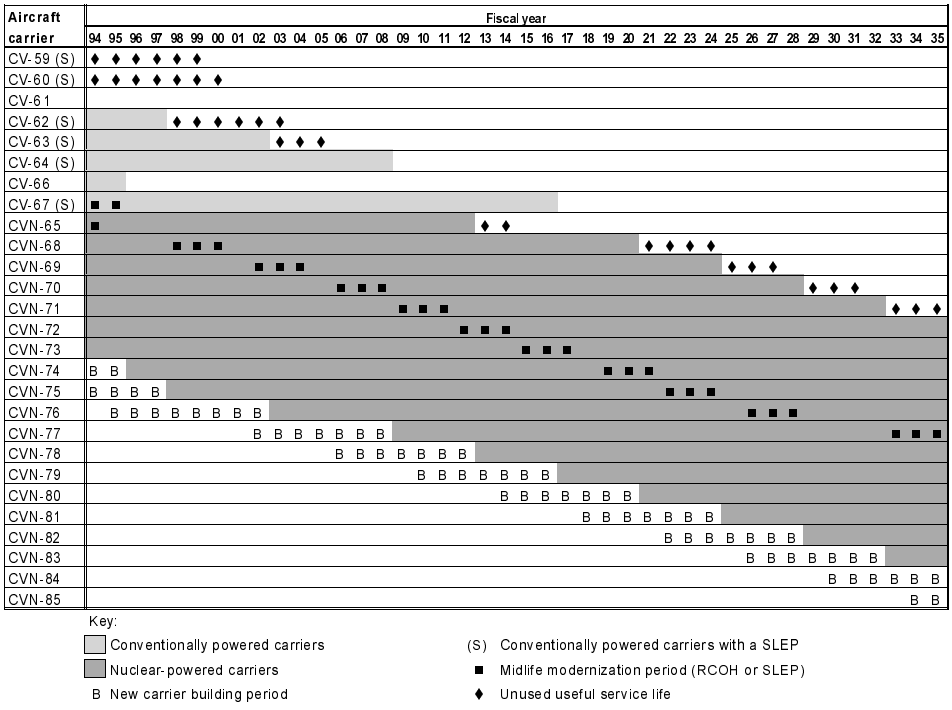
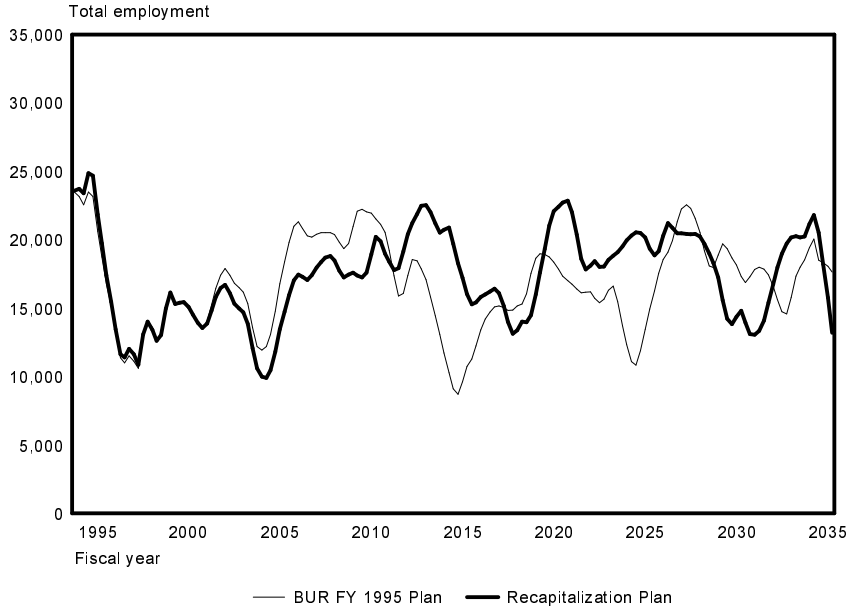


Figure 2.4: Total Employment Level at NNS Under the Navy's Recapitalization Plan Option



Alternative 1A: Maximize Budgetary Savings Through a Nuclear Carrier Replacement Rate Strategy

Using this force structure option, the Navy builds a new carrier only to replace a carrier that has to be inactivated at the end of its service life (see fig. 2.5). The U.S.S. Independence (CV-62) is the last carrier to be decommissioned before the end of its service life to maintain a 12-carrier force level when the U.S.S. United States (CVN-75) enters the force. All Nimitz-class carriers will use their entire projected 50-year service lives, which will require that each receive a nuclear refueling complex overhaul at 23 years. This option's construction schedule leads to a variable build interval; construction starts may be anywhere from 3 to 10 years apart. Construction for CVN-76 begins in fiscal year 1999, and the ship will replace the U.S.S. Kitty Hawk (CV-63) in fiscal year 2006.

Figures 2.5 and 2.6 show that although the Navy receives the full value of its carrier force investment, workforce management is complicated by several short-term surges in total employment and then large drop-offs because of the varying build intervals. Those changes in employment levels are similar to those in the BUR baseline force option, although the drop-off between fiscal years 1996 and 2000 under this option is much more drastic, with the employment level falling below 10,000. The workload gap could be filled by having the government direct other work to the shipyard or reschedule delivery of work under contract. Employment at the shipyard improves under this option in the mid- and long terms. Between fiscal years 2001 and 2015, the total employment level at NNS is generally at a higher level than in the BUR option. After fiscal year 2020, this option's total employee level has fewer major shifts over the remaining 15 years of the period we analyzed than the BUR option.

Since new ship construction and inactivations occur only when needed under this option, money is not outlaid prematurely for procurement and major investment costs. Outlays are less than half of those incurred under the BUR option for fiscal years 1995-99 but are only $161 million less than those between fiscal years 1995 and 2035 because, in the long term, the BUR maintains a similar replacement rate new carrier construction strategy. [4] Outlays for this option in the long term are higher then those in the options delaying CVN-76's construction start to fiscal years 1998 and 2000; however, in the near term, this option requires over $530 million less outlays than the option that builds CVN-76 in fiscal year 1998 due to the additional 1-year delay in CVN-76's construction start.

[4]Our present value analysis of each option's outlays shows no relative difference from the constant dollar analysis of outlays used throughout the report (see table II.1).

Figure 2.5: Force Structure Option 1A—Nuclear Carrier Replacement Rate Strategy

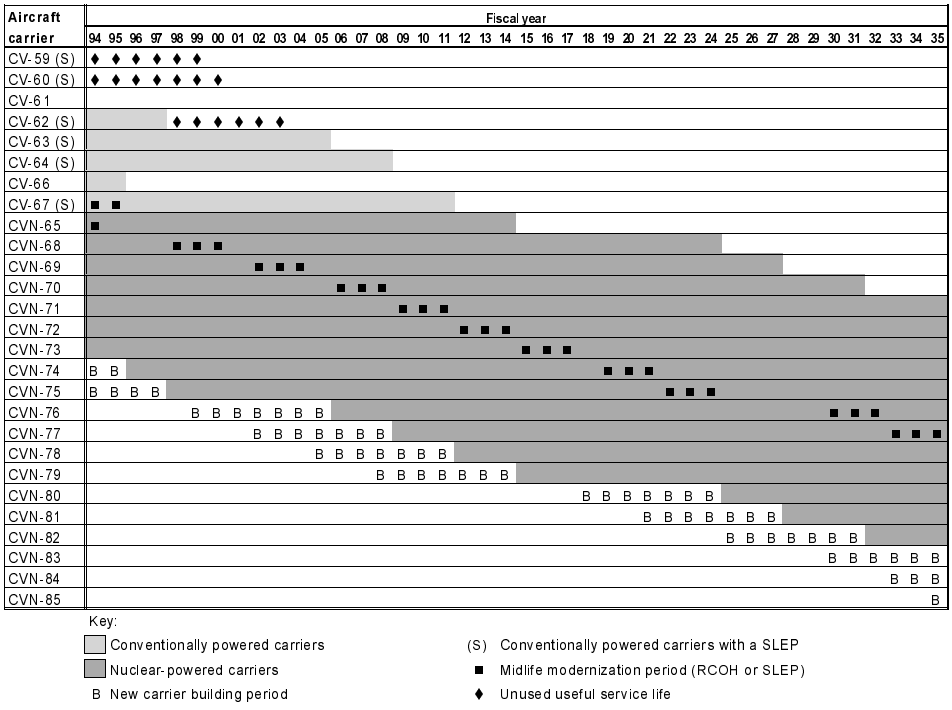
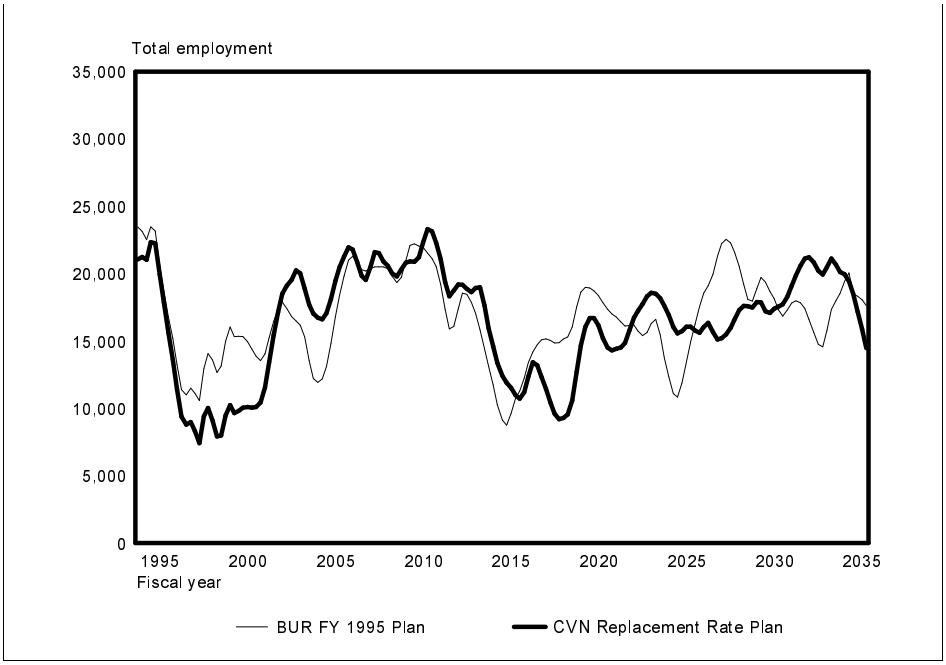


Figure 2.6: Total Employment Level at NNS for Option 1A—Nuclear Carrier Replacement Rate Strategy



Alternative 1B: Maximize Budgetary Savings Through a Conventional Carrier Replacement Rate Strategy

The government will receive the full value of its investment in aircraft carriers under this option because both conventional and nuclear carriers will remain in the active fleet until the end of their expected service lives (see fig. 2.7). Nimitz-class nuclear carriers receive nuclear refuelings and complex overhauls after 23 years and are inactivated at the end of their 50-year service lives. Conventional carriers remain active for 45 years, entering the service life extension program after 30 years of service. After fiscal year 1994, only the U.S.S. Independence (CV-62) is inactivated before the end of its projected service life so that the U.S.S. United States (CVN-75) can be commissioned into the fleet in fiscal year 1998. This early inactivation will allow the Navy to maintain the 12-carrier force level, and carriers will only be built to replace others.

The next carrier, CVA-76, is programmed to begin construction in fiscal year 2000 at NNS, and new construction start intervals would fluctuate between 3 and 10 years, similar to the BUR baseline force structure option. Figure 2.8 shows that this fluctuating new construction start rate results in a total employee level profile similar to that in the BUR option. During the near-term period of fiscal years 1995-99, the employment level under this option ranges from 7,500 to 10,000 compared with 11,000 and 15,000 under the BUR option. The decrease in the employment level could be mitigated by other shipyard work being directed by the government to NNS or by bidding for projects in the commercial shipbuilding market, such as liquified natural gas tankers or cruise ships.[5]

Since this option requires new ship construction and decommissioning only when needed, major procurement and investment costs are not incurred prematurely. Therefore, this option has the lowest value of outlays in the long term. Outlays for this option are over $2 billion less between fiscal years 1995 and 2015 and $6.5 billion less between fiscal years 1995 and 2035 than the option that transitions to conventional carrier construction with CVA-77. Also, this option's outlays are approximately one-third less than those for the BUR baseline force structure option for fiscal years 1995-2015 and approximately 37 percent less than those between fiscal years 1995 and 2035.

[5]NNS has had no major commercial shipbuilding projects under contract since the early 1980s, but it recently signed a letter of intent to build up to four tankers for a Greek company. In the late 1970s, commercial production represented approximately 40 percent of the shipyard's work. The basis of NNS' shipbuilding and conversion revenue shifted during the 1980s, and the shipyard's revenue became dependent almost solely on federal government contract work.

Figure 2.7: Force Structure Option 1B—Conventional Carrier Replacement Rate Strategy

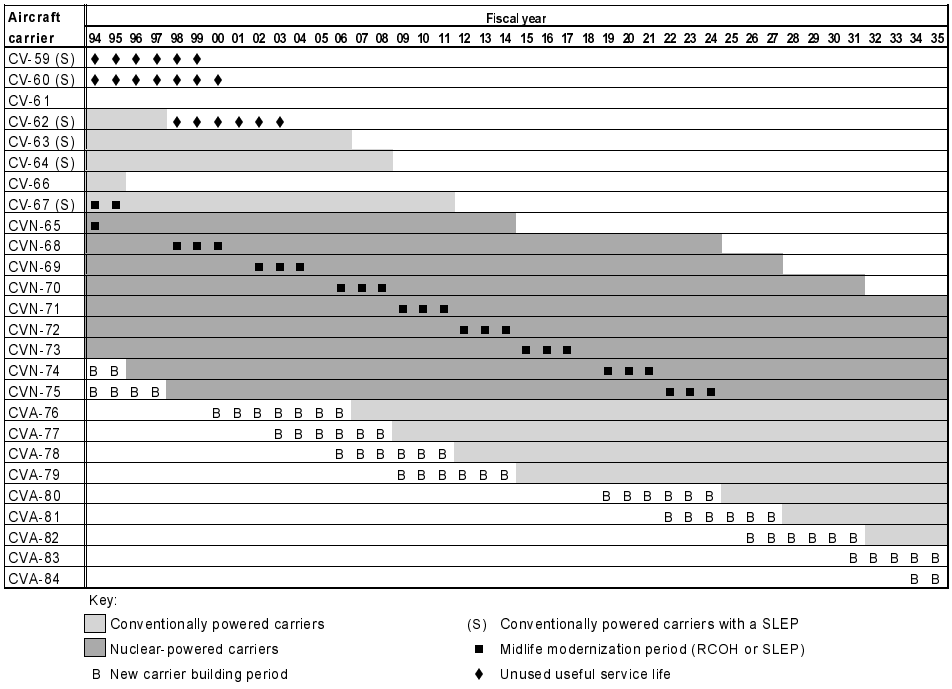
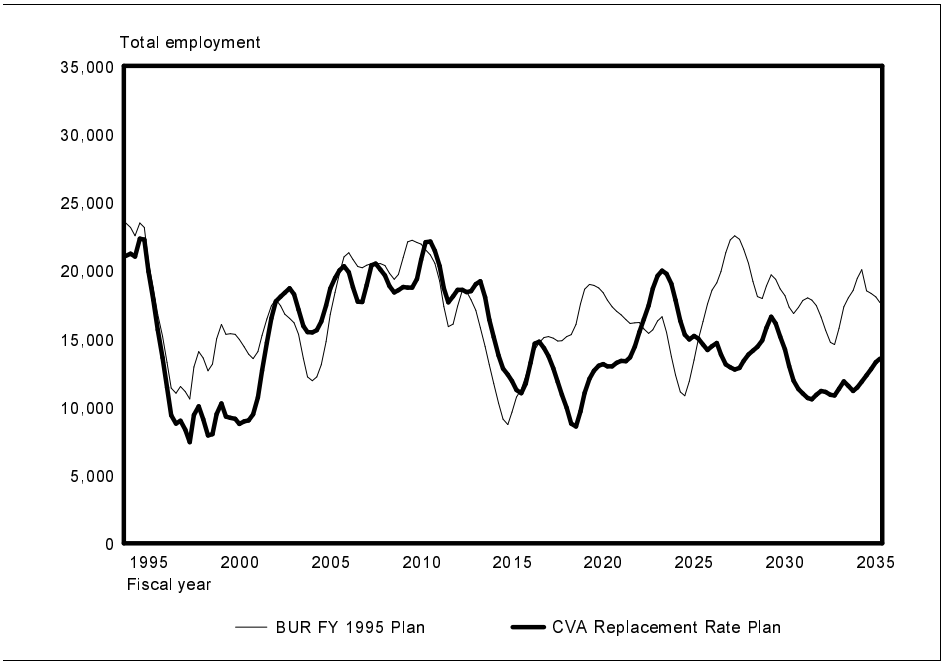


Figure 2.8: Total Employment Level at NNS Under Option 1B—Conventional Carrier Replacement Strategy



Alternative 2A: Maximize Newport News Shipbuilding Employment Level Stability Through a Nuclear Carrier Sustaining Rate Strategy

This option emphasizes maximizing the stability of NNS' employment level through a sustained rate of new carrier construction, regardless of cost (see fig. 2.9). New nuclear carrier construction starts begin in fiscal year 1995 at a historical rate of every 3 years.[6] All nuclear carriers receive their nuclear refuelings and complex overhauls but are retired early, after approximately 37 years. Conventional carriers in the fleet, the U.S.S. Independence (CV-62), the U.S.S. Kitty Hawk (CV-63), and the U.S.S. Constellation (CV-64), are retired before the end of their expected service lives as well.

The benefit of this option is that NNS could sustain a workforce averaging over 20,000 employees with very few shifts in the overall employment level (see fig. 2.10). Employment levels remain above those under the BUR option throughout the 1995 to 2035 time frame.

Constructing new nuclear carriers every 3 years is extremely expensive, and the outlays are significantly greater than those in the BUR baseline force structure option in the near term (fiscal years 1995-99), mid-term (fiscal years 1995-2015), and long term (fiscal years 1995-2035). This option requires more outlays because maintaining a 12-carrier force level at this construction rate requires the Navy to retire all of its carriers early, most with 25 percent of their service life remaining. Therefore, the Navy will need to fund costly nuclear carrier inactivations prematurely. This option procures 14 carriers between fiscal years 1995 and 2035, compared with 10 carriers under the BUR plan. This investment strategy represents the long-term investment implications of building carriers at historical rates to protect the carrier shipbuilding industrial base and employee levels.

Figure 2.9: Force Structure Option 2A—Nuclear Carrier Sustaining Rate Strategy

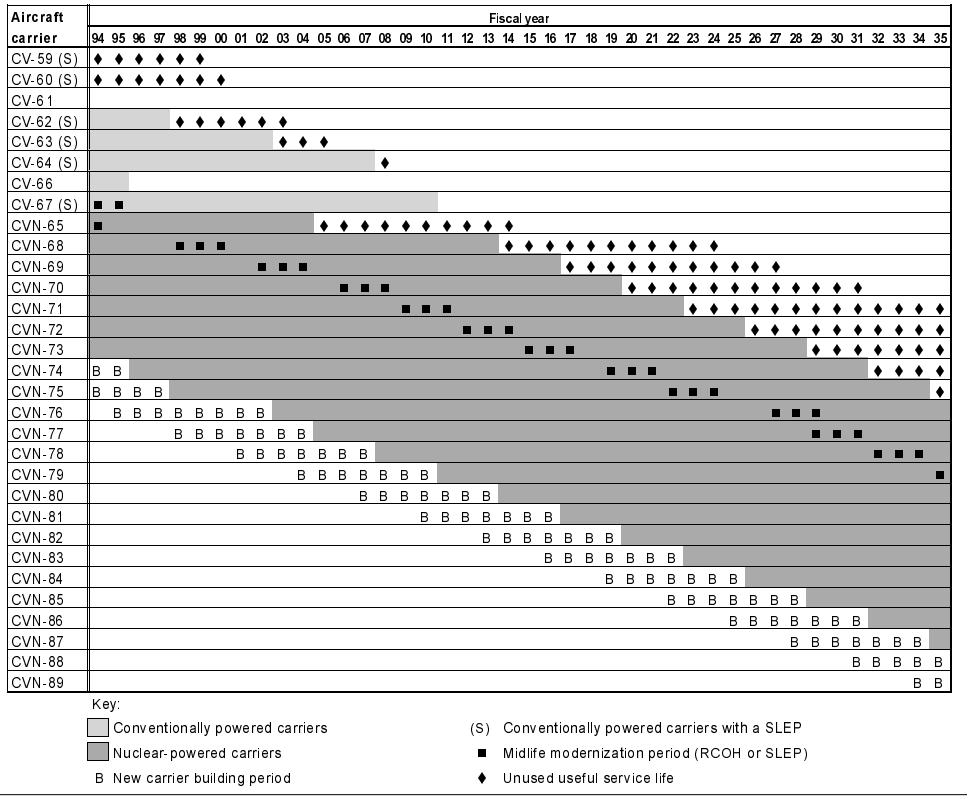
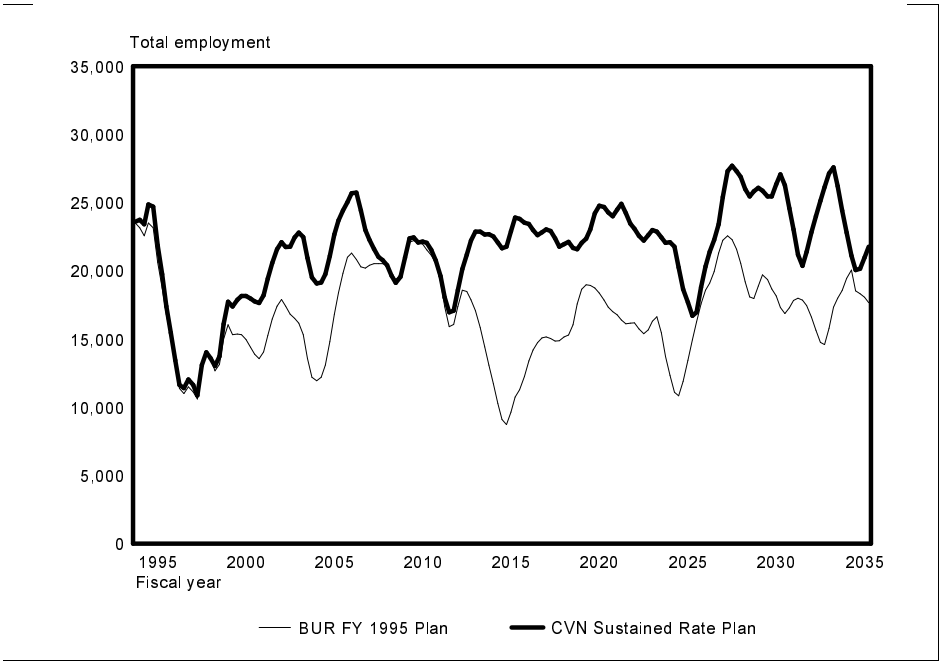


Figure 2.10: Total Employment Level at NNS for Option 2A—Nuclear Carrier Sustaining Rate Strategy



Alternative 2B: Maximize Newport News Shipbuilding Employment Level Stability Through a Conventional Carrier Sustaining Rate Strategy

To support a sustained-rate construction program, the Navy would need to inactivate eight Nimitz-class nuclear carriers prematurely with 20 percent of their useful service life remaining. The new conventional carrier construction start is programmed for fiscal year 2000, and the follow-on conventional carriers have construction starts every 3 years. (See fig. 2.11.) No nuclear carriers are built after the completion of the U.S.S. United States (CVN-75). The nuclear capabilities at NNS would be sustained through a series of nuclear refuelings and complex overhauls of the Nimitz-class carriers through fiscal year 2024, some or all of the decommissioning work of the nuclear carrier fleet, and other nuclear repair and maintenance work. None of the remaining conventionally powered carriers would be decommissioned early except for the U.S.S. Independence (CV-62) to maintain a 12-carrier force when the U.S.S. United States (CVN-75) is brought into service in fiscal year 1998.

NNS will have a severe drop-off in its workload between fiscal years 1996 and 2000 (see fig. 2.12) unless other work is directed to the shipyard. Consolidating all Atlantic Coast-based nuclear shipbuilding and overhaul work at NNS would help maintain nuclear capabilities and help mitigate the severe drop-off in the workload. Between fiscal years 2000 and 2014, the employment level at the shipyard averages about 17,500 employees, and between fiscal years 2015 and 2025 the employment level averages about 22,000 employees. In fiscal year 2026, the shipyard's workforce level drops below 15,000 employees and does not return to the 15,000-employee level until fiscal year 2027.

Due to the frequent new construction starts and the earlier decommissioning of the Nimitz-class nuclear carriers, this option costs approximately $8 billion more in the long term (fiscal years 1995-2035) than the conventional replacement rate strategy. During the near-term period (fiscal years 1995-99) this option still costs less than the conventional carrier option that builds CVA-77 in fiscal year 2002 because this option delays the new construction start and cancels the construction of CVN-76. Maximizing the NNS employment levels through a high-production rate is a very costly approach to maintaining a carrier force level in the long term, and the value of the total outlays is higher during this period than in any other conventional option. However, this option is still $11.5 billion less than the BUR option over the long term.

Figure 2.11: Force Structure Option 2B—Conventional Carrier Sustaining Rate Strategy

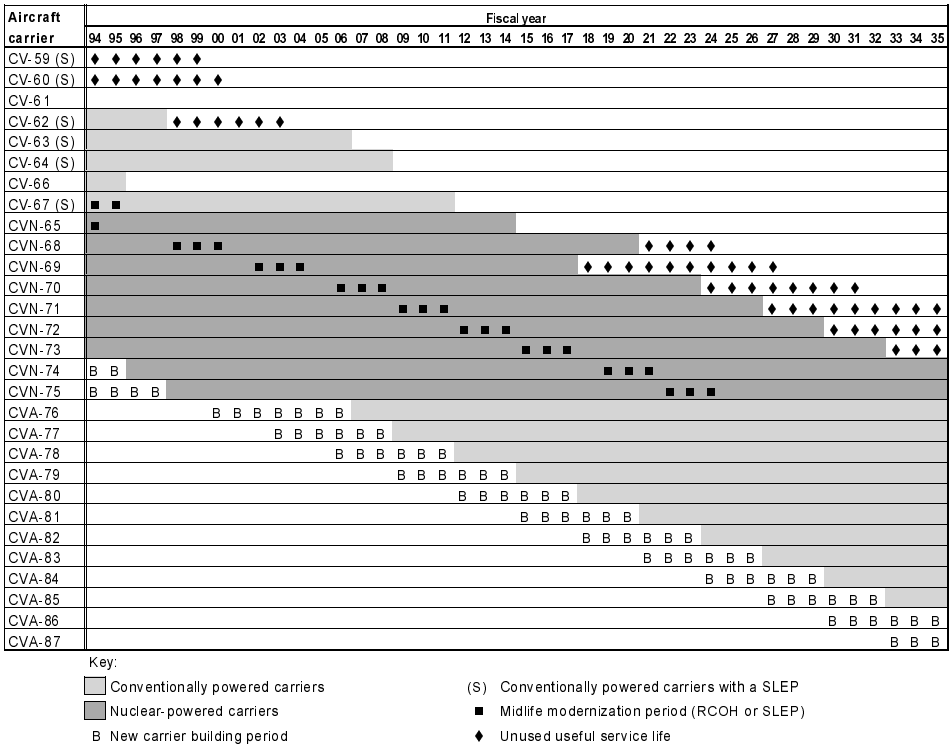
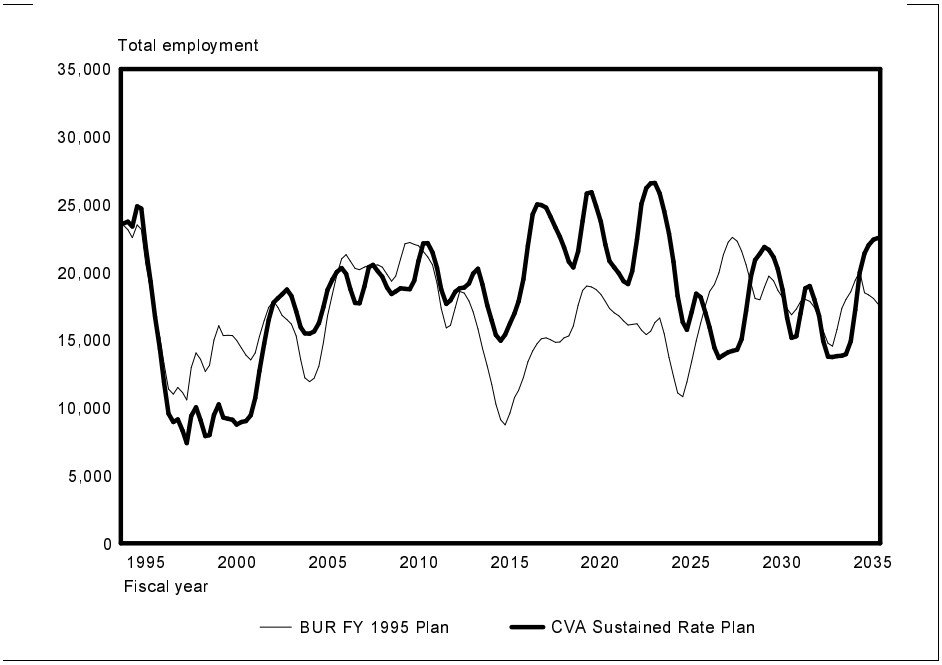


Figure 2.12: Total Employment Level at NNS for Option 2B—Conventional Carrier Sustaining Rate Strategy



Alternative 3: Optimize Budget Savings and Newport News Shipbuilding Employment Level Stability

This option is consistent with DOD's plan to request funding for CVN-76 in fiscal year 1995. The next ship, however, would be a new design conventional carrier as shown in figure 2.13. The BUR report recommended the deferment of the advance procurement funding beyond fiscal year 1999 for the carrier after CVN-76 pending the completion of an evaluation of alternative aircraft carrier concepts for the next century, including the conventional carrier force option.

Under this option, the construction start for CVA-77 is in fiscal year 2002. New starts for follow-on conventional ships are at 4-year intervals, which would support a sustained rate production program at NNS. The employment level under this option is projected to have fewer extreme increases and drop-offs than in the BUR plan. Nuclear carriers currently in the fleet will have 45- to 48-year service lives, requiring all of them to undergo nuclear refuelings and complex overhauls. Both the U.S.S. Independence (CV-62) and the U.S.S. Kitty Hawk (CV-63) will be inactivated 6 and 3 years, respectively, before the end of their estimated service lives. The plan requires that the U.S.S. John F. Kennedy (CV-67) remain in the active fleet 5 years longer than currently planned.[7] This longer service life may be feasible for the ship in its new role as the reserve/training carrier because it will have a reduced tempo of operations, resulting in a reduced amount of "wear and tear."

This option maintains the workforce at NNS above the 10,000-employee level throughout fiscal years 1995-2035. The shipyard maintains a very stable employment level after fiscal year 2006—the workforce fluctuates between approximately 15,000 and 20,000 employees in fiscal years 2006-7, with only one significant drop in employment in fiscal year 2015. After fiscal year 2027, the employment level ranges between 11,900 and 16,500. (See fig. 2.14.)

Since this option requires building CVN-76 in fiscal year 1995, the near term outlays are similar to those in the BUR baseline option. However, in the mid-term (fiscal years 1995-2015) and long term (fiscal years 1995-2035), the outlays are approximately 25 percent less than those in the BUR option. These savings could help reduce the Navy's Recapitalization Plan projected annual funding shortfall of $3.5 billion in fiscal years 1999 and beyond.

[7]The BUR considered extending the U.S.S. John F. Kennedy's service life, but rejected this option because it "would require an additional, unplanned, and costly overhaul." This problem could be managed through more innovative approaches, such as the adoption of an incremental maintenance strategy whereby maintenance is incrementally managed over a number of years, an option that is considerably less expensive than building a new ship for $4 billion to $6 billion.

Figure 2.13: Force Structure Option 3—Optimize Budget Savings and NNS Employment Level Stability

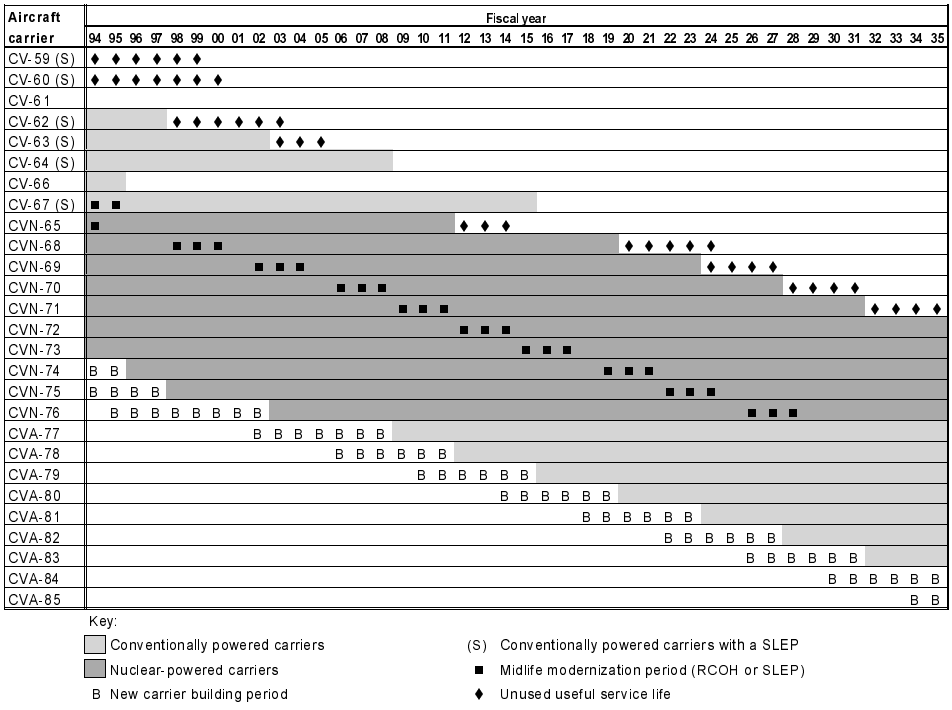
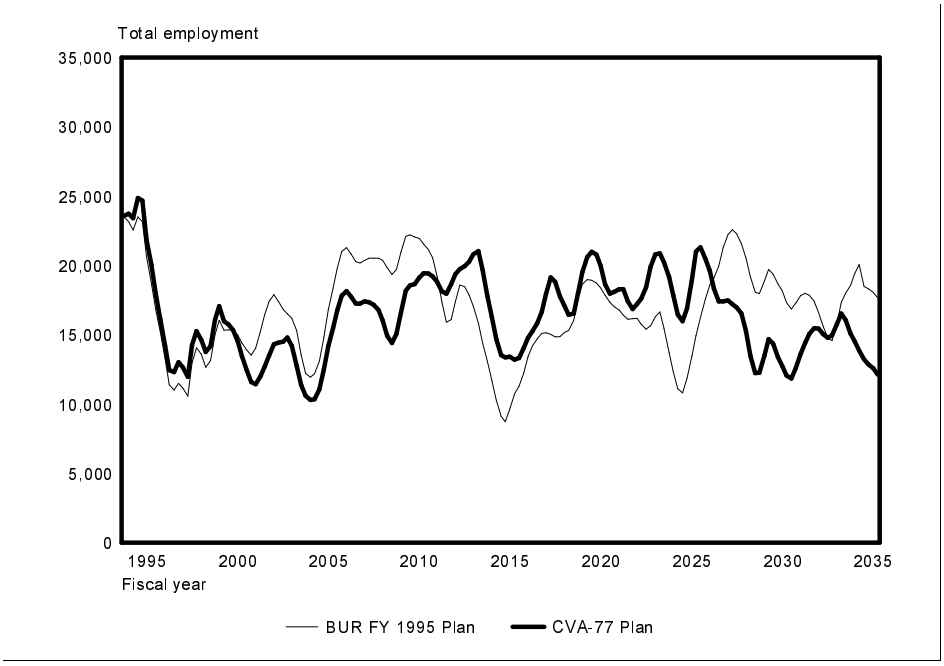


Figure 2.14: Total Employment Level at NNS for Option 3—Optimize Budget Savings and NNS Employment Level Stability



Alternative 4A: Defer Construction of CVN-76 Until Fiscal Year 1998

If the construction start for the next nuclear carrier—CVN-76—is delayed 3 years to fiscal year 1998, the Navy could maintain a 12-carrier force and maximize the service lives of its nuclear carriers. (See fig. 2.15.) All nuclear carriers will be refueled and overhauled, extending each carrier's service life over 23 years to its full 50-year service life. This option creates fewer drastic shifts in the overall employment level than the BUR option because it has a new carrier construction start rate of every 4 to 5 years compared with the BUR rate of 3 to 7 years. Two conventional carriers, the U.S.S. Kitty Hawk (CV-63) and the U.S.S. Constellation (CV-64), are retained in the active fleet for several years longer than projected in the BUR option and are inactivated closer to or at the end of their projected useful lives. This alternative also retains the U.S.S. John F. Kennedy (CV-67) in the fleet 7 years past the BUR option's plan. This ship, in its new role as the reserve/training carrier, will have a reduced tempo of operations and thus a reduced amount of wear and tear. Other carriers are replaced when required to meet force structure needs.

Under this option, NNS' employment level drops to around 7,500 employees and remains below the critical 10,000-employee level for about 3 years. As shown in figure 2.16, overall employment is more stable during fiscal years 2005 through 2034 than under the BUR option. Increased stability in shipyard employment requires fewer adjustments to the workforce over time. Compared to the BUR option, this option's employment troughs are significantly smaller in fiscal years 2004, 2018, and 2025-26. The Navy could mitigate the employment decline in fiscal year 1998 by redirecting other shipbuilding and maintenance work to the yard, or, as the BUR suggested, by rescheduling the delivery of carriers under contract, overhauls, and other work.

DOD's financial investment requirement for this option is less than in the BUR option for the near term (fiscal years 1995-99), mid-term (fiscal years 1995-2015), and long term (fiscal years 1995-2035). The difference in outlays from fiscal years 1995 to 1999 for this option are approximately $1.6 billion less than the BUR option.

Figure 2.15: Force Structure Option 4A—Defer Construction of CVN-76 Until Fiscal Year 1998

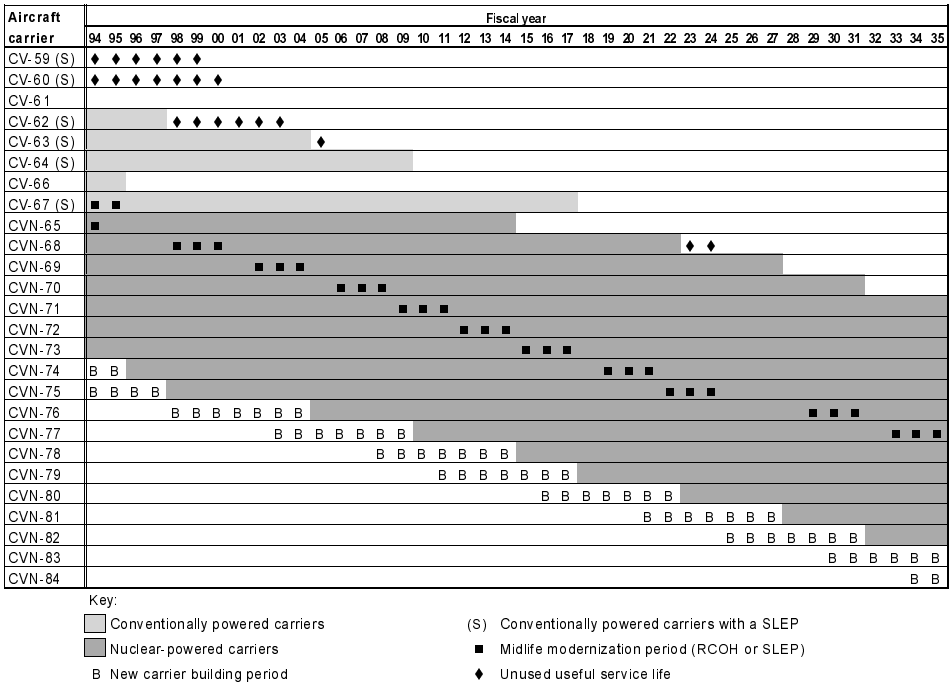
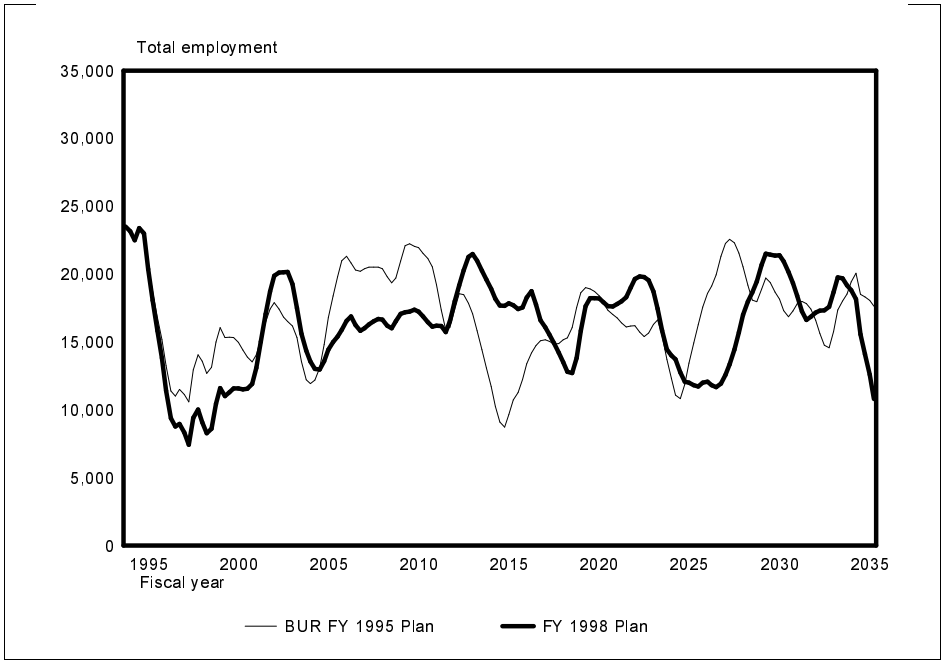


Figure 2.16: Total Employment Level at NNS for Option 4A—Defer Construction of CVN-76 Until Fiscal Year 1998



Alternative 4B: Defer Construction of CVN-76 Until Fiscal Year 2000

Under this option, the Navy generally retains each nuclear carrier to the end of its useful 50-year service life and therefore will need to refuel each nuclear carrier after 23 years (see fig. 2.17). Two conventional carriers, the U.S.S. Kitty Hawk (CV-63) and U.S.S. Constellation (CV-64), are retained in the active fleet to the end of their expected service lives. Also, the U.S.S. John F. Kennedy (CV-67) will remain in the active fleet for a total of 50 years, 7 years longer than projected in the BUR option. This should be feasible, since the carrier will have a reduced tempo of operations as the reserve/training carrier. Only two nuclear carriers are retired before the end of their useful service lives—the U.S.S. Enterprise (CVN-65) 1 year early and the U.S.S. Nimitz (CVN-68) 2 years early. In addition, this option builds new carriers to replace carriers that are at the end of their service lives, which will lead to a stable new construction start rate every 4 to 5 years. DOD considered delaying the construction of CVN-76 until fiscal year 2000. However, the BUR concluded that, as a result of the delay, existing contracts would not be completed until the mid-1990s, and a lack of subsequent orders would threaten NNS' viability by 1997.

NNS will need to fill in a large gap in workload between fiscal years 1996 and 2001. The shipyard does have the capability to construct nuclear submarines and other surface ships and therefore could complete other types of shipyard work to compensate for the drop-off in workload.[9] The shipyard will begin the nuclear refueling complex overhaul of the U.S.S. Nimitz (CVN-68) in fiscal year 1998 while it completes construction work on the U.S.S. United States (CVN-75), scheduled for commissioning in fiscal year 1998. This work will enable NNS to sustain a nuclear-capable workforce.

Figure 2.18 shows that the overall employment level at NNS is at or below the critical 10,000-employee level in fiscal years 1996-2001. This option does not have as large a drop-off in the projected total workforce beginning in fiscal year 2014 than either the BUR option, in which employment level drops below 10,000, or the option to start construction of CVN-76 in fiscal year 1998.

The financial outlays required for this option are less than any of the nuclear carrier force structure options for the near term (fiscal years 1995-99) and long term (1995-2035). In the near term, the outlays are less than half of those required for the BUR option because of the delay in the construction start of CVN-76.

[9]NNS submitted a bid to the Navy for the fast sealift ship contracts, but it lost out to National Steel and Shipbuilding Company, San Diego, California, and Avondale Shipyards, New Orleans, Louisiana. NNS is currently completing modernization work on fast sealift ships already in the Navy's fleet.

Figure 2.17: Force Structure Option 4B—Defer Construction of CVN-76 Until Fiscal Year 2000

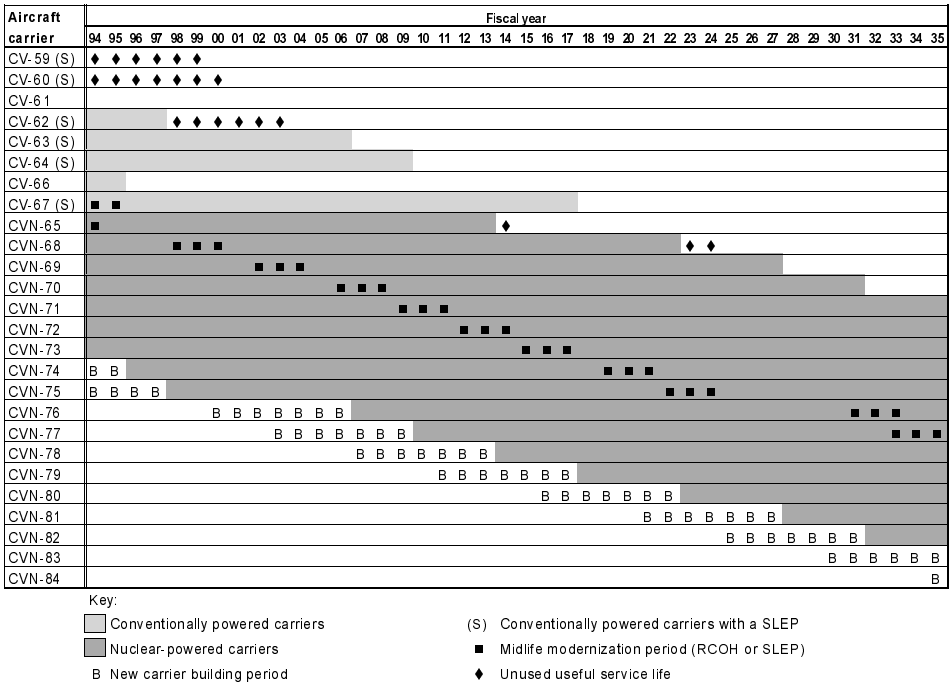
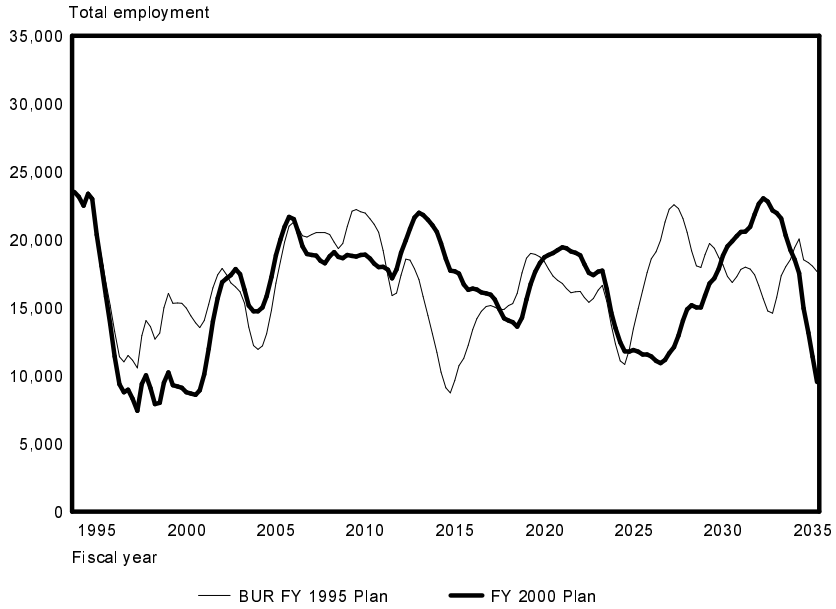


Figure 2.18: Total Employment Level at NNS for Option 4B—Defer Construction of CVN-76 Until Fiscal Year 2000



Alternative 4C: Defer Construction of New Conventional Carrier (CVA-76) Until Fiscal Year 2002

Using this option the Navy would not build a nuclear carrier before the transition to a conventional carrier construction program in fiscal year 2002, with the start of CVA-76. This option provides a 7-year design period, sustains a steady new carrier construction start interval of 3-1/2 years, and fully utilizes the service lives of almost all of the conventional carriers in the fleet. (See fig. 2.19.) The delay in the construction start enables several conventional carriers in the active force to remain in service longer than in the BUR plan. This option also provides for longer service lives for most carriers currently in the active fleet than under the Navy's Recapitalization Plan.

The U.S.S. Kitty Hawk (CV-63) and U.S.S. Constellation (CV-64) remain active slightly beyond their estimated notional lives, enabling these ships to complete a last deployment within their last maintenance cycle. The U.S.S. John F. Kennedy (CV-67) is programmed for a 50-year service life because of its reduced tempo of operations as the reserve/training carrier. Nimitz-class nuclear carriers remain in the fleet for 47 to 50 years. This option requires all Nimitz-class nuclear carriers to undergo nuclear refuelings and complex overhauls.

As shown in figure 2.20, deferring construction of the next carrier until fiscal year 2002 results in continuing near-term declines in employment levels at NNS. The only carrier program work expected in the shipyard during that time period is the completion of construction of the U.S.S. United States (CVN-75) and the nuclear refueling complex overhaul of the U.S.S. Nimitz (CVN-68), which begins in fiscal year 1998. NNS would need other work to bring levels above the critical 10,000-employee level between fiscal years 1996 and 2001. After this period, employment levels average from 15,000 to 20,000 persons through fiscal year 2024.

This option requires fewer outlays than any other option we examined except for option 1B's (conventional carrier replacement rate) long-term estimate. The reduction in outlays is a result of delaying the construction start of the next aircraft carrier until fiscal year 2002, building conventional carriers that have a much lower procurement cost, and retaining carriers longer in the active fleet. The near-term outlays (fiscal years 1995-99) are approximately 35 percent of the BUR option's outlays for the same period. In the long term (fiscal years 1995-2035), this option will save almost $19 billion in outlays over the amount projected to be spent for the BUR option. This option costs approximately $4.5 billion less in the long term than the option that begins conventional carrier construction with CVA-77.

Figure 2.19: Force Structure Option 4C—Defer Construction of New Conventional Carrier (CVA-76) Until Fiscal Year 2002

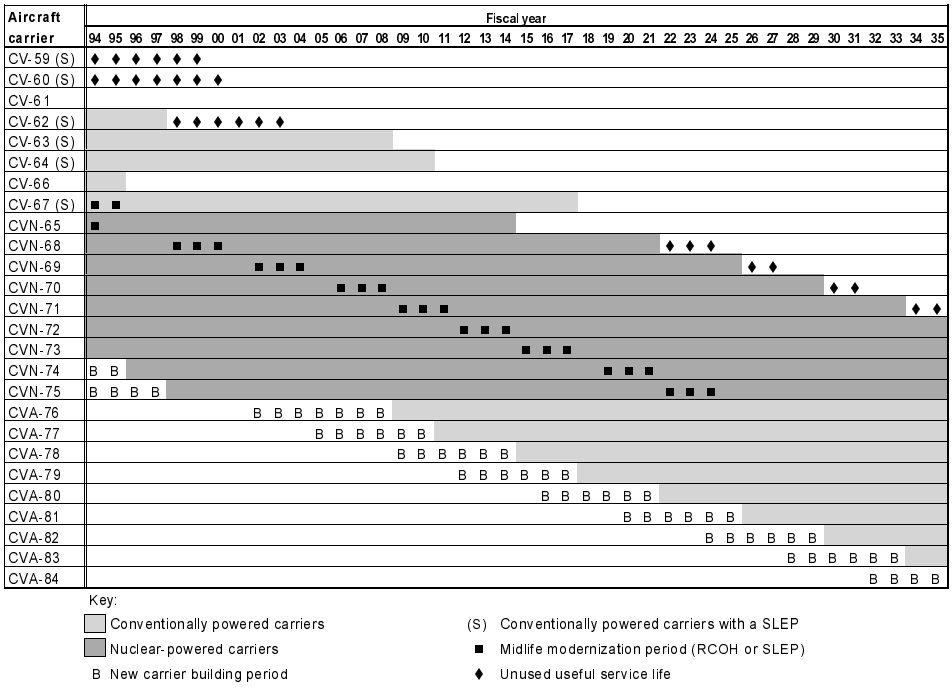
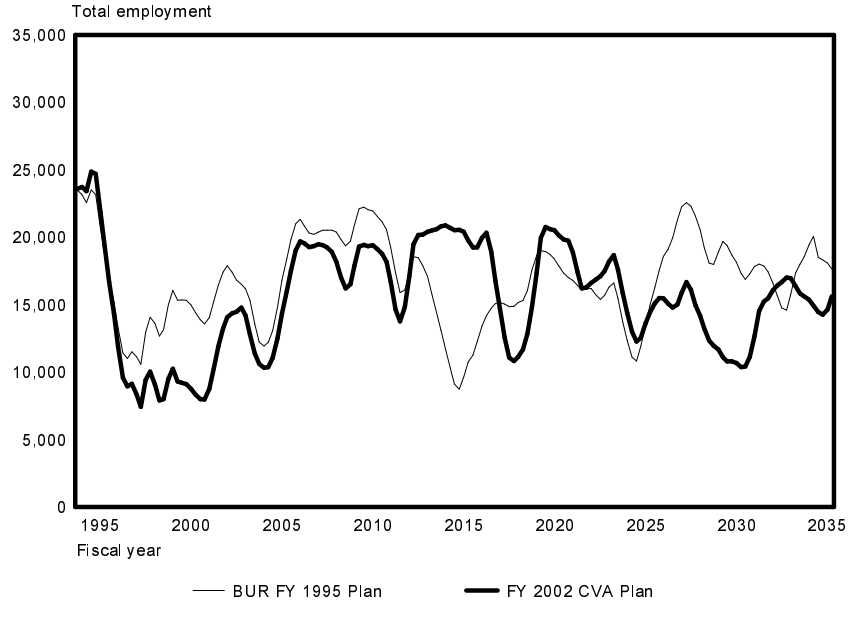


Figure 2.20: Total Employment Level at NNS for Option 4C—Defer Construction of New Conventional Carrier (CVA-76) Until Fiscal Year 2002



Scope and Methodology

Force Structure Alternatives

We reviewed the administration's rationale for structuring its carrier force of 11 active aircraft carriers plus 1 reserve/training carrier. We analyzed the BUR and the Navy Recapitalization plans to determine their effect on the carrier force structure, financial resource requirements, and the Newport News Shipbuilding total employment level. In addition to the BUR and the Navy Recapitalization plans, we analyzed eight other alternatives for stucturing a 12-carrier force to achieve one of the following objectives: maximize budgetary savings through a carrier replacement rate strategy, maximize stability in the Newport News Shipbuilding employment level through a sustained rate construction and refueling/complex overhaul strategy, optimize both budgetary savings and employment level stability, or defer near-term budgetary outlays and reduce overall carrier program costs. These options were developed to emphasize the trade-offs between budget requirements and Newport News Shipbuilding's overall employment levels. We made similar comparisons of the trade-offs for the BUR recommendation and the Navy Recapitalization Plan.

Each of our force structure options was based on one of four basic force planning guidelines (see ch. 2). There are numerous ways to structure the carrier force under each option, but to be representative of a specific planning goal, we generally chose one nuclear and one conventional alternative for each scenario. For example, to maximize NNS' employment stability through a sustained rate construction and refueling/complex overhaul program, our nuclear carrier option proceeds with the construction of CVN-76 in fiscal year 1995 and then continues to build a new nuclear carrier every 3 years. This stabilizes employment at NNS between fiscal years 1995 and 2035. Other options that maximize employment stability might build carriers at intervals ranging from 2-1/2 to 4 years. Therefore, actual costs could differ, and the overall employment level at NNS could shift slightly depending on the option chosen to analyze for a certain planning goal.

Force structure modernization decisions—procurements, service life extensions, nuclear refuelings and overhauls, and decommissionings—are made during a 2-year defense budget cycle. This 2-year cycle includes the year DOD internally prepares its budget request and the following year when the Congress considers DOD's request.

Force structure planning for aircraft carriers requires that several explicit assumptions be made about the projected baseline useful service life, procurement periods, and midlife modernization and service life extension. These assumptions were used to develop each of our force

structure options. Planning is made particularly challenging because of the substantial investment costs, the 2-year defense budget cycle, the long lead time required to build and deliver a carrier, and the carrier's lengthy useful service life. Planning flexibility is also complicated because nuclear fuel is a fixed expense that commits planners to a 23-year period and becomes an expensive sunk cost once it has been purchased.

Notional baseline planning factors used to develop the force structure options are shown in tables I.1 and I.2. The procurement period includes the advance procurement and procurement periods. For example, the nuclear aircraft carrier includes a 2-year advance procurement period for the acquisition of long lead nuclear components plus a 7-year production period, culminating in delivery. The baseline service life for conventional carriers is the design life of the carrier; for nuclear carriers, it is the estimated amount of time the initial fueling will last. The actual longevity of the nuclear cores depends on the consumption rate of the carrier and other factors.

Table I.1: Notional Baseline Planning Factors for Nimitz-class Nuclear Carriers

Fiscal year 1993 dollars in billions

	Number of years		
Planning factors			**Cost**
Procurement period		9	$3.8
Active service life			
Baseline service life	23-1/2		[a]
Midlife modernization	3		1.8
Service life added	23-1/2		[a]
Subtotal		**50**	**[a]**
Inactivation period		3	0.9
Total		**62**	**$6.5**

Note: Costs do not include nuclear fuel. Nuclear fuel costs were removed to make the nuclear carrier investment costs comparable to the conventional carrier costs. Initial nuclear fueling costs of $291 million were excluded from the ship procurement cost, and nuclear fuel costs of $238 million were excluded from the nuclear refueling complex overhaul cost. The service life added after the midlife modernization is dependent on the carrier's tempo of operations (i.e., the rate of fuel depletion).

[a]Not applicable.

Table I.2: Notional Baseline Planning Factors for Conventional Carriers

Fiscal year 1993 dollars in billions

	Number of years		
Planning factors			**Cost**
Procurement period	6		$2.1
Active service life			
Baseline service life	30		[a]
Midlife modernization	3		1.0
Service life added	15		[a]
Subtotal		**48**	[a]
Inactivation period		1	0.1
Total		**55**	**$3.2**

Note: Carriers are in the Kitty Hawk and John F. Kennedy classes.

[a]Not applicable.

The midlife modernization period represents the service life extension program for conventional carriers and the nuclear refueling complex overhaul for nuclear carriers. A service life extension program includes repairs to the basic hull, power generation systems, and auxiliary systems; upgrades of basic support systems to meet present and future weapon system requirements; and upgrades of aircraft launch and recovery systems. A refueling complex overhaul includes refueling the reactor plant, making propulsion plant repairs, and performing the mandatory modernization of aircraft launch and recovery systems and ship electronics and communications systems.

The inactivation period includes removing functioning, but not obsolete, equipment from the carrier and then scrapping or recycling the hull. For nuclear carriers, this period also includes defueling the reactors, reactor plant inactivation, removal and disposal of all radiologically contaminated reactor plant systems and structure (including removal of some equipment for reuse), and sending the contaminated components to a Department of Energy facility in either Hanford, Washington, or Savannah River, Georgia. The residual nuclear fuel is removed from the reactor, placed into a shielded transfer container, and then shipped in a specially designed transport container to the Department of Energy's expended core facility in Idaho Falls, Idaho.

Investment Resource Analysis

We analyzed the investment resource implications of each of the force structure options, including the BUR and the Navy's Recapitalization Plan options. We developed a projected budget authority profile that included the following costs: advance procurement, procurement, outfitting, post-delivery, complex overhauls for both conventional and nuclear carriers, nuclear refuelings, decommissioning, and disposal. Projected outlay profiles were generated for each budget authority profile based on official outlay rates from the Office of the Secretary of Defense and the Navy. We also performed a present value analysis of each force structure option's outlays to account for the time value of money, since each investment alternative has a different annual outlay profile. This analysis showed no relative difference from the constant dollar analysis of outlays used throughout the report (see app. II). Our estimates provide a general measure of the financial impacts of various force structure plans at a 12-carrier force level, but the actual costs incurred may vary depending on several factors, including the actual dates of new carrier procurement; overhauls and decommissionings; new carriers' performance characteristics; and changes in the overhead/labor rate, projected escalation rate, and vendors.

Our investment resource profile either included or excluded certain costs to provide a reasonable estimate of major investment costs to sustain a 12-carrier force. The investment analysis included the following cost items: research and development (new design conventional carriers); advance procurement, procurement, post-delivery, and outfitting; midlife modernization (service life extensions for conventional carriers and refueling complex overhauls for nuclear carriers); and inactivation and disposal. We excluded the cost of nuclear fuel for both new nuclear carrier procurement and nuclear refueling to allow an appropriate investment comparison between nuclear and conventionally powered carriers.

Decommissioning and disposal costs were included because the investment required to inactivate a Nimitz-class nuclear carrier is estimated at $750 million to $900 million, almost one-quarter the cost of procuring a new Nimitz-class carrier. (These costs are normally funded in the Navy's operations and maintenance appropriation account.) The nuclear carrier inactivation cost is approximately 20 times the cost estimated for the decommissioning and disposal of conventional carriers currently in the fleet.

Navy officials were unable to provide us with an estimate of the change in carrier procurement cost due to loss of learning, shipyard reconstitution,

and changes in the overhead rate for funding delays greater than 1 year. Therefore, we included an allowance for an increase in cost due to industrial and vendor base impacts, overhead escalation, and changes in direct construction costs for the nuclear carrier options that delay authorization of the next nuclear carrier to fiscal years 1998, 1999, or 2000. These cost increases are based on an interpolated straight-line adjustment to the BUR's estimated increase of $2.1 billion for the next nuclear carrier, CVN-76, if construction were delayed to fiscal year 2000. We did not verify the reasonableness of the detailed information DOD used to create this cost increase estimate.

Navy officials, citing a variety of factors, were unable to provide a cost estimate of procuring a conventional carrier and project general performance characteristics of a new conventional carrier. Our estimate of the cost of procuring a new design, conventional aircraft carrier was based on the best available information we could obtain from the Naval Sea Systems Command, the Naval Center for Cost Analysis, the Office of the Assistant Secretary of Defense for Program Analysis and Evaluation, and the Center for Naval Analysis, as well as our own analysis. Since a conventional aircraft carrier has not been built in almost 25 years, many unknowns are involved in creating a rough estimate of the current cost of constructing this type of carrier. We developed our cost estimate for a new design conventional carrier by applying the cost per ton ratio of the U.S.S. John F. Kennedy (CV-67) and the U.S.S. Nimitz (CVN-68) to the Navy's projected cost per ton of CVN-76. The resulting ratio was then multiplied by the new design conventional carrier's displacement. The U.S.S. John F. Kennedy, the last conventional carrier built for the Navy and the largest conventional carrier in the active fleet, was used as a proxy for the new design carrier. This size carrier is capable of employing air wings comparable in size to those currently utilized and planned for the fleet. We also assume that a 5- to 7-year research, development, and design period is a sufficient amount of time to develop and design a new conventional aircraft carrier.

Since our carrier force structure model includes planning, construction, and ship modernization and overhauls for fiscal years 1995 through 2035, the accuracy of our estimates, especially after fiscal year 1999, is subject to change and uncertainty.

Newport News Employment Level Analysis

To examine the impact of each of the force structure options on NNS' overall employment level for the period we analyzed, the Navy created employment level curves based on information we provided on the BUR, the Navy's Recapitalization Plan, and our force structure options. The data we provided were entered into the Navy's standard program for calculating shipyard employment levels. These curves include work at the shipyard related to the carrier construction and maintenance program and other DOD-funded shipbuilding and conversion work currently under contract or expected to be under contract in the future at NNS. For example, we included new carrier construction, nuclear carrier refueling complex overhauls, East Coast-based aircraft carrier complex overhauls, and nuclear carrier inactivations. We also identified, but did not include in this report, other Navy shipbuilding and conversion work that NNS could compete for or could be directed to NNS as well as commercial shipbuilding work that NNS could bid for, such as liquified natural gas carriers. We did not examine the impact of our alternative investment strategies on Newport News Shipbuilding's nuclear carrier industrial base, nuclear construction-related skills, and vendors, and we did not assess the need to preserve this base.

Information Sources

To develop the force structure options and budget authority and outlay profiles, we reviewed pertinent documentation, including DOD's Report on the Bottom-Up Review and the aircraft carrier force structure plan that implements the BUR's recommendations; the Navy's Recapitalization Plan aircraft carrier force structure; the Navy's cost, schedule, and outlay rate estimates for various major investments such as new carrier construction, refueling complex overhaul of nuclear carriers, and carrier inactivations; the Department of the Navy 1994 Posture Statement; and Highlights of the FY 1995 Department of the Navy Budget.

We obtained information from DOD and Navy officials on the BUR recommendation and the Navy's Recapitalization Plan, the assumptions used to develop these options, estimates for the various investment-related costs, outlay rates for the relevant appropriation accounts, and total employment over time at Newport News Shipbuilding for various force structure options. We discussed other issues with these officials, including current and future carrier force levels, force structure and planning assumptions, carrier inactivations, learning curves involved in carrier construction, carrier maintenance strategies, and new carrier designs (including propulsion systems).

We performed our work between April 1993 and July 1994 in accordance with generally accepted government auditing standards.

Locations of Fieldwork or Contacts

Offices and locations visited or contacted during this assignment include the following:

Department of Defense

Office of the Secretary of Defense, Washington, D.C.
- Deputy Under Secretary of Defense for Policy
- Deputy Under Secretary of Defense for Acquisition
- Director, Tactical Systems (Maritime Systems)
- Assistant Secretary of Defense (Production and Logistics)
  - Industrial Engineering and Quality
- Assistant Secretary of Defense (Program Analysis and Evaluation)
  - General Purpose Programs (Naval Forces)
  - Resource Analysis

Department of the Navy, Washington, D.C.
- Comptroller
  - Naval Center for Cost Analysis
- Assistant Secretary of the Navy (Research, Development, and Acquisition)
- Office of the Chief of Naval Operations
  - Deputy Chief of Naval Operations (Logistics)
  - Deputy Chief of Naval Operations (Resources, Warfare Requirements, and Assessment)
  - Programming Division (Program Plans and Development)
  - Director, Air Warfare

Naval Sea Systems Command
- Comptroller Directorate (Cost Estimating and Analysis Division)
- Deputy Commander for Ship Design and Engineering (Future Ship Concepts Division)
- Industrial and Facilities Management Directorate (Supervisor of Shipbuilding, Conversion, and Repair Management Group)
- Nuclear Propulsion Directorate
- Aircraft Carrier Program
- Surface Combatants Ship Program

Naval Surface Warfare Center
Carderock Division, Carderock, Maryland
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Department of Transportation, Washington, D.C.
Maritime Administration (Office of Ship Construction)

Center for Naval Analyses, Alexandria, Virginia

Shipbuilders' Council of America

Present Value Analyses

Present Value Analyses Methodology

Investment options normally involve incurring different costs at different times. To compare two or more options on an equal economic basis, it is necessary to consider the current costs of each option or its "present value." For our analysis, we determined the Navy's outlays for each option after accounting for the time value of money. We used present value techniques to convert future dollar outlays into their value at the midpoint of fiscal year 1993. A present value analysis makes the options' outlays comparable despite each option's differing outlay profiles. Table II.1 shows the projected budget authority, outlays, and our present value analysis for each of the 10 force structure options we analyzed. The figures cover three time periods: the near term (fiscal years 1995-99), mid-term (fiscal years 1995-2015), and long term (fiscal years 1995-2035).

Discount Rate Comparison

Although present value analysis is a generally accepted practice, selecting an appropriate discount rate has been the subject of much controversy. For federal government investment analysis and decision-making, arguments have been presented for discount rates ranging from the cost of borrowing by the Treasury to the rate of return that can be earned in the private sector. Since the Treasury meets most government funding requirements, we maintained that its estimated cost to borrow was a reasonable basis for the discount rate used in present value analysis. Accordingly, for our analysis, we used the average yield on outstanding marketable Treasury obligations that had remaining maturities similar to the time period involved in our analysis. We subtracted a 20-year average of the projected gross domestic product deflator from the average yield on outstanding marketable Treasury obligations and applied the resulting discount rate to the 1993 constant dollar outlay values. DOD uses the Office of Management and Budget (OMB) Circular A-94's prescribed present value method, which applies a flat 7-percent discount rate to constant dollars.

Despite the differences in the two methodologies, the end results are very similar. Both present value analyses of the outlays for the 10 force structure options show approximately the same relative value to the outlays for the BUR baseline force structure option. Table II.2 shows the comparisons of the different methodologies.

Table II.1: Budget Authority, Outlays, and Present Value Analysis for Nuclear and Conventional Carrier Force Structure Options

Fiscal year 1993 dollars in billions

	Budget authority			Outlays			Present value		
Carrier option	**FY 95-99**	**FY 95-15**	**FY 95-35**	**FY 95-99**	**FY 95-15**	**FY 95-35**	**FY 95-99**	**FY 95-15**	**FY 95-35**
Nuclear									
BUR—Buy CVN-76 in fiscal year 1995	$5.6	$31.1	$62.9	$4.2	$26.0	$56.2	$3.7	$17.8	$28.9
Navy's Recapitalization Plan	5.1	31.1	62.2	4.2	26.4	58.6	3.7	17.6	29.8
1A—Replace all carriers at retirement with nuclear carriers	6.3	28.4	62.7	2.1	26.9	56.0	1.9	18.1	28.7
2A—Build nuclear carriers at a sustained rate of production	9.5	40.5	85.1	5.1	36.2	79.3	4.5	24.4	40.6
4A—Defer CVN-76 until fiscal year 1998	6.0	28.4	58.1	2.6	25.6	54.7	2.3	16.9	27.9
4B—Defer CVN-76 until fiscal year 2000	1.9	29.1	58.7	1.9	26.5	54.3	1.7	17.4	27.9
Conventional									
1B—Replace all carriers at retirement with conventional carriers	2.2	20.1	37.0	1.6	18.2	35.4	1.4	12.0	18.5
2B—Build conventional carriers at a sustained rate of production	2.2	24.2	45.8	1.6	19.6	44.6	1.4	12.7	22.5
3—Buy CVN-76 in fiscal year 1995 but transition to a conventional carrier construction program with CVA-77	5.1	23.3	42.6	4.2	20.4	41.9	3.7	13.9	22.2
4C—Defer CVA-76 until fiscal year 2002	1.9	20.3	37.8	1.5	17.3	37.4	1.3	11.2	19.0

Table II.2: Constant Dollar and Two Present Value Analyses of Outlays for Force Structure Options for Fiscal Years 1995-2035

Fiscal year 1993 dollars in millions

Carrier option	Outlays[a]	Treasury rate[b]	OMB rate[b]
Nuclear			
BUR—Buy CVN-76 in fiscal year 1995	$56,154	$28,910	$15,109
Navy's Recapitalization Plan	58,600	29,821	15,180
1A—Replace all carriers at retirement with nuclear carriers	55,993	28,678	14,706
2A—Build nuclear carriers at a sustained rate of production	79,275	40,611	20,910
4A—Defer CVN-76 until fiscal year 1998	54,667	27,875	14,128
4B—Defer CVN-76 until fiscal year 2000	54,317	27,918	14,154
Conventional			
1B—Replace all carriers at retirement with conventional carriers	35,410	18,505	9,551
2B—Build conventional carriers at a sustained rate of production	44,630	22,455	11,020
3—Buy CVN-76 in fiscal year 1995 but transition to a conventional carrier construction program with CVA-77	41,873	22,198	11,892
4C—Defer CVA-76 until fiscal year 2002	37,393	18,962	9,376

Note: Estimates do not include the cost of nuclear fuel.

[a]Outlays are in fiscal year 1993 dollars.

[b]The present value analyses are also presented in fiscal year 1993 dollars. The present value of each option is as of the midpoint of fiscal year 1993.

List of Aircraft Carrier Hull Numbers and Names

CV-59	U.S.S. Forrestal
CV-60	U.S.S. Saratoga
CV-61	U.S.S. Ranger
CV-62	U.S.S. Independence
CV-63	U.S.S. Kitty Hawk
CV-64	U.S.S. Constellation
CV-66	U.S.S. America
CV-67	U.S.S. John F. Kennedy
CVN-65	U.S.S. Enterprise
CVN-68	U.S.S. Nimitz
CVN-69	U.S.S. Dwight Eisenhower
CVN-70	U.S.S. Carl Vinson
CVN-71	U.S.S. Theodore Roosevelt
CVN-72	U.S.S. Abraham Lincoln
CVN-73	U.S.S. George Washington
CVN-74	U.S.S. John C. Stennis
CVN-75	U.S.S. United States

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