

Options for Funding AIRCRAFT CARRIERS

John Birkler • John F. Schank • James Chiesa • Giles Smith
Irv Blickstein • Ronald D. Fricker, Jr. • Denis Rushworth

Approved for public release; distribution unlimited
Prepared for the United States Navy

RAND

National Defense Research Institute

Report Documentation Page

Report Date 000002002	Report Type N/A	Dates Covered (from... to) -
Title and Subtitle Options for Funding AIRCRAFT CARRIERS		Contract Number
		Grant Number
		Program Element Number
Author(s)		Project Number
		Task Number
		Work Unit Number
Performing Organization Name(s) and Address(es) RAND 1700 Main Street, P.O. Box 2138 Santa Monica, CA 90407-2138		Performing Organization Report Number
Sponsoring/Monitoring Agency Name(s) and Address(es)		Sponsor/Monitor's Acronym(s)
		Sponsor/Monitor's Report Number(s)
Distribution/Availability Statement Approved for public release, distribution unlimited		
Supplementary Notes The original document contains color images.		
Abstract		
Subject Terms		
Report Classification unclassified	Classification of this page unclassified	
Classification of Abstract unclassified	Limitation of Abstract UU	
Number of Pages 75		

The research described in this report was conducted for the U.S. Navy within the Acquisition and Technology Policy Center of RAND's National Defense Research Institute, a federally funded research and development center supported by the Office of the Secretary of Defense, the Joint Staff, the unified commands, and the defense agencies under Contract DASW01-01-C-0004.

Library of Congress Cataloging-in-Publication Data

Options for funding aircraft carriers / John Birkler ... [et al.].

p. cm.

"MR-1526."

Includes bibliographical references.

ISBN 0-8330-3167-8

1. United States. Navy—Appropriations and expenditures. 2. Aircraft carriers—United States. I. Birkler, J. L., 1944—

VA60 .O68 2002

359.6'21—dc21

2002021394

RAND is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND® is a registered trademark. RAND's publications do not necessarily reflect the opinions or policies of its research sponsors.

© Copyright 2002 RAND

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Cover design by Maritta Tapanainen

Published 2002 by RAND

1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516

RAND URL: <http://www.rand.org/>

To order RAND documents or to obtain additional information,
contact Distribution Services: Telephone: (310) 451-7002;

Fax: (310) 451-6915; Email: order@rand.org

For over 40 years, Congress has funded the construction of U.S. Navy ships by appropriating enough money to pay for the entire construction project in the initial year of construction. This “full-funding” practice was undertaken to ensure that Congress was aware of the total cost of a project before it was begun and that one Congress would not bequeath to subsequent ones a choice between further appropriations and midcourse cancellation.

The Navy begins construction of a new aircraft carrier every fourth or fifth year (on average), and the fully funded cost of a carrier can represent a quarter or more of the total Navy shipbuilding budget. Because federal revenues do not increase by the cost of a carrier every fourth or fifth year, appropriating money for a carrier usually means reducing appropriations for something else that year—for other shipbuilding efforts, other Navy programs, spending elsewhere in the Department of Defense (DoD), or outside DoD.

Other funding strategies than full funding might result in a smoother carrier-funding profile. The Navy’s Program Executive Office for Carriers asked RAND to explore the implications of alternative funding strategies for carriers. During the early phase of the project, RAND researchers were concerned that carrier-funding spikes might result in costly disruptions in the scheduling of other shipyard work. However, it soon became apparent through interviews with knowledgeable persons that any disruptions and their costs were not likely to be extensive. Furthermore, we were able to show, through statistical analysis, that most of the carrier-funding spike was not “paid for” by reductions in the shipbuilding budget. We did not attempt to

identify where the remainder of the compensatory reductions might be taken, but assumed that decisionmakers at some level within DoD might be interested in avoiding them. Our focus then narrowed to an examination of ways to modulate the year-to-year changes in shipbuilding budgets. We addressed two questions:

- To what extent would alternative funding strategies smooth the spiky full-funding profile of annual budget authority?
- How would a change of funding strategies shift risks and thus incentives among Congress, the Navy, and the shipyard contractor?

The focus through most of the project was on two alternative funding mechanisms: *incremental funding*, in which funds would be appropriated year by year to match expenditures, and a *carrier capital account*, in which fairly level annual appropriations would supply a revolving fund, to be drawn on as needed. Later, we examined a third option: *advance appropriations*, a variant of full funding in which the full amount needed for construction is appropriated up front but the budget authority is provided incrementally. The implications of advance appropriations for Navy shipbuilding in general are discussed in a companion volume:

Irv Blickstein and Giles Smith, *A Preliminary Analysis of Advance Appropriations as a Budgeting Method for Navy Ship Procurements*, Santa Monica, Calif.: RAND, MR-1527-NAVY, 2002.

The current report is the final product of the project “Exploring Options for Funding Aircraft Carriers,” carried out within the Acquisition and Technology Policy Center of RAND’s National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the unified commands, and the defense agencies.

CONTENTS

Preface	iii
Figures	vii
Tables	ix
Summary	xi
Acknowledgments	xvii
Acronyms	xix
Chapter One	
INTRODUCTION	1
Chapter Two	
BACKGROUND	3
Full Funding	4
Incremental Funding	7
Advance Appropriations	8
Capital Account	9
Chapter Three	
BUDGETARY EFFECTS	13
Full Funding	13
Carrier Appropriations	13
Effects on Other Shipbuilding Programs	16
Incremental Funding	22
Advance Appropriations	24
Carrier Capital Account	29
Combination of a Capital Account with Other Funding Strategies	34

Fully Funded Capital Accounts	35
Summary	38
Chapter Four	
EFFECTS ON ORGANIZATIONAL BEHAVIOR	43
Capital-Account Balances Might Be Raided	44
The Problem	44
Solutions	45
Contractors Would Try to Compensate for	
Increased Risk	46
Risks	46
Contractor Response to Risk	48
Mitigating Factors	49
DoD and Contractors Would Spend More Time	
Selling the Program	50
Incentives to Contain Costs Might Be Weakened	52
Options to Change Funding Strategies Might Be	
Narrowed	53
Summary	54
Conclusion	56
Bibliography	57

FIGURES

S.1.	Year-to-Year Variation and Year-End Balances for Alternative Carrier-Funding Strategies	xiii
2.1.	Appropriations for National Defense Sealift Fund	12
3.1.	Carrier-Construction Funding Has Exhibited Wide Swings in Recent Years	14
3.2.	Carrier-Funding Spikes Will Continue Indefinitely . . .	15
3.3.	Carrier-Funding Spikes Are Reflected in SCN Procurement Funding	16
3.4.	Shipbuilding TOA Varies with President and with Defense Expenditures	17
3.5.	Model Depicting Shipbuilding TOA as a Function of Two Factors	20
3.6.	The Incremental Approach Smooths Out Carrier-Funding Peaks	23
3.7.	Advance Appropriations Smooths Out Carrier Budget-Authority Peaks Somewhat Better Than Incremental Funding	27
3.8.	A Capital Account Funded at a Constant Average-Expenditure Rate Will Run into the Red	30
3.9.	The Annual Investment Can Be Raised to Keep the Balance Above Zero, but the Result Is a High Average Balance	31
3.10.	Inserting a Midcourse Change in Investment Amount Reduces the Average Balance	32
3.11.	A Four-Segment Investment Profile Keeps Balances Low Without Excessively Frequent Adjustments in the Annual Investment Level	33

3.12.	Capital-Account Balances Can Be Limited by Restricting the Account to RCOH Cost Elements	35
3.13.	A Mixed Strategy Does Not Reduce Funding-Profile Variability Relative to Full Funding	36
3.14.	A Mixed Strategy Reduces Funding-Profile Variability Relative to Incremental Funding	37
3.15.	A Mixed Strategy Slightly Reduces Year-to-Year Expenditure Swings Relative to Advance Appropriations	38
3.16.	A Capital Account Based on a Full-Funding Paradigm Runs High Year-End Balances	39
3.17.	Moving the Start Date from a Spike Year Permits the Capital Account Providing Full Funding to Run Low Balances	39
3.18.	Most Alternatives to Full Funding Entail Less Year-to- Year Variation and Lower Year-End Balances	41

TABLES

3.1.	Assumed Outlay Profiles for Carrier-Funding Categories	24
3.2.	Assumed Annual-Appropriation Profiles for Carrier-Funding Categories	26
3.3.	Cumulative Percentage Savings (Apparent Surplus) for Advanced Appropriations Compared with Full Funding	28
3.4.	Average Annual-Funding Swings and Year-End Balances for Different Carrier-Funding Strategies	40
4.1.	Summary of Risks of Alternative Funding Mechanisms	55

Except for funds needed for some long-lead items procured in advance, the money required to build an aircraft carrier is appropriated by Congress all in one year. Because a carrier costs much more than any other ship, this “full-funding” policy results in a periodic peak in the Shipbuilding and Conversion–Navy (SCN) budget. This peak is not, of course, accompanied by a corresponding rise in federal revenues. Does the Navy accommodate these peaks by decreasing funding for other ships in peak carrier-funding years, or is the reduction taken elsewhere in the federal budget? What are the implications of other funding strategies for the SCN budget and for the behavior of the various parties involved in carrier acquisition? To answer these questions, we interviewed Navy and contractor personnel and conducted some simple mathematical analyses of carrier-funding history and plans.

We considered three alternative funding policies:

- *Incremental funding*, which entails appropriating sufficient funds each year to cover the work as it proceeds.
- *Advance appropriations*, in which ships are fully funded up front but the charge against the budget is spread out over several years.
- *Capital-account funding*, in which Congress commits to a specified level of annual funding (adjustable from time to time) sufficient to support all carrier-construction activities over the long term. The account could serve as a source of either incremental or full funding.

BUDGETARY EFFECTS

Under the currently planned full-funding strategy, in 17 of the next 30 years, funding for carrier construction and midlife overhaul will vary by \$2 billion or more from the previous year. The standard deviation (variability) of the funding profile will be \$1.6 billion. To determine from what source funds were being taken to cover carrier-funding peaks, we compared funding for ships other than carriers in years when carriers were built and in years when they were not. We took into account confounding factors, most importantly the level of the defense budget relative to total federal spending. Our conclusion was that, historically, approximately three-fourths of the average \$3.8-billion full-funding appropriation for a carrier was associated with a boost in total SCN funding over SCN funding in years when carriers have not been built. The other quarter was related to a decrease in the funding for other ships. Whether programs for other ships lose money to the carrier program depends on what happens to funding for those ships in non-carrier-funding years. Regardless, construction of other ships might have to be scheduled around the carrier start to ensure that enough manpower is available for the latter. While compressing or extending the construction schedules of other ships might entail inefficiencies, we were not able to verify, within the scope of the current study, that such inefficiencies occur.

Strategies other than full funding can reduce the variability of the carrier-funding profile. Incremental funding drops the standard deviation of the funding profile to \$420 million, and advance appropriations, to \$360 million (see Figure S.1). A carrier capital account could, by design, drop the variability close to zero. Unlike incremental funding, such an account would leave an unspent balance, which might be claimed for other programs, at the end of each year. That balance could average anywhere from over a billion dollars down to less than half that amount, depending on how often the annual appropriation to the account is adjusted (more adjustments allow lower balances; the version shown in the figure is adjusted three times). A hybrid funding scheme could be implemented in which, for example, only the refueling and overhaul costs are covered by a capital account, and the new-ship costs are covered by one of the other approaches. We found, however, that such an approach

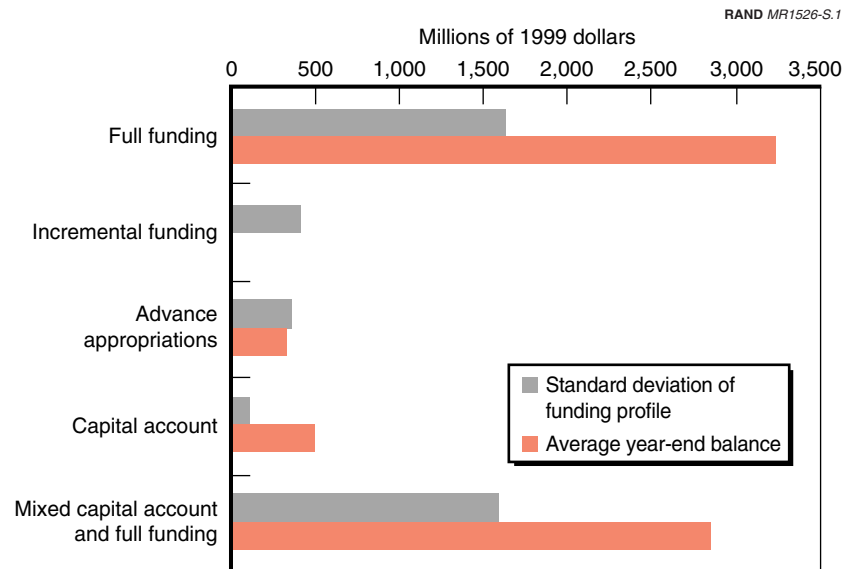


Figure S.1—Year-to-Year Variation and Year-End Balances for Alternative Carrier-Funding Strategies

has no practical advantage over the use of full funding, incremental funding, or advance appropriations to cover all costs.

ORGANIZATIONAL RESPONSES TO RISK SHIFTS

If the Navy were to shift from full funding to incremental funding, a carrier capital account, or advance appropriations, the institutional risks associated with carrier construction would be shifted around. That is, the risks of unfavorable project outcomes would be borne by parties different from those that bear them now. As a result, we would expect changes in the behavior of the major parties involved—DoD and the Navy, Congress, and the shipbuilding contractors. Three types of risk shift, or transfer, are of particular importance.

First, unobligated balances in a capital account would create a new risk for the Carrier Program Executive Office, presenting an inviting target for Congress, DoD, or the Navy itself to reallocate in support of causes they judge more urgent. The carrier program itself was the

beneficiary of such a reallocation in FY95, when money was taken from a capital account, the National Defense Sealift Fund, to fill out the appropriation for the *Ronald Reagan* (designated CVN 76). However, other shipbuilding programs are not the only potential claimants of unspent balances. The Chief of Naval Operations has declared personnel and current-readiness programs to be higher priorities than shipbuilding.

Second, dividing lump-sum funding into annual increments would present more opportunities for Congress to cut the program, raising risks for contractors. Among the plausible responses of contractors would be higher bids, including cancellation fees. Two factors might partly offset the tendency to raise costs:

- Contractors working for the government have become accustomed to the vicissitudes of government contracting, which they treat as normal business risks.
- A capital account's separation of funding from specific ships could complicate subsequent cancellation, thus mitigating the risk increase for contractors.

Higher contractor bids might also be partly offset by any incentives the government puts into place to increase efficiency.

Besides increasing their bids, contractors might respond to greater risk of interrupted funding by investing more heavily in keeping the program sold to Congress. Such selling activities include lobbying and placing articles in the print media, as well as attempting to curry favor with influential Congress members through strategic (although not necessarily efficient) selection of subcontractors.

Finally, incremental funding, either directly or through a capital account, implies lower visibility of full project costs to Congress. As a result, there may be less incentive on the Navy's part to check cost growth. This scenario translates into a risk for Congress of eventually approving more money for carrier construction than it would have under full funding. For a capital account, this risk might be mitigated by legislation requiring that the account fund all carrier life-time costs—an ambitious and complex approach but one that might generate advantages in efficiency and effectiveness.

If Congress and the Navy decide to shift from full funding to an alternative approach, there is the possibility that they will want to switch back at some time in the future, which could be problematic in any scheme involving incremental budget authority: On return to full funding, the budget would have to be increased to cover both full funding for new starts and incremental funding for ships still under construction.

CONCLUSION

The large carrier-funding peaks in the SCN budget are not associated with big drops in funding for other shipbuilding programs. However, the money must come from somewhere—other DoD or federal programs—and there is thus a potential gain from finding a way to smooth the peaks. Alternative strategies greatly reduce the variability in funding but have drawbacks of their own. Incremental funding entails higher contractor risks and costs and less visibility to Congress of the eventual project budget. Capital accounts involve the accumulation of balances that may be difficult to obligate—commit to expenditure of funds—quickly; they are thus open to reallocation. Both of these strategies may stimulate additional efforts by the Navy and contractors to keep the program sold. Advance appropriations shares some of these risks to a lesser degree.

Choosing from among the various strategies thus requires trading off the benefits of funding stability against increased risks in various areas. Such trading off is something that Navy decisionmakers must do, possibly with the aid of further supporting analyses. It is beyond the scope of the analysis here.

ACKNOWLEDGMENTS

This work could not have been undertaken without the steadfast support and encouragement we received from Brian Persons, Deputy Carrier Program Executive Officer (PEO), and members of his staff. Many individuals in the Program Executive Office Carriers provided their time, knowledge, and information to help us perform the analyses discussed in this report.

RADM Roland Knapp, USN, Carrier PEO; CAPT Chuck Bush, USN, Program Manager, Aircraft Carriers; and Robert Murphy and Stacy Marcott, Naval Reactors, Nuclear Directorate, also deserve special mention and our gratitude. Their insights and questions were highly valued and caused us to think more broadly about the issues. Irvin Chewning, Senior Cost Analyst, and his staff graciously provided much of the necessary data and patiently answered our many questions. At Newport News Shipyard, Michael Petters, David Lambert, and Daniel Arczynski provided data, shared their insights with us, and offered many constructive comments and suggestions. These interactions added to the richness and quality of the study.

Finally, for their careful and constructive comments on earlier drafts, we thank RAND colleagues Frank Lacroix and Frank Camm. We are additionally indebted to Joan Myers for her deft assistance in organizing and formatting the many drafts and to Marian Branch for her editing.

ACRONYMS

AP	Advance procurement
CV	Carrier vessel
CVN	Carrier vessel, nuclear
CVNX	Carrier vessel, nuclear, new design
DoD	Department of Defense
DOE	Department of Energy
FY	Fiscal year
GAO	General Accounting Office
LHD	Amphibious assault ship (multipurpose)
NAVSEA	Naval Sea Systems Command
NDSF	National Defense Sealift Fund
OMB	Office of Management and Budget
PEO	Program Executive Office
R&D	Research and Development
RCOH	Refueling and complex overhaul
SCN	Shipbuilding and Conversion–Navy

SD	Standard deviation
SLEP	Service life extension program
SSN	Attack submarine
TOA	Total obligation authority
U.S.C.	United States Code

Most funding for any U.S. aircraft carrier or other naval vessel is provided in a single year by Congress, even though it takes several years to build a carrier. A similar funding approach is taken for the refueling and complex overhaul (RCOH) that occurs at a carrier's midlife, an operation that costs about half as much as the building of a new ship. This "full-funding" policy has advantages and potential disadvantages relative to other funding alternatives.

An important advantage of full funding—and the principal motivation for instituting it in the 1950s—is that it lets Congress members know how much of a commitment they are making to a program at the outset. An important disadvantage is that every fourth or fifth year, several billion dollars must be committed to procuring the next carrier. Because federal revenues do not increase accordingly, funding a new carrier would typically mean reducing the funding of other programs. Such programs may be other Navy shipbuilding efforts, programs elsewhere in the Navy, or other programs in or beyond the Department of Defense (DoD).

There is thus bound to be an interest somewhere in smoothing out the carrier-funding profile. Several alternatives are available for doing so. Carriers might, for example, be funded incrementally to reflect the amount that must actually be spent each year on construction or refueling. Or the funding might be provided in advance but the money would be released—that is, the budget authority would be provided—year by year. A third alternative is to create a revolving fund into which a constant amount of money is deposited each year, to be drawn on as needed. These alternatives raise risks of their own.

Acting at the request of the Program Executive Office (PEO) for Carriers, Naval Sea Systems Command (NAVSEA), we sought to objectively assess the advantages and disadvantages of the current and possible alternative carrier-funding strategies. In the assessment, we considered two central sets of questions:

- To what extent does the current carrier-funding profile—that is, the distribution of funding amounts across years—affect the funding profile for other shipbuilding? How might a different approach to funding alter the carrier-funding profile? We address these questions in Chapter Three.
- How are the current and alternative funding profiles likely to vary in their effects on actions taken by the Navy, Congress, and shipbuilding contractors in trying to achieve the objectives associated with their involvement in the carrier-construction program? We address this question in Chapter Four.

First, however, we provide background on current and alternative carrier-funding approaches, including full definitions of each and the historical record of their employment, in Chapter Two.

Funding approaches are described using a number of terms with meanings specific to the funding agencies of the U.S. government. In this chapter, we define what we mean by *full funding* and give some historical background on this practice. We also define the three principal funding alternatives that we consider—incremental funding, advance appropriations, and capital account—and review precedents for their adoption:

- *Authorization*: establishment or approval by Congress of an acquisition program.
- *Appropriation or funding*: approval by Congress of the expenditure by DoD of funds on a given program up to a specified amount.
- *Budget authority*: the legal power conferred on DoD by Congress in an appropriations act to expend the amount appropriated.
- *Total obligation authority* (TOA): funds corresponding to the total budget authority across DoD or some specified part of it in a given year.
- *Obligation*: an action taken by DoD that commits it to an expenditure of funds; examples of obligations include contracts let and positions filled.
- *Outlay*: the expenditure of funds to satisfy an obligation. Thus, when we talk about funds *spent*, we mean that an outlay has occurred.

With the exception of the definition of *funding*, the definitions of these terms follow those typically used in the literature on federal budgeting. Conventionally, *funding* is not as specifically defined, but in the context of full funding of aircraft carriers, it refers to congressional appropriation, and that is how we always use it in this report.

Federal law (31 U.S.C. 1341 [a] [1]) provides that the government

may not make or authorize an expenditure or obligation exceeding an amount available in an appropriation or fund for the expenditure or obligation

However, as long as the contract provides for termination should the funds not be appropriated in a timely manner, the government is not prohibited from initiating a contract for a multiple-year period without funds immediately available (41 U.S.C. 254c [d]):

Such [multiple-year] contract may provide that performance under the contract during the second and subsequent years of the contract is contingent on the appropriation of funds

Throughout the following, it should be kept in mind that the choice of funding strategy does not necessarily imply a choice of contracting strategy. Multiple-year contracts are possible with incremental funding, advance appropriations, or a capital account, and various contractual incentives intended to constrain costs may be applied with any funding strategy.

FULL FUNDING

According to the Office of Management and Budget's (OMB's) *Circular A-11* (2000b, Part 3, p. 549),

Full funding means that appropriations . . . are enacted that are sufficient in total to complete a useful segment of a capital project before any obligation may be incurred for that segment Full funding for an entire capital project is required, if the project cannot be divided into more than one useful segment.

An aircraft carrier or other ship is not divisible into useful segments, which means that the entire construction cost (or the entire cost of a

refueling and complex overhaul) must be appropriated in one lump sum.

Congress imposed the full-funding policy on DoD in the 1950s to make the total procurement costs of DoD weapons and equipment more visible, thereby enhancing Congress's ability to understand and track those costs.¹ Congress's intent in imposing the policy was to strengthen discipline in DoD budgeting and improve its own ability to oversee DoD activities. As the DoD Comptroller puts it (1993, p. 1-18),

The objective is to provide funds at the outset for the total estimated cost of a given item so that Congress and the public can be fully aware of the dimensions and cost when it is first presented in the budget.

Since the full-funding method became policy for major DoD acquisitions, most Navy ship procurements have been fully funded in a single year.

Until 1996, full funding had not been the rule for major acquisitions by other departments. The Department of Energy (DOE), in particular, had experienced significant difficulties with major acquisitions. According to the General Accounting Office (GAO, 1996), delays and cost overruns in nearly all major DOE acquisitions between 1980 and 1996 were, in part, a consequence of incremental funding. Such funding required neither DOE nor Congress to agree and act upon a good estimate of a project's total cost before beginning work. The GAO made a strong case for full funding of all major federal acquisitions, a practice required at about the same time by OMB *Circular A-11*.

¹Except where cited otherwise, the factual basis of the remainder of this section and the next is drawn from U.S. House of Representatives, House Armed Services Committee, *Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee, Subcommittee on Military Procurement, Hearing on Littoral Warfare Protection and Ship Recapitalization, March 9, 1999*, Washington, D.C., 1999. Our interpretation of the factual record may vary from O'Rourke's in places.

An important exception to the full-funding policy and one that is relevant to carriers is the use of advance procurement funding² for items with long production lead times, such as reactors in the Navy's nuclear-powered warships, for which it is used routinely and extensively. Such reactors and other propulsion-system components must be started years in advance of the ship construction itself if they are to be ready when they are needed. Therefore, the funding profile for such a warship usually begins with hundreds of millions of dollars committed one to five years before appropriations are made for the remainder of the ship.

There have been other congressional exceptions to the letter, if not the spirit, of the full-funding policy. The third and final ship (SSN-23) of the *Seawolf* attack submarine class was funded across several years. Originally intended to comprise 29 ships, the Seawolf program was canceled in 1992, and funds for completing only two ships had been appropriated. However, Congress had provided sufficient funding to build SSN-23's combat system, and three-quarters of its nuclear propulsion system had been completed.³ In FY96, Congress authorized completion of the ship, but spread the remaining needed funds over three years (\$700 million that year, \$649 million in FY97, and \$153 million in FY98).

In two other recent cases, Congress has also departed from the full-funding policy. In FY93, Congress appropriated only \$305 million of the eventual \$1.1-billion cost of the amphibious assault ship LHD-6 but asked the Navy to include the remainder in its FY94 budget request. Congress appropriated \$50 million in FY94 and in FY95 toward the \$1.4-billion cost of LHD-7 as an expression of intent to build the ship (which the Clinton administration did not want), then funded the remainder in FY96.

²Advance procurement items may themselves be fully funded. That is, an amount sufficient to cover a component's construction cost may be appropriated in the initial year of component construction and expended over several years. Any of the alternative strategies discussed in this chapter could be used to fund advance procurement; among these is advance appropriations, with which advance procurement should not be confused.

³Clifford Mussen, Seawolf PEO, Washington, D.C., personal communication, September 29, 2000.

None of these cases, however, was inconsistent with the objectives of funding large portions of a project at one time. The \$1.3-billion provided for SSN-23 in FY96 and FY97 represented well over two years of work on the ship. In the other examples, over two-thirds of the funds were provided at once. Furthermore, no Congress was committing an appreciable fraction of a ship's funding while leaving the remainder to the discretion of some future Congress.

INCREMENTAL FUNDING

Before the full-funding policy was imposed, DoD weapon procurement was frequently accomplished through incremental funding. That is, the funding to procure a given item was provided in portions, or increments, over a series of years in a pattern reflecting requirements for paying the contractor as successive stages of work were accomplished. Incremental funding fell out of favor because Congress members had several concerns about it:

- That it made total procurement costs more difficult for Congress to track
- That it allowed DoD to start procurement of an item without stating its total cost up front, or without explicitly planning for the funding needed to complete it
- That it might permit one Congress appropriating the initial funds for construction of a large item to “tie the hands” of future Congresses by leaving them to provide the bulk of funding for it.

The full-funding policy was introduced in response to these congressional concerns. However, Congress has funded and continues to fund projects otherwise. For example, in the FY01 appropriation for the Department of Transportation, Congress specifically directed the acquisition of a new Great Lakes icebreaker with incremental funding.

An important disadvantage of incremental funding is that the ship-funding priority within the overall Navy program may be revised each year when a new increment is required. Each increment must therefore compete for funding priority from year to year, whereas in full funding the competition is closed after the initial funding decision. Another disadvantage is that incremental funding can still

create substantial swings in carrier-construction funding, particularly when one ship's midlife RCOH coincides with major construction activity on a new ship.

ADVANCE APPROPRIATIONS

Uncertainty over future funding could be partially alleviated through a hybrid of full and incremental funding that would provide the full appropriation up front but the budget authority year by year. The intent and mechanism of advance appropriations are described in several places throughout OMB *Circular No. A-11*:

- “Advance appropriation means appropriation of new budget authority that becomes available one or more fiscal years beyond the fiscal year for which the appropriation act was passed” (OMB, 2000b, Section 20, p. 24). That is, the full amount is appropriated at the outset, as with full funding. Advance appropriation differs from full funding as described above in that the amount appropriated can only be obligated as budget authority becomes available, and in that the funds are counted as part of the budget only as budget authority becomes available. Thus, the full amount required for constructing a carrier would not be counted in the Shipbuilding and Conversion–Navy (SCN) budget for year 1 of construction, as it is with full funding.
- “Capital projects or useful segments of capital projects must be *fully funded* either through regular or advance appropriations. *Full funding* means that appropriations—regular annual appropriations or advance appropriations—are enacted that are sufficient in total to complete a useful segment of a capital project before any obligations may be incurred for that segment Full funding for an entire capital project is required if the project cannot be divided into more than one useful segment” (OMB, 2000b, Section 300, p. 549).
- “Regular appropriations for the full funding of a capital project or a useful segment of a capital project in the budget year are preferred. If this results in spikes that, in the judgment of OMB, cannot be accommodated by the agency or the Congress, a combination of regular and advance appropriations that together provide full funding for a capital project or a useful seg-

ment should be proposed in the budget” (OMB, 2000b, Section 300, p. 549).⁴

The last quote from OMB *Circular No. 11* goes on to say, in a later paragraph, “Advance appropriations have the same benefit as regular appropriations for improving planning, management and the accountability of the project.” It therefore appears that while full funding is the appropriation method preferred by OMB, there is an allowance for the use of advance appropriation. Advance appropriation is thus legally a form of full funding and shares some of the benefits (and drawbacks) of incremental funding.

CAPITAL ACCOUNT

A carrier capital account could lower the uncertainty of future resourcing inherent in incremental funding while eliminating annual funding swings. In such a scheme, Congress would appropriate a fairly constant level of funding into an account that would then be drawn on as needed. The money in the account might be merely enough to cover outlays year by year, or enough might be allowed to accumulate in the account so that carrier projects could be fully funded from that source. In either case, the annual commitment might be adjusted from time to time as needs change.

Although there are no strictly analogous precedents for shipbuilding, DoD has maintained a National Defense Sealift Fund (NDSF). The NDSF is at least superficially similar enough to a carrier capital account to discuss in some detail.

The NDSF was born of the 1992 DoD Mobility Requirements Study, which identified shortcomings in the nation’s sealift capacity in the post–Cold War environment (Grasso, 1996). Increasing sealift capacity became a long-term defense objective. The concept of a special fund was advanced by Secretary of the Navy Sean O’Keefe as a means of providing sealift funding that would be resistant to the constant

⁴Clearly, from this quote and the preceding one, OMB sees advance appropriations as a type of full funding, as opposed to “regular appropriations.” While clear in the context quoted, “regular appropriations” is not clear enough for our purposes (to stand in distinction, for example, to incremental funding), so we use “full funding” instead, to apply only in cases in which the budget authority is allocated in one year.

pressures for reprogramming to meet near-term needs.⁵ The 1993 Defense Appropriations Act created the NDSF and specified that the funds in the account were to be used only for

(A) Construction, purchase, alteration and conversion of [DOD] sealift vessels, (B) Operation, maintenance and lease or charter of [DOD sealift] vessels, (C) Installation and maintenance of defense features [on privately owned vessels], (D) Research and development relating to national defense sealift, and (E) Expenses for maintaining the National Defense Reserve Fleet

In October 1994, Deputy Secretary of Defense John Deutch signed the charter laying out the process for administering the fund. The Secretary of the Navy was assigned as executive agent, and the Under Secretary for Acquisition and Technology was assigned as the acquisition official. Acquisition authority was subsequently delegated to the Naval Sea Systems Command. The fund's charter applies DoD Acquisition Directives 5000.1 (2000) and 5000.2 (1993) to the NDSF; the directives require the Navy to prepare detailed information identifying the full life-cycle cost of a ship acquisition program. To date, although the fund could legally be used to acquire almost any Navy ship other than a warship, only large, medium-speed roll-on/roll-off ships have been funded by way of the NDSF.⁶ And whereas the appropriations are targeted to specific hulls, the Navy has the flexibility to move the level of effort around between years and hulls without going to Congress for approval.

Funds that were appropriated in earlier years for sealift ships were transferred from the SCN accounts to the NDSF when it was created in 1994. Since that time, the NDSF has been funded and administered separately from the SCN account. The NDSF is administered as a working-capital revolving-fund account. That is, appropriations bills typically provide funds "to remain available until expended,"⁷ which is done on a first-in, first-out basis. Appropriations are sup-

⁵Corky Fitzpatrick, NAVSEA PMS 325, personal communication.

⁶Although \$1.2 billion in FY94 NDSF funds was transferred to an SCN account to partially fund construction of CVN 76, the ship was not funded under the NDSF program.

⁷For example, refer to the Department of Defense Appropriations Act, 2000, National Defense Sealift Fund.

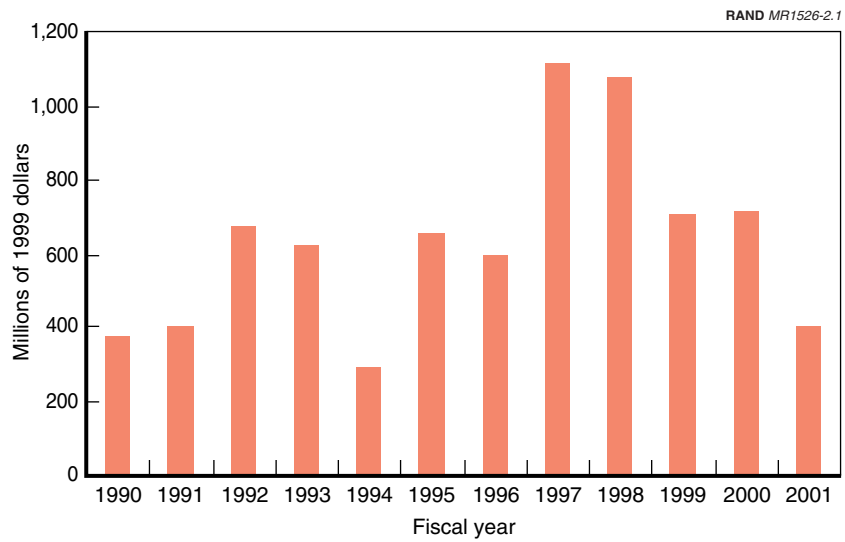
plemented by other sources of income, including the sale of unneeded sealift assets.

Despite its establishment as a revolving fund, the NDSF differs from a carrier capital account as defined above. Resembling full funding somewhat, in a capital account funds are appropriated for specific ships, and the amounts are spread over as many as five years, although there is always a peak funding year for each ship. For example, the \$290-million cost of TAKR 311 was funded over a span of six years, from FY91 through FY96, but almost \$220 million of that was provided in FY93 (Grasso, 1996). Some factors help reduce variation in the funding profile. Sealift ships are less expensive than new warships and so can be built in quantity, with overlapping starts. The fund also supports operations and maintenance of completed ships. However, the NDSF carries no mandate for a smooth funding profile, and the profile to date, shown in Figure 2.1, shows wide variation.⁸

It is not clear that sealift would have been funded at the same level without the NDSF. Part of the motivation for establishing the NDSF was to ensure that sealift got built. The NDSF was thus, in part, a device to reallocate funds from other purposes. A carrier capital account would simply move, from one year to others, appropriations already dedicated to carriers. Thus, the NDSF represents an illustration of how a capital account can be organized and administered, but is not a perfect analog to the suggested capital account for carrier construction.

The mix of characteristics may have played a part in the fund's success. The assets to be produced by the program were well defined in the beginning, and the total costs were well known in advance. As a result, the program has been able to provide all the assets when required, and on budget, despite extending over a period of nine years. Thus, the program has never carried the risks or uncertainties inherent in such incrementally funded programs as the DOE projects mentioned earlier in this chapter.

⁸The profile shown in Figure 2.1 includes three years of sealift funding before the program was formally begun. (The trough in FY94 marks the diversion of a large amount of money from NDSF to partially fund CVN 76.)



SOURCES: OMB, *Planning, Budgeting, and Acquisition of Capital Assets*, Circular A-11, Part 3 (FY90–FY96), Washington, D.C., July 2000b; and DoD appropriation or authorization legislation (FY97–FY01).

Figure 2.1—Appropriations for National Defense Sealift Fund

A principal motivation for considering alternatives to full funding is to find an option that will result in a smoother year-to-year funding profile. In this chapter, we graph funding profiles for each of the alternatives previously defined and compare the variability of those profiles with that for full funding. We pay particular attention to the apparent effects of carrier funding on noncarrier programs, to the creation of an apparent surplus when budget authority is delayed, and to the broad array of options available for planning a carrier capital account.

FULL FUNDING

Assuming the current fleet size, we present the temporal profile of appropriations for carrier construction under the current full-funding regime. We then search for evidence permitting an answer to this question: Has the need to fund carriers in a lump sum subtracted from construction of other types of ships?

Carrier Appropriations

The spiky profile of carrier funding under the current full-funding regime is quite apparent in Figure 3.1, which shows the total obligation authority for the carrier portion of the SCN account for the past two decades.¹ This account includes advance procurement, new

¹All monetary figures in this chapter have been converted to 1999 dollars.

construction, refuelings and overhauls, and service life extension programs (SLEPs). The peaks over \$1 billion were for the following purposes:

- FY80: Full funding of CVN 71, *Theodore Roosevelt*
- FY83: Full funding of CVN 72, *Abraham Lincoln*, and CVN 73, *George Washington*
- FY88: Full funding of CVN 74, *John C. Stennis*, and CVN 75, *Harry S. Truman*
- FY90: RCOH of CVN 65, *Enterprise*
- FY95: Full funding of CVN 76, *Ronald Reagan*, including \$1.2 billion reallocated from FY94 funding for the National Defense Sealift Fund (see Chapter Two)
- FY98: RCOH for CVN 68, *Nimitz*.

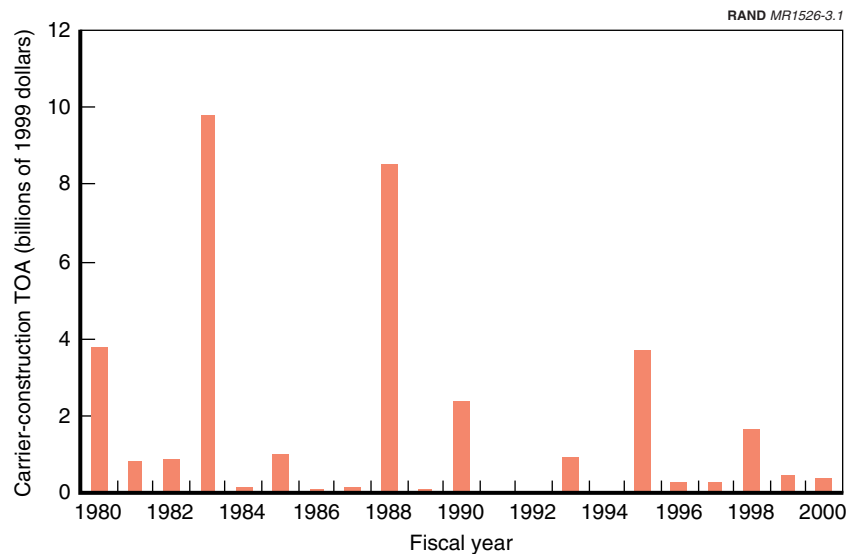


Figure 3.1—Carrier-Construction Funding Has Exhibited Wide Swings in Recent Years

The spiky profile is inherent in full funding. Figure 3.2 adds to the funding recorded to date those appropriations expected for the next three decades, assuming the Nimitz-class ships (CVN 68 through CVN 76) will be refueled and that the 12-ship carrier force is to be sustained. (The 12-ship force implies a 4-year carrier replacement interval if ships are to be retired around age 48 years to avoid a second expensive RCOH and subsequent mounting costs and risks.) The projection begins with full funding of the next carrier to be constructed and the RCOH for CVN 69, both in FY01, and proceeds with \$4-billion new-construction funding spikes occurring approximately every four years thereafter. Other spikes indicate RCOHs and procurement in advance of new construction, often occurring simultaneously. Because of the need to conduct RCOHs on the Nimitz-class carriers beginning in 1998, the funding profile fills in somewhat in the coming decades. Even so, in the next 27 years there will be 16 swings of \$2 billion or more in funding from one year to the next. The standard deviation (a conventional measure of variability) of the annual appropriations will be \$1.6 billion. Throughout this section,

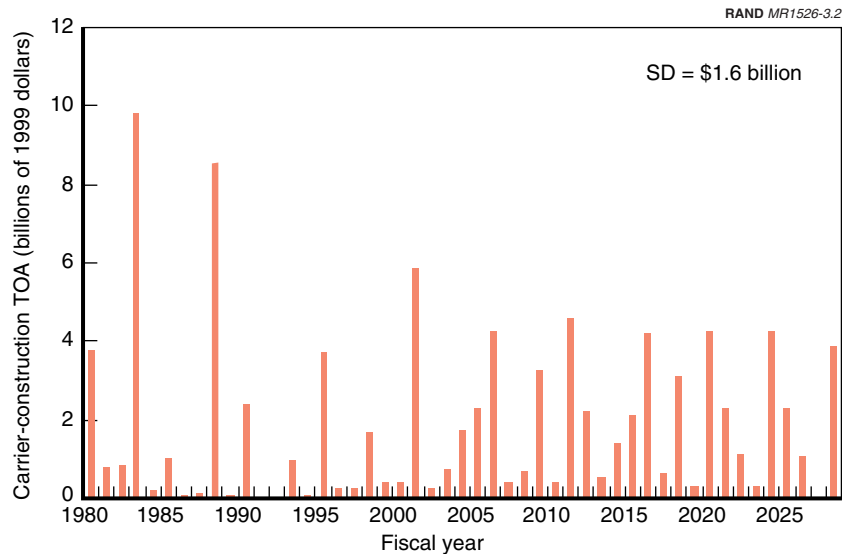


Figure 3.2—Carrier-Funding Spikes Will Continue Indefinitely

we will be comparing this number with standard deviations for other funding strategies.

Effects on Other Shipbuilding Programs

The implications of full carrier funding for the entire SCN budget are evident in Figure 3.3. The carrier procurement spikes of 1983, 1988, and 2001 are clearly reflected in the SCN trend.

It appears that carrier construction is added on to a prevailing total SCN level of effort. But do the peaks in Figure 3.3 fully account for carrier construction? Or does the Navy ask for lower funding levels in carrier-funding years for other shipbuilding, perhaps out of a reluctance to ask Congress and DoD for what decisionmakers with other priorities might perceive as too much?

To gain some insight into the answer to the latter question, we conducted a statistical analysis of the FY80-to-FY00 TOA profile for all

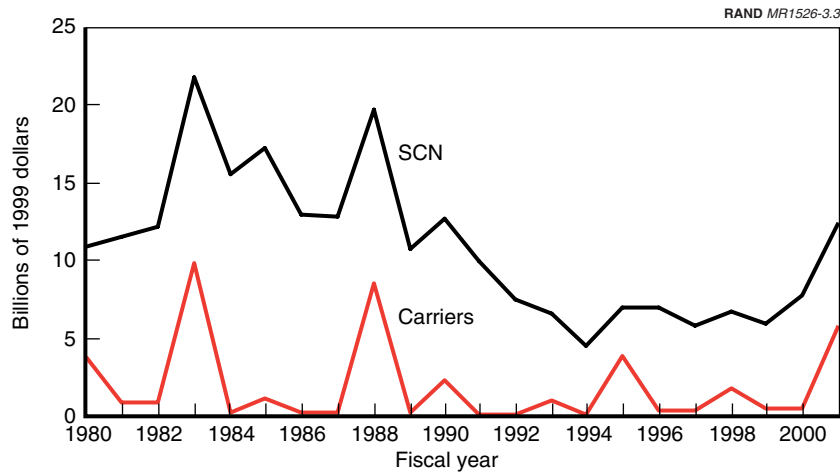


Figure 3.3—Carrier-Funding Spikes Are Reflected in SCN Procurement Funding

Navy shipbuilding (see Figure 3.4). We are mainly interested here in quantifying how much of the funding required by new carrier construction is offset by reductions in other SCN programs and how much is offset elsewhere in the federal budget; we have not attempted to identify the specific source of any offsets external to SCN.

The first thing that is apparent from Figure 3.4 is that annual SCN TOA exhibits broad trends over time; multiyear trends in noncarrier funding (indicated by the light gray bars) may thus reflect influences other than whether a carrier happened to be funded in a particular year. (For the purposes of this section, by *noncarrier funding* we mean all shipbuilding funds other than those devoted to new carrier construction in the year of full funding. *Noncarrier* thus includes funds for carrier advance procurement and RCOHs, which is appropriate: Our principal interest here is whether carrier *funding spikes* affect the flow of funds to all other shipbuilding and conversion efforts.)

It would thus not have been sufficient to simply compare average noncarrier SCN funding in carrier years with that in noncarrier years (i.e., years including full funding for carrier construction with years

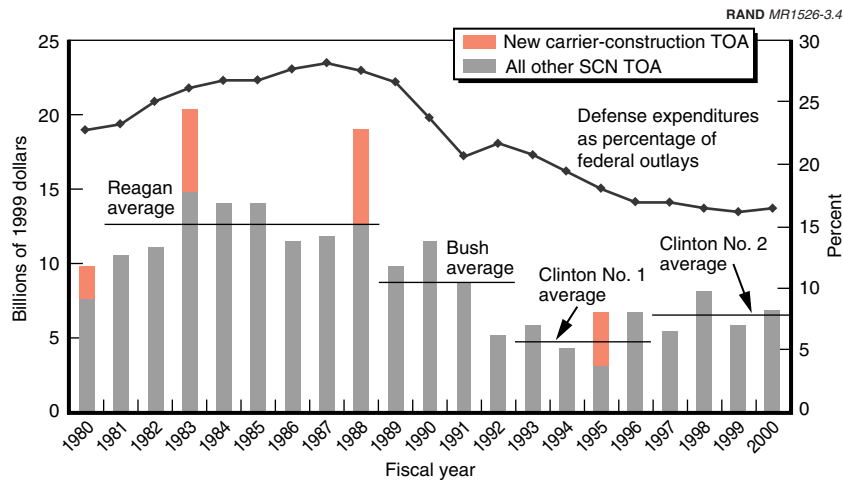


Figure 3.4—Shipbuilding TOA Varies with President and with Defense Expenditures

not doing so). Instead, we wanted to know whether noncarrier SCN funding in carrier years was lower than it would have been without the carrier, taking into account the influences apparently at work during that period of time.

In the remainder of this subsection, we first seek to infer, through a descriptive analysis based on inspection of the graph, what those influences might be. We then control for them in a formal statistical analysis.

Descriptive Analysis. Figure 3.4 shows, for example, that TOA varied substantially according to who was president. President Reagan's military buildup is clearly evident, as is the post-Desert Storm draw-down during President Clinton's first term. The horizontal lines show the average noncarrier SCN spending by presidential term. On the one hand, President Reagan had almost the same average spending for both terms in office (\$12.54 billion/year in his first term and \$12.51 billion/year in his second term, in 1999 dollars). President Clinton, on the other hand, had a significantly smaller level of expenditure in his first term (\$4.9 billion/year) than in his second term (\$6.5 billion/year).²

The fluctuations in total shipbuilding funds also follow the proportion of federal funds allocated to defense spending (the black curve). During the 1980s, defense spending often amounted to more than 25 percent of federal outlays (read off right-hand vertical axis), while in the mid- to late-1990s, it made up little more than 15 percent of outlays (OMB, 2000a).

Graphing these administration-specific averages and the outlay trend gets us a little closer to determining whether carrier funding displaced funding for other ships. For example, in 1983 and 1988, when four new carriers were funded, the remaining shipbuilding funding was at or above the average noncarrier spending level for the Reagan years. This is initial evidence that, during those two years, other shipbuilding funding did not seem to suffer as a result of new

²We do not mean to suggest here that these broad trends are solely, or even principally, the result of differing administration policies. Presidential terms are a convenient way of defining periods of time that may represent the confluence of several factors.

aircraft carrier construction. Rather, the picture seems to show that carrier funding was added on top of other shipbuilding funding. Perhaps at that time, political pressure to restrain spending on ship construction may have been lower, or it may have focused more on outlays than on appropriations. By contrast, in 1995 under President Clinton, noncarrier funding was lower than in any other Clinton year. Perhaps in that year, noncarrier funding may have been sacrificed to accommodate carrier funding.

Formal Analysis. To clarify such ambiguities in accounting for influences on noncarrier funding, we constructed a statistical model with a range of factors to explain the overall variation in total TOA and noncarrier TOA.

The model is a simple one. It expresses either noncarrier TOA (all TOA other than new carrier construction) or total shipbuilding TOA or any year in terms of the percentage of the federal budget devoted to defense and the number of carriers built that year (see Figure 3.5). This model accounted for as much of the variation across years as more-complicated analyses that we tried (e.g., models accounting for who was president).

Both percentage of the federal budget devoted to defense and number of carriers built exhibited an association with *total shipbuilding* TOA that was statistically significant. Total shipbuilding TOA increased by \$3 billion for each carrier built (top part of model in Figure 3.5).

But while percentage of the federal budget devoted to defense was also significantly associated with *noncarrier* TOA ($p < .0001$), the number of carriers built exhibited an association that did not quite reach conventional standards for statistical significance ($p = .1$). This lack of significance may have simply been the result of small sample size: only four carrier years. If the data had contained one more year in which an aircraft carrier was purchased, and that year was similar to the four years that were observed, then the relationship between noncarrier TOA and number of carriers would have been statistically significant.

Although short of statistical significance, the results were interesting nonetheless: They suggest that noncarrier TOA decreased by

RAND MR1526-3.5

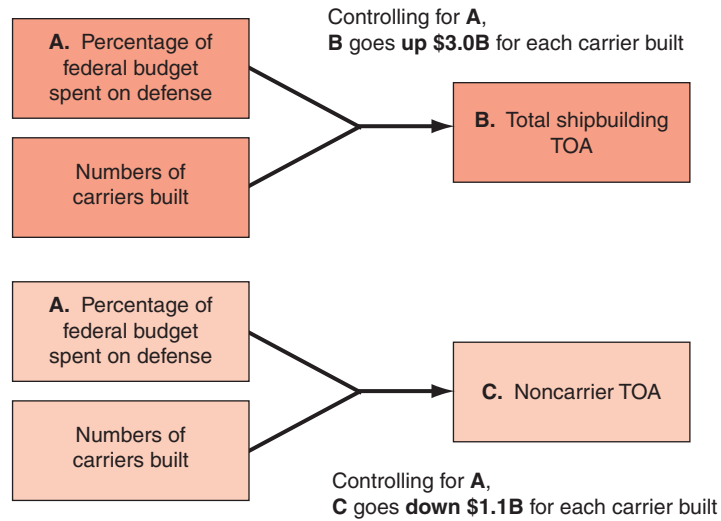


Figure 3.5—Model Depicting Shipbuilding TOA as a Function of Two Factors

\$1.1 billion for every carrier built (bottom part of model in Figure 3.5). Recall that total shipbuilding TOA increased by \$3 billion in a carrier year. The implication is that full carrier funding averaged \$4.1 billion, which is close to the actual \$3.8 billion average for FY80–FY00.

Conclusion. It would thus appear that approximately three-fourths of the cost for fully funding new carrier construction comes by way of an increase in total shipbuilding TOA in the year of full funding. If most of the carrier full-funding spike is not the result of losses to other shipbuilding programs, it may still represent a loss to the Navy; it may be that other Navy programs take the hit and suffer delays and disruptions. Or the money to fund carriers may be diverted by DoD from other defense acquisition programs or from personnel accounts. For example, in the two-carrier funding years of 1983 and 1988, Air Force procurement spending dipped. Finally, carrier-funding spikes may be offset outside the DoD budget as Congress

struggles to keep total federal spending within agreed-upon limits. Which of these alternatives predominates is a topic for further analysis.

Yet, it appears that a quarter of the carrier full-funding spike does come from a decrease in noncarrier funding for that year. This result may seem at odds with the 1983 and 1988 peaks in Figure 3.4, where, as mentioned above, comparison with other Reagan years suggests no dip in noncarrier funding. We have found, however, that the black curve in the figure accounts more fully for variation in noncarrier funding over the entire 21-year period than does the presidential administration. On the basis of that more-reliable predictor, we would have expected noncarrier funding in 1983 and 1988 to be above the level suggested by the Reagan average. We did try more-sophisticated models accounting for the differences between the Clinton and Reagan administrations, as well as defense-expenditure variation, and these suggested that the amount of non-carrier underfunding was less for 1983 and 1988 than for 1995.³

The full carrier funding that may be associated with a drop in funding for other ships does not necessarily translate into money lost to the other shipbuilding programs. It may be that the Navy plans its SCN budget over the long term so that the amount of funding, averaged over carrier and noncarrier years, is the desired funding. Or it may be that the Navy compensates for the periodic drops in noncarrier SCN funds by raising its request in certain noncarrier years. There is some support for this hypothesis in Figure 3.4: Three of the four carrier years are followed by one or two years in which funding for noncarrier construction is higher than the average for the administration then holding office. In a given year, the Navy often contracts for two or three surface combatants or (in the future) new submarines. Thus, the resource managers in the ship programs could move funding for a ship or two either to precede or to follow the carrier spike, subject, of course, to operational needs for a ship with a specified delivery date.

To this point, we have been discussing budgetary implications solely in terms of allocation of funds, not in terms of cost. If carrier-related

³This result was not statistically significant, which is to be expected, given that the presidential administration was statistically insignificant in the original models.

SCN budget spikes do cause rescheduling of the construction of other ships, that construction may be more inefficient and thus more costly than it would have been had the carrier-funding peak not been there. Leveling the spikes would then result in cost reductions for those programs. However, based on our interviews and discussions with various ship programs, it is not clear that such costs are in fact incurred. A thorough understanding of the potential magnitude of any cost savings would require a complete analysis of all the workloads at the various shipbuilders.

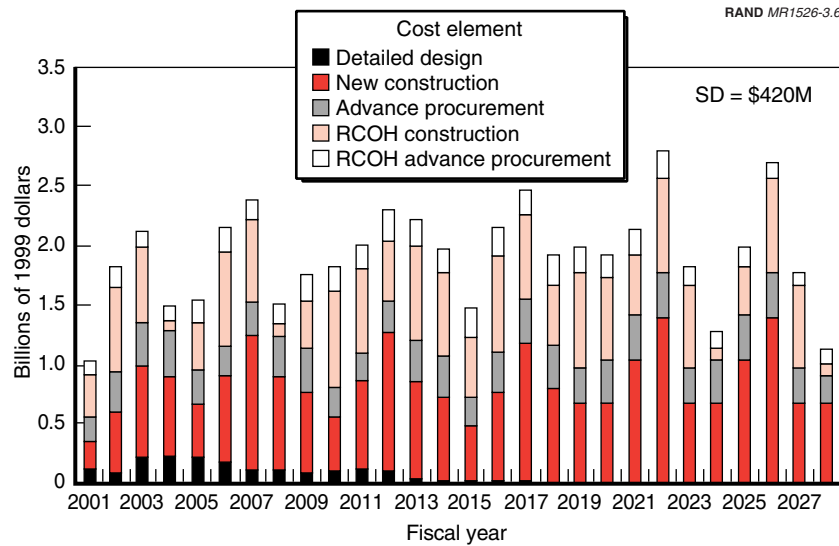
INCREMENTAL FUNDING

Reducing the large year-to-year funding swings inherent in the current system is a principal motivation for considering alternatives to full funding.⁴ What happens to the future carrier-funding profile in Figure 3.2 if carrier construction and RCOHs are funded incrementally—i.e., the annual appropriation to the SCN account for carriers would be just enough to cover the costs expected to be incurred that year—instead of in lump sums?

Incremental funding would reduce the annual swings in carrier-construction and RCOH funding (see Figure 3.6). The number of \$2-billion swings over the next three decades would drop from 17 with full funding to zero; in fact, the biggest variation from one year to the next would be the \$800-million increase as the incremental-funding regime got under way. The standard deviation would be \$420 million, down from \$1.6 billion for full funding.

To estimate the costs on which Figure 3.6 is based, we worked with NAVSEA's Cost Estimating Division (SEA 017) and Nuclear Propulsion Directorate (SEA 08) to derive, from historical data, the distribution of outlays over the course of carrier construction.

⁴Noncarrier programs can also combine to create a sharp peak in SCN funding, although such a peak has occurred only once in the past 20 years (in 1998). We do not consider it here.



NOTE: This graph covers all costs associated with RCOHs, beginning with the one scheduled for construction funding in FY01 and all costs associated with the CVNX class up through 2028. For CVN 77, it covers detailed design, the last three years of advance procurement (AP) funding (AP 3, AP 2, and AP 1), and construction. It omits currently accruing construction and advance-procurement costs for CVN 76, all of which were fully funded prior to FY98.

Figure 3.6—The Incremental Approach Smooths Out Carrier-Funding Peaks

Typical funding profiles could then be applied to the future full-funding profile provided by the Carrier PEO. These full-funding data covered construction of CVN 77 and the ships of the next class (CVNX), plus RCOHs for the Nimitz class. The outlay profiles we developed for each category of carrier funding are shown in Table 3.1.

Table 3.1
Assumed Outlay Profiles for Carrier-Funding Categories

Year	Ship Construction				Refueling and Complex Overhaul		
	Detailed Design ^b (percent)	Advance Procurement ^c (percent)		Construction (percent)	Advance Procurement ^c (percent)		Execution (percent)
		2	1		2	1	
1 ^a	43	27.5	12.0	5.9	27.5	12.0	20
2	29	22.5	25.5	13.9	22.5	25.5	40
3	11	21.0	28.5	20.6	21.0	28.5	35
4	7	13.0	17.0	17.7	13.0	17.0	5
5	4	9.0	10.0	12.0	9.0	10.0	
6	2	6.0	6.0	13.6	6.0	6.0	
7	2	1.0	1.0	16.3	1.0	1.0	
8	2						

^aYear 1 = year of full funding.

^bFor CVN 77 and CVNX 1 only; the funding profile for CVNX 2 is assumed to be 38-38-12-8-3-3-3-2 percent from years 1 through 8, respectively. Detailed design is not expected to be necessary for the remainder of the CVNX class.

^cUnder full funding, advance procurement is funded in several consecutive years, with each lump sum expended over periods of one to six years. Advance procurements are here numbered backward, beginning with the last one in the year before full funding of construction. For ship construction, no AP 1 is assumed for ships following CVNX 2. AP 3 and AP 4 for both ship construction and RCOHs are assumed expended in the year of funding (100 percent in year 1).

RAND MR1526-T3.1

ADVANCE APPROPRIATIONS

Advance appropriations require that the needed funds be appropriated in full at the outset, when a plan is also devised to provide enough budget authority year by year to cover at least those costs to be incurred each year. Thus, the effect of advance appropriations on the future carrier budgetary profile should be much like the incremental-funding profile, which matches the expenditure stream. However, in the case of advance appropriations, some variation of the budgetary profile from the expenditure profile is to be expected, because the latter varies from one project to the next and cannot be predicted with confidence. Thus, it would not make sense to adopt a

budget profile exactly like the expenditure profiles shown in Table 3.1. Where the work runs ahead of the averages on which the advance budget-authority profile is based, the government will be caught without enough funds to cover that work. Given the need to hedge against this risk, we expect that the budget-authority profile under advance appropriations will lead the spending profile by a bit rather than match it exactly.⁵ The more the budget-authority profile leads the expenditure profile, the less smooth it will be.

We have rerun the analysis depicted in Figure 3.6 with the budget-authority allocation shown in Table 3.2. To allow a margin for covering higher-than-average progress,⁶ the amount appropriated through a given year in this allocation is 5 to 10 percentage points higher than the expected spending profile in Table 3.1. The resulting funding profile, graphed in Figure 3.7, represents a modest improvement in variability from the incremental-funding profile; the standard deviation would be \$360 million, as opposed to \$420 million.

Both incremental funding and advance appropriations entail moving budget authority from full-funding years to later years.⁷ Moving this authority out of full-funding years reduces the amount of obligation authority used in those years. This reduction can be viewed as a “surplus” in relation to the current budget. This surplus is then drawn on during the years following each carrier-construction spike, when the funding deferred under incremental funding or advance appropriations is provided. It is not, however, drawn on completely,

⁵Expenditure uncertainty and the need to allow for flexibility in work scheduling by an efficient contractor are what motivate the anticipatory budget profile. Funding of long-lead items is not a significant additional incentive, because such funding is, presumably, reflected in the expenditure stream in Table 3.1.

⁶Other profiles are, of course, possible. Notably, Blickstein and Smith (2002) use a funding profile provided to them and preferred by the Navy (35 percent in year 1; 35 in year 2; 20 in year 3; 10 in year 4). Their report focuses on advance appropriations. Here, we compare advance appropriations with several other funding alternatives. To give advance appropriations a fair hearing, we use the less front-loaded profile, which results in lower variability and much lower year-end balances.

⁷These alternate-funding strategies raise issues about informing Congress of the full cost of the project, and of one Congress placing obligations for future funding on future Congresses. These matters are explored in the companion report (Blickstein and Smith, 2002).

Table 3.2
Assumed Annual-Appropriation Profiles for Carrier-Funding Categories

Year	Ship Construction				Refueling and Complex Overhaul		
	Detailed Design ^b (percent)	Advance Procurement ^c (percent)		Construction (percent)	Advance Procurement ^c (percent)		Execution (percent)
		2	1		2	1	
1 ^a	50	35	20	15	35	20	25
2	30	20	25	10	20	25	40
3	10	25	30	25	25	30	35
4	5	10	15	15	10	15	0
5	5	10	10	15	10	10	
6	0	0	0	10	0	0	
7	0	0	0	10	0	0	
8	0						

NOTE: These numbers are based on those in Table 3.1, but are front-loaded to keep the cumulative funding totals 5 to 10 percentage points ahead of the cumulative expenditure totals in the earlier table.

^aYear 1 = year of full funding.

^bFor CVN 77 and CVNX 1 only; the funding profile for CVNX 2 is assumed to be 38-38-12-8-3-3-3-2 percent from years 1 through 8, respectively. Detailed design is not expected to be necessary for the remainder of the CVNX class.

^cUnder full funding, advance procurement is funded in several consecutive years, with each lump sum expended over periods of one to six years. Advance procurements are here numbered backward, beginning with the last one in the year before full funding of construction. For ship construction, no AP 1 is assumed for ships following CVNX 2. AP 3 and AP 4 for both ship construction and RCOHs are assumed expended in the year of funding (100 percent in year 1).

RAND MR1526-T3.2

because we assume seven years of construction funding for each ship, whereas the interval between starts must average four years to sustain a 12-ship fleet (with a 48-year nominal life span).⁸

Table 3.3 compares the cumulative “savings” of the advance-appropriations budgetary profile given in Table 3.2 with that for a full-

⁸Blickstein and Smith (2002) assume a 4-year advance-appropriations profile, so that the “surplus” is spent by the time construction on the next carrier starts.

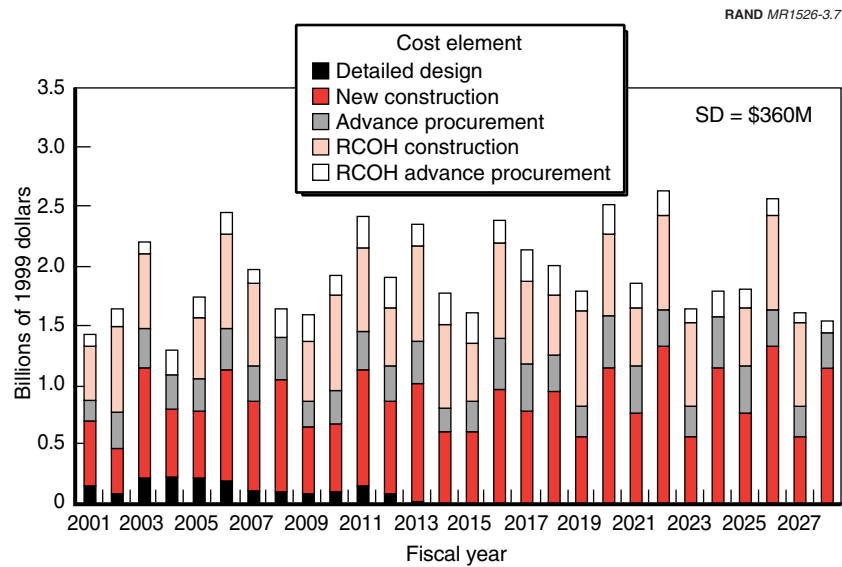


Figure 3.7—Advance Appropriations Smooth Out Carrier Budget-Authority Peaks Somewhat Better Than Incremental Funding

funding profile. To show more clearly how the surplus accumulates, we use a nominal full-funding profile for new construction only, rather than the data series depicted in Figure 3.2. (We bring in the “real” data in the second paragraph below.)

For advance appropriations in year 1, 15 percent of the first carrier is funded, following the profile in Table 3.2; in the fully funded case, all of that carrier would be funded. (To save space, the table shows the full-funding profile for CVs 1, 2, and 3 all in one column.) Thus, 85 percent of the cost of a carrier is “saved” under advance appropriations. But because budget authority must be invoked under advance appropriations, that savings is mostly drawn on over the next three years; no further budget authority need be provided under full funding. After year 4 for advance appropriations, 35 percent of the cost of a ship remains as a “savings.” In year 5, CV 2 is started, requiring 100 percent of the needed budget authority under full funding, but, again, only 15 percent under advance appropriations. Meanwhile, another 15 percent of a ship must be funded in the fifth

Table 3.3
Cumulative Percentage Savings (Apparent Surplus) for
Advanced Appropriations Compared with Full Funding

Year	Advance-Appropriations Profiles (percent of 1 ship)			Full-Funding Profile (percent of 1 ship)	Cumulative Difference (percent of 1 ship)
	CV 1	CV 2	CV 3		
1	15			100	85
2	10			0	75
3	25			0	50
4	15			0	35
5	15	15		100	105
6	10	10		0	85
7	10	25		0	50
8		15		0	35
9		15	15	100	105
10		10	10	0	85
11		10	25	0	50
12			15	0	35

RAND MR1526-T3.3

year of the CV 1 budget profile. Thus, $(100 - 15 - 15) = 70$ percent of a ship saved under advance appropriations, for a cumulative total of 105 percent.

It is apparent from the table that, as long as construction intervals and budgetary profiles remain as shown, the cumulative savings with advance appropriations will never drop below 35 percent of the fully funded value of a carrier. (Not coincidentally, this sum is equal to the percentage of CV 1 budgeted in overlap years 5, 6, and 7.) Full funding for a carrier amounts to approximately \$3.8 billion, of which 35 percent is \$1.3 billion. This calculation is for a notional full-funding profile for new construction only. When the other carrier budget elements in Table 3.2 are included and the true full-funding profile from Figure 3.2 is used, the cumulative “savings” drop to as

low as \$1.2 billion.⁹ That amount represents an *apparent* surplus that the Navy might be able to use for some other purpose, if it is suitably authorized by Congress. The surplus is only apparent because, if the Navy were ever to stop building carriers, years 5, 6, and 7 of budget authority for the last ship would be charged against the budget, with no full-funding offset for a subsequent ship. (These charges would also occur if the Navy switched back to full funding; see Chapter Four.) The “surplus” is thus a long-term loan against the (far) future.¹⁰

CARRIER CAPITAL ACCOUNT

It is possible to eliminate all variability from the carrier-funding profile. With a carrier capital account, all these remaining peaks will be flattened out to some constant annual level of investment. However, sustaining such an account means that, in years of lower-than-average activity, funds will accumulate in the account; in years of above-average activity, funds will be depleted.

The annual investment needs to be set so that a series of low-activity years does not allow so large a surplus to accumulate that it will draw claims for more-urgent uses. Neither must the fund be allowed to drop into the red because of a run of high-activity years preceded by inadequate surplus accumulation.

For example, Figure 3.8 shows the balance of a capital account funded at a constant level of \$1.92 billion annually, which is the anticipated *average* expenditure level for carrier construction and RCOH from 2001 through 2028. Because funding levels are based on expenditures, as they are for incremental funding, we refer to this as

⁹Incremental funding also results in “savings” with respect to budget authority under full funding. Under incremental funding, they would be slightly larger (by \$100 million) than with advance appropriations, because a larger percentage of the total required for ship construction would be budgeted in the “overlap” years (compare the numbers for years 5 through 7 under “Construction” in Tables 3.1 and 3.2).

¹⁰For a general treatment of apparent surpluses under advance appropriations, see Blickstein and Smith (2002).

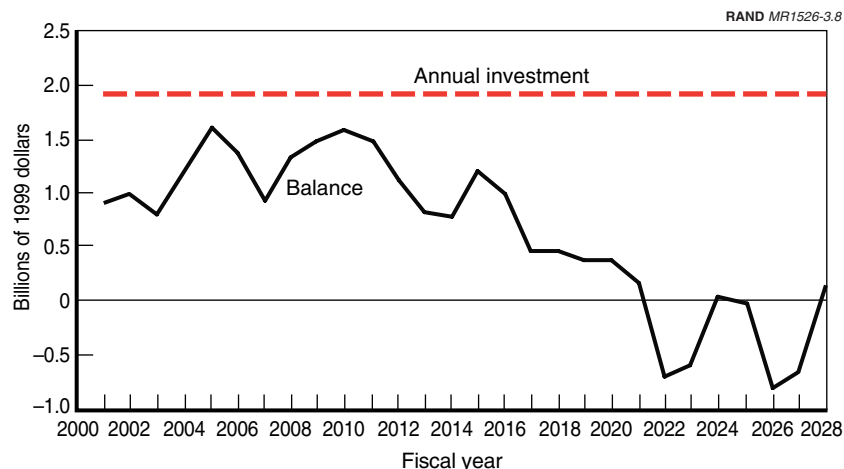


Figure 3.8—A Capital Account Funded at a Constant Average-Expenditure Rate Will Run into the Red

an incrementally funded capital account. The cost series used is the same one as that in Figure 3.6. Thus, expenditures in 2001 amount to \$1.03 billion, leaving an \$890-million balance after the annual injection of \$1.92 billion into the account. Through 2016, the balance fluctuates between \$750 million and \$1.5 billion as yearly expenditures vary around the \$1.92-billion average. After 2016, a string of high-activity years begins, soon dropping the balance below zero.

Of course, it is possible to bring the third-decade negative balances above zero by raising the constant-funding rate. As Figure 3.9 shows, an increase of \$40 million a year, to \$1.96 billion, is sufficient. However, the balance would then peak at \$2 billion and would average \$1.2 billion—more, perhaps, than the Navy would feel comfortable leaving exposed to reallocation risk at a time of need.¹¹ Note, however, that full funding would entail unspent year-end balances

¹¹However, the federal highway and airport trust funds generally carry unobligated balances on the order of \$10 billion.

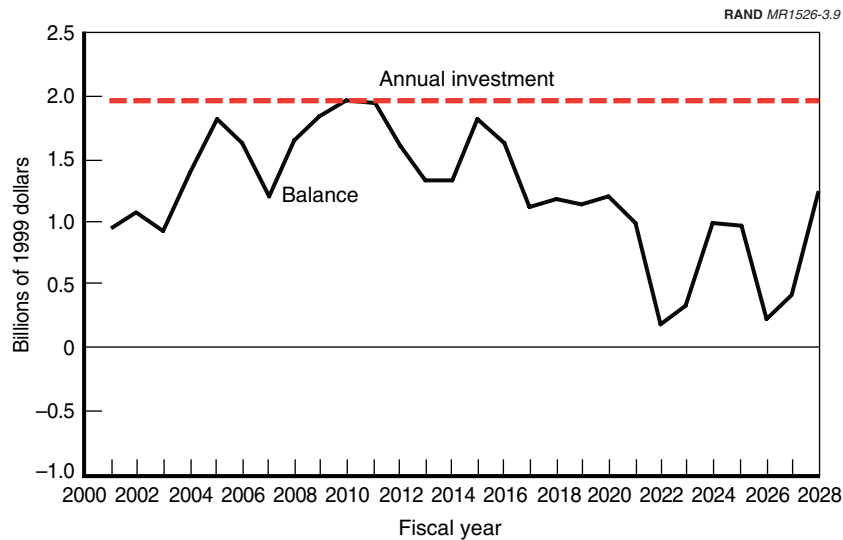


Figure 3.9—The Annual Investment Can Be Raised to Keep the Balance Above Zero, but the Result Is a High Average Balance

averaging \$3.2 billion, although some portion of that money is likely to have been obligated through multiple-year contracts, and all of it, in any case, would have been appropriated to fund specific ships.

By changing the amount paid in at some point during the 28-year period, it is possible to reduce the average capital-account balance while keeping all annual balances in the black. A good dividing point is the middle of the period, because the balance then is still above a billion dollars; consequently, a smaller annual investment number can be chosen for the first 14 years without risking a negative balance. In Figure 3.10, \$1.87 billion is paid into the account annually during the first 14 years and \$2.10 billion thereafter. These are the minimum amounts required to keep the yearly balance out of the red for the first and second halves of the period. The average balance over the 28 years drops by more than one-third, to \$760 million.

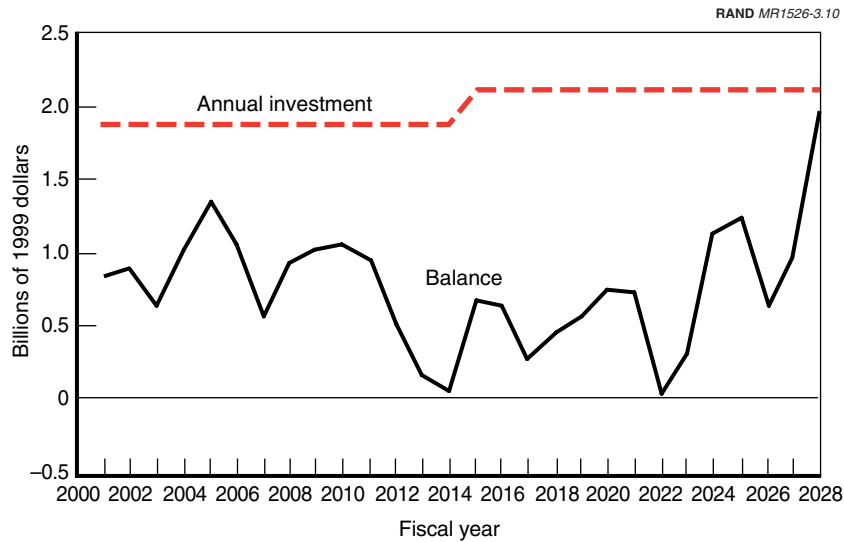


Figure 3.10—Inserting a Midcourse Change in Investment Amount Reduces the Average Balance

The average balance can be brought lower with more-frequent adjustments of the annual investment. But, at some point, the strategy is going to begin to look less like a capital account and more like incremental funding. However, we examine the potential of one further division of the 28-year period, into four segments, which would keep the periods of constant investment at least as long as the time elapsed between carrier starts. Dividing the full period into four *equal* segments does not allow further balance reduction; it actually requires an increase in the balance, because an upswing in expenditures in year 22 forces a raise in that year's infusion (and thus all subsequent ones).

A much more favorable result can be obtained by dividing the 28-year period into segments of seven, seven, eight, and six years (see Figure 3.11). We set funding at \$1.79 billion annually for the first segment, \$1.95 billion for the second, \$2.10 billion for the third, and \$1.95 billion for the fourth. All annual balances would then be below \$1.1 billion, and the average balance would drop by another third, to \$510 million.

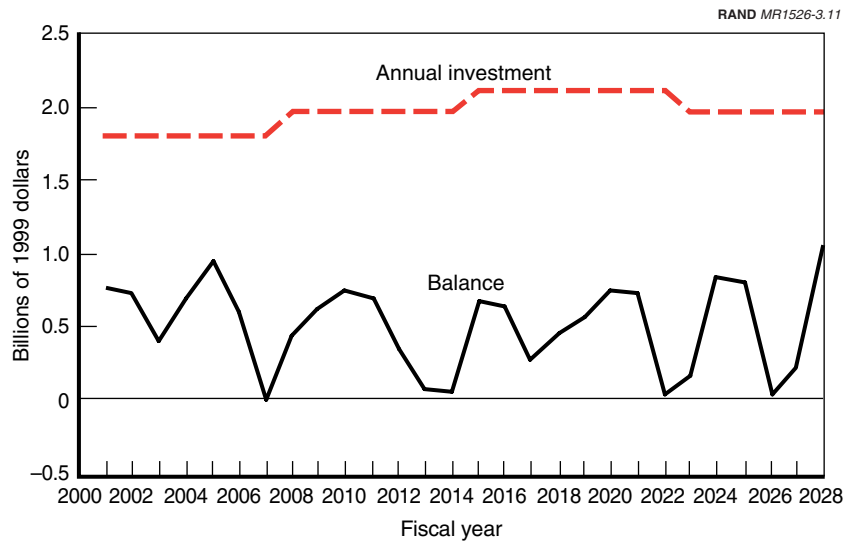


Figure 3.11—A Four-Segment Investment Profile Keeps Balances Low Without Excessively Frequent Adjustments in the Annual Investment Level

To ensure that our analysis is firmly grounded in real costs and not dependent solely on far-future projections, we have chosen to include cost streams for the first few years of the current decade. Some of these costs have already accrued or are for tasks for which a full-funding decision has already been made and cannot be reversed. We have merely attempted to indicate how a capital account would affect the overall expenditure profile and what needs to be done to minimize the account balance while keeping it above zero. The inclusion of some sunk costs is thus immaterial. However, we are not attempting here to set out a detailed plan for future expenditures.

Note that 2001 is a peak year under full funding. This means that, under carrier capital-account funding, a \$4-billion apparent surplus is run up.¹² This surplus reaches or approaches \$4 billion

¹²It is important to distinguish this apparent surplus from the balances we have been discussing so far. The latter are the accumulated difference between capital-account funding (investment) and expenditures. The surplus is the accumulated difference between full funding and capital-account funding.

on several subsequent occasions, but it never drops below \$1.1 billion. That is, the total carrier budget will always be at least \$1.1 billion lower than it would have been under full funding (and so will the SCN line, other things being equal). There will thus be \$1.1 billion of budgetary savings outside the capital account that could be spent for other purposes but that will eventually have to be paid back under the circumstances discussed earlier in this section.

Combination of a Capital Account with Other Funding Strategies

If the Navy judges the balances shown in Figure 3.11 still to be too large, a mixed funding strategy could be devised that funds certain cost elements through a capital account and the rest through another funding approach. For example, by restricting the capital fund to RCOH cost elements, the average balance could be dropped to \$320 million (Figure 3.12). The remaining elements could be funded fully, incrementally, or by advance appropriations. (If the capital account is restricted instead to costs related to new-ship construction, the average year-end balance remains around \$500 million.) Which of these three funding approaches is chosen determines whether such a mixed strategy would be desirable from a cost-smoothing viewpoint. Figures 3.13, 3.14, and 3.15 show the results of choosing the scheme involving full funding, incremental funding, and advance appropriations, respectively.

In the first case, Congress would take the RCOH elements out of the full-funding profile shown in Figure 3.2 and fund them through a capital account. The spikiness of the full-funding profile is not appreciably changed by this maneuver. The standard deviation drops only from \$1.64 billion (for fully funding everything) to \$1.59 billion (compare Figure 3.13 with Figure 3.2; note different scales). Thus, no useful gain in funding smoothness is achieved by taking on the average \$320-million RCOH capital-account balance.

Next, suppose that, within an otherwise incrementally funded paradigm, RCOH elements were to be funded through a capital account (Figure 3.14). This would reduce the standard deviation from

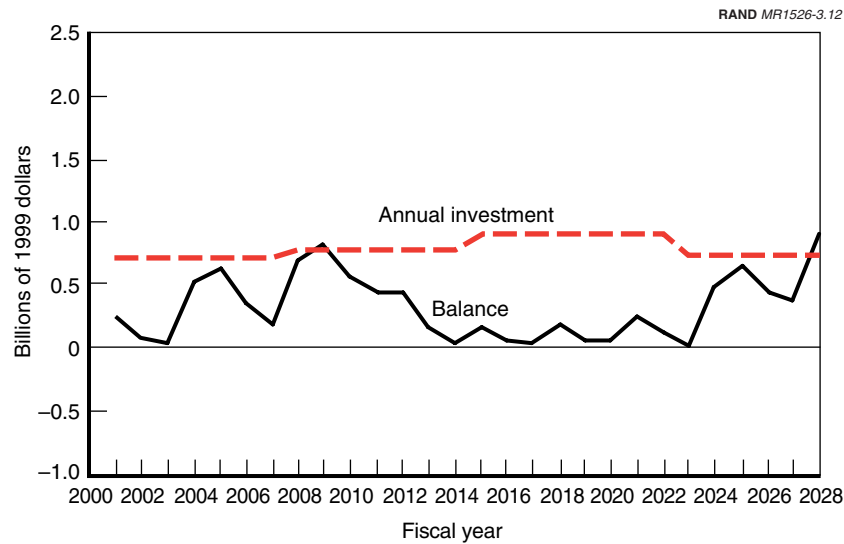


Figure 3.12—Capital-Account Balances Can Be Limited by Restricting the Account to RCOH Cost Elements

\$420 million, if everything were funded incrementally (compare with Figure 3.6), to \$310 million.

Finally, substituting an RCOH capital account into an advance-appropriations scheme yields somewhat less of an improvement over substitution in the incrementally funded example, to \$300 million from \$360 million (compare Figure 3.15 with Figure 3.7).

Fully Funded Capital Accounts

Throughout this analysis, we have been assuming a capital account in which the annual appropriations and the running balance are sufficient to cover each year's carrier-construction expenses. An alternative capital-account concept would require the appropriations to be large enough so that the previous year's balance plus the current

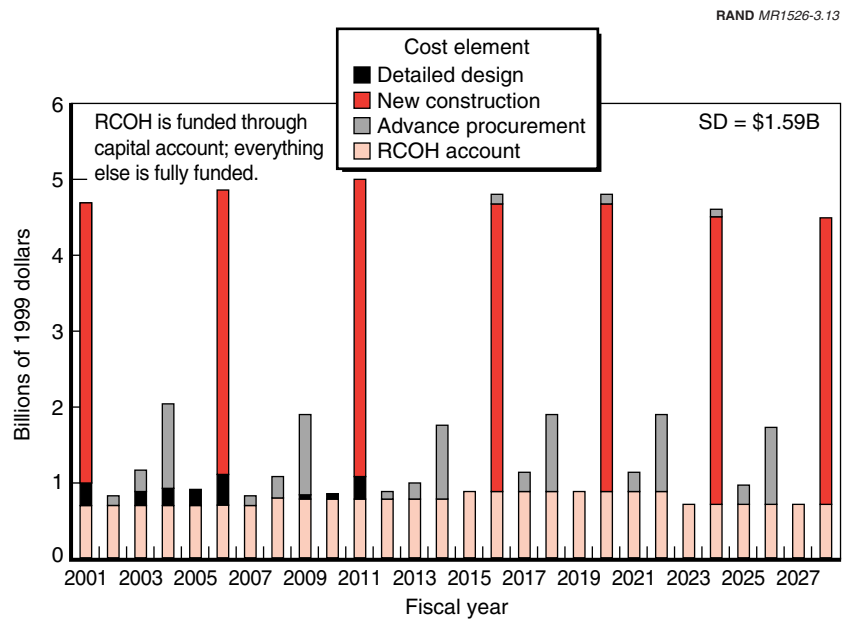


Figure 3.13—A Mixed Strategy Does Not Reduce Funding-Profile Variability Relative to Full Funding (see Figure 3.2; note differences in scales)

year's investment would be sufficient to fully fund all construction tasks beginning in the current year (the amounts required are those in Figure 3.2). For example, in 2006, \$4.2 billion of carrier-construction work is to start. This alternative concept would require that the 2005 year-end balance plus the 2006 investment equal \$4.2 billion. The objective of such a concept would be to confer upon the capital account some portion of the kind of confidence in the funding stream that one has under full funding. This concept should facilitate the multiple-year contracting required for carrier building and constrain costs (see Chapter Four).

The costs of attaining this objective within the capital-account paradigm are high. As shown in Figure 3.16, we use a four-step appropriation scheme, as we did in Figure 3.11, except that we allow a fifth step for one year to cover the \$5.8-billion funding spike occurring in 2001. The average year-end balance required to sustain such

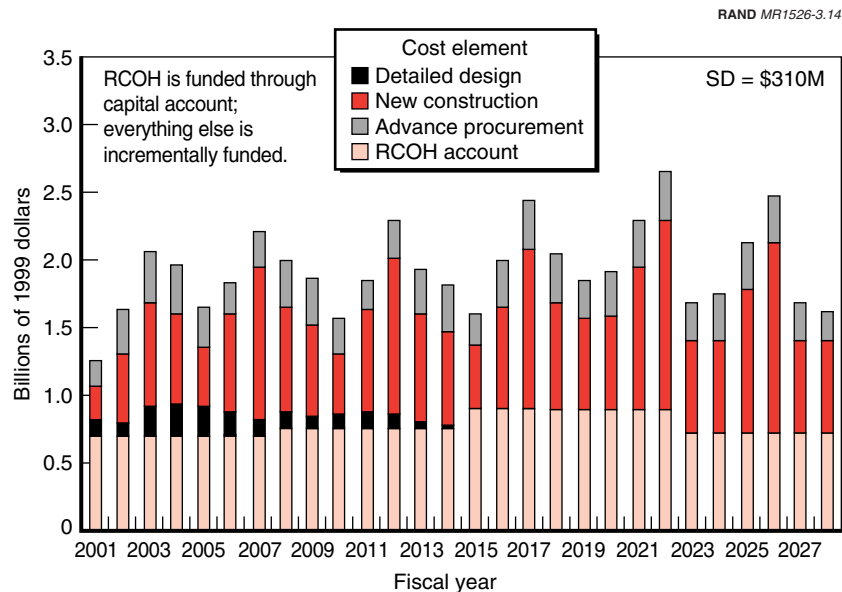


Figure 3.14—A Mixed Strategy Reduces Funding-Profile Variability Relative to Incremental Funding (see Figure 3.6)

an account is high; in fact, at \$4.9 billion, it is higher than that for full funding itself. However, this money can be more easily obligated through multiple-year contracts than that in a capital account based on expenditures, although the money would be sitting in the account unobligated while enough accumulates to fund the next task. The standard deviation over the entire funding profile is \$750 million; omitting the first year, it is \$230 million.

The large balances in Figure 3.16 are not generally characteristic of a fully funded capital account but an artifact of starting the analysis period in a full-funding spike year (2001). A large excess of appropriations over expenditures is built up that year. If the excess is allowed to fall toward zero in subsequent years, not enough funds will be accumulating in the account to fully fund the next spike. If, instead, the first year is omitted from the series and the capital account is started in 2002, the balance falls dramatically to approximately \$640

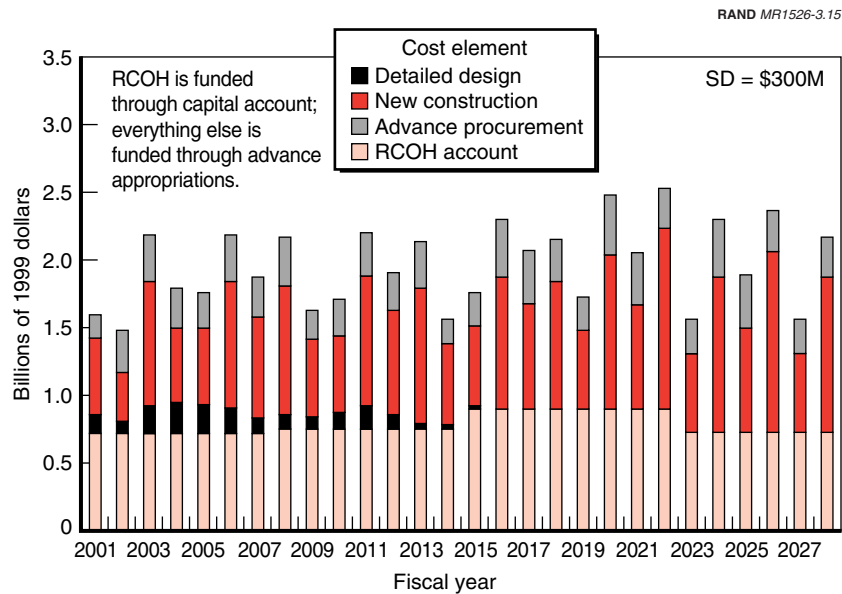


Figure 3.15—A Mixed Strategy Slightly Reduces Year-to-Year Expenditure Swings Relative to Advance Appropriations (see Figure 3.7)

million on average, with a funding-profile standard deviation of \$250 million (see Figure 3.17). (Omitting 2001 from the capital-account concept based on incremental funding has very little effect on the average year-end balance.)

SUMMARY

We have reviewed the budgetary implications of several alternatives to full funding. The variability of the funding profiles, as measured by the standard deviation, and their average year-end balances are summarized in Table 3.4 and Figure 3.18. We have seen that the alternatives in this chapter greatly reduce the spikiness of the full-funding profile; they also cut back substantially on the level of appropriated, but unspent, funds, which can be reduced to zero with

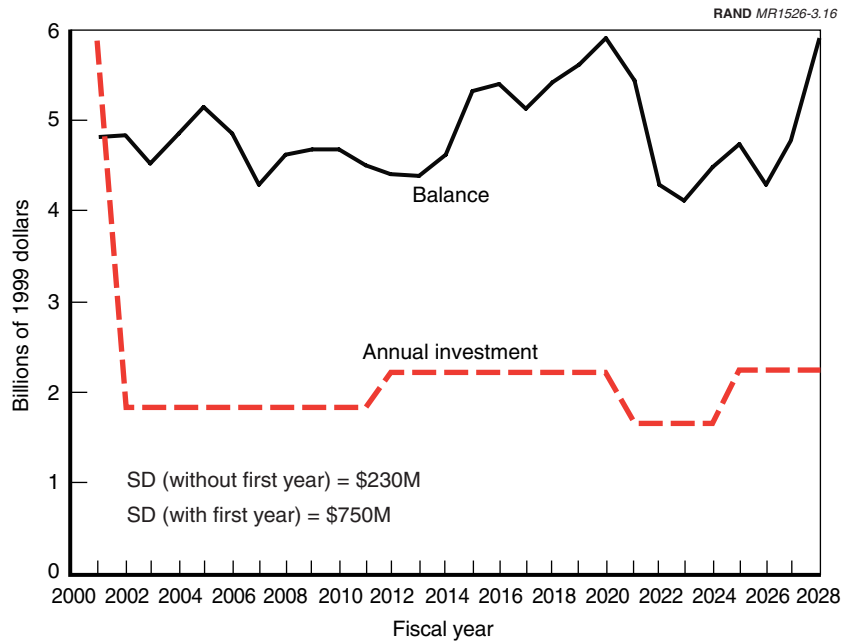


Figure 3.16—A Capital Account Based on a Full-Funding Paradigm Runs High Year-End Balances

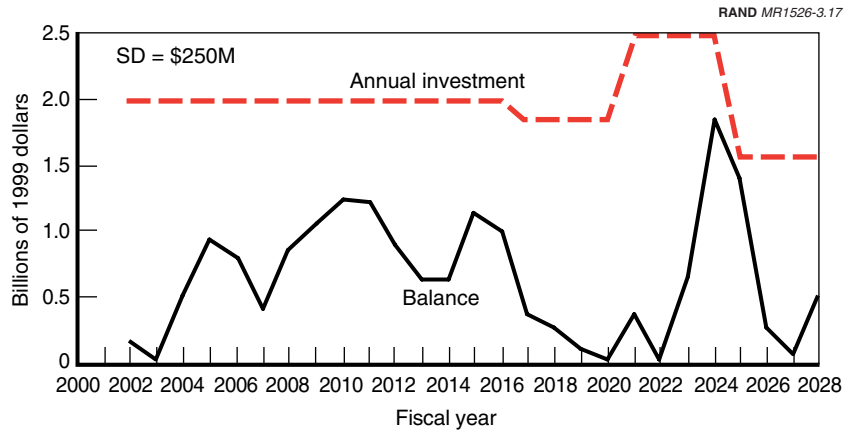


Figure 3.17—Moving the Start Date from a Spike Year Permits the Capital Account Providing Full Funding to Run Low Balances

Table 3.4
Average Annual-Funding Swings and Year-End Balances
for Different Carrier-Funding Strategies

Funding Strategy ^a	Standard Deviation of Funding Profile (millions)	Average Year-End Balance (millions)	Figure
Full Funding	\$1,643	\$3,239	3.2
Incremental Funding	\$419	\$0	3.6
Advance Appropriations	\$365	\$335	3.7
Capital Account, Constant Funding	\$0	\$1,206	3.9
Capital Account, Two-Step Funding	\$115	\$763	3.10
Capital Account, Four-Step Funding	\$113	\$511	3.11
Mixed Capital and Full	\$1,587	\$2,854	3.13
Mixed Capital and Incremental	\$310	\$315	3.14
Mixed Capital and Advance Appropriations	\$299	\$579	3.15
Capital Account Providing Full Funding ^b	\$252	\$636	3.17

^aSee respective sections in text for definition of capital-account funding steps. Capital-account strategies are illustrative only and have many variants on the ones presented in this chapter, possibly including some that could lower average balances somewhat. In the mixed strategies, the capital account covers RCOH-related costs.

^bFor time frame not beginning in a funding-spike year.

RAND MR1526-T3.4

incremental funding. Advance appropriations could achieve a reduction in funding variability similar to that of incremental funding but would require running a small, unobligated balance.¹³

Even greater reductions in funding variability, all the way to zero, are possible with a carrier capital account. The \$1.2-billion balance

¹³We say “could achieve” because the more the advance-appropriations profile varies from the expenditure profile for a carrier—the more the former leads the latter—the greater will be the variability *and* the balance. For example, suppose 35 percent of the funding for each carrier cost element was allocated in the first year, 35 percent in the second year, 20 percent in the third year, and 10 percent in the fourth year. The standard deviation would still be fairly low at \$470 million, but the unspent balance would average \$2 billion.

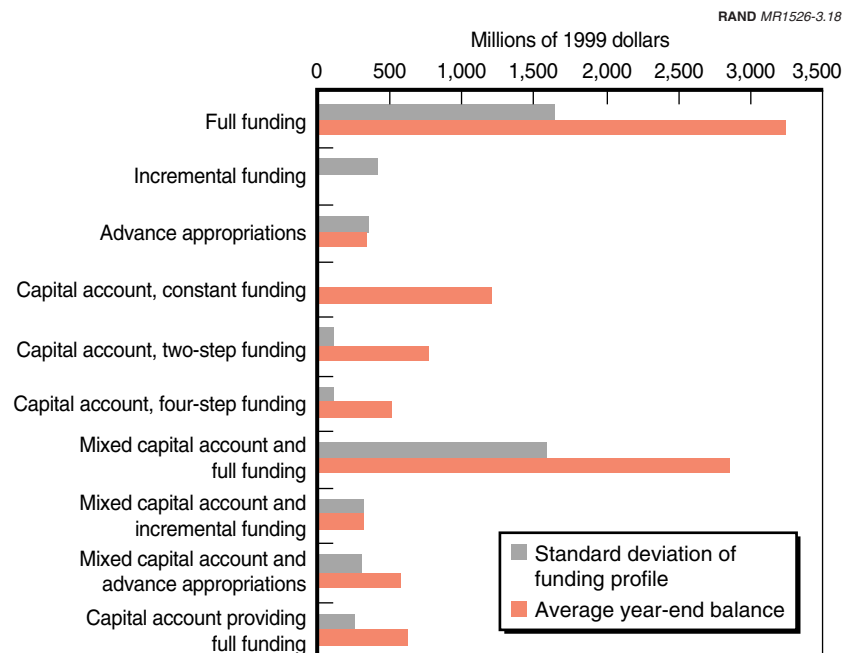


Figure 3.18—Most Alternatives to Full Funding Entail Less Year-to-Year Variation and Lower Year-End Balances

required to support the zero-variability strategy can be reduced by more than half in exchange for minor fluctuations in the funding profile. For modest penalties in variability and average balance, the capital account could be devised to fully fund carrier projects.

Combining a capital account with one of the other funding modes does not appear advantageous. If RCOH-related elements are funded through a capital account, neither the spikiness of the full-funding profile nor the residual variability of the incremental-funding or advance-appropriation profile is much reduced.

There is no overlap between strategies with a low standard deviation (under \$200 million) and a low year-end balance (under \$400 million). Trade-offs must be made. However, budgetary implications such as those considered in this chapter are not the only factors to be taken into account in choosing a funding strategy. The various

strategies have very different implications for which parties bear the risks and costs of the carrier-construction program. We turn to those in the next chapter.

EFFECTS ON ORGANIZATIONAL BEHAVIOR

Any major acquisition poses a set of risks that must be shared among various government agencies and the contractor. For example, there is a risk that, among other things,

- the contractor will be too optimistic about its achievement of cost, schedule, and performance targets
- once construction has begun, the threat environment will change in a way that makes some other investment more attractive
- technologies will develop in such a way that the project will not be as valuable as it would have been had it been started later.

Shifting from full to incremental funding or a carrier capital account would shift around the risks, costs, responsibilities, and incentives associated with carrier construction. As a result, we would expect changes in the behavior of the major parties involved—DoD and the Navy, Congress, and the shipbuilding contractors.¹

We organize our discussion in this chapter according to four shifts of risk involved in switching funding strategies:

¹Although currently only one prime contractor (Newport News Shipbuilding) in the United States is capable of building a nuclear-powered aircraft carrier, the design and construction of a new carrier involve many subcontractors, and almost all of them would be affected by a change from full funding to incremental funding.

- Unobligated balances in a capital account would create a new risk for the Carrier Program Executive Office. Such balances would present an inviting target for Congress, the Office of the Secretary of Defense, or the Navy itself to raid in support of causes it judges more urgent.
- The division of lump-sum funding into annual increments presents more opportunities for Congress to cut a program, raising risks for contractors. Among the responses of contractors (and the Carrier PEO) would be a greater investment of resources in selling the program to Congress.
- Lower visibility of full project costs to Congress implies a lower incentive on the Navy's part to check cost growth, which translates into a risk for Congress of eventually approving more money for carrier construction than it would have under full funding.
- Spreading out the budgetary top line (the total budgeted) creates an apparent surplus with respect to that line. This "surplus" places a cost on a future Congress or administration in the sense that shifting back to full funding at some point would require that modest, temporary increments be added into the carrier-construction budget.

CAPITAL-ACCOUNT BALANCES MIGHT BE RAIDED

The Problem

As discussed in Chapter Three, a carrier capital account whose annual funding level is only occasionally adjusted will sustain unspent balances averaging \$500 million, with frequent peaks around \$1 billion. These amounts are not large compared with the balances in other federal trust funds and with the amounts spent yearly in other DoD accounts. However, they may be big enough as a source of funds for other purposes to draw the attention of Congress and of DoD or the Navy itself, especially in a budgetarily lean year. Indeed, the current stated priorities of the Chief of Naval Operations are, in order, personnel, current readiness, future readiness, quality of service, and alignment. Shipbuilding falls under "future readiness." Thus, in any given year, any number of specific programs may be

viewed as being more urgent than finishing the next carrier on time, or they may simply have a broad, strong constituency.

The propensity to raid capital accounts has already been demonstrated for the closest current equivalent to a carrier capital account: the National Defense Sealift Fund. To come up with the amount needed to fully fund CVN 76, over \$1 billion was taken in FY95 from the unspent portion of the NDSF's FY94 appropriation. While that carrier construction is not an alternate use that managers of a carrier capital account would have to worry about, other shipbuilding programs would be potential claimants. Construction funding of surface combatants and submarines now amounts to \$4–\$5 billion annually and could reach \$10 billion around 2010 and remain close to that level for the following two decades.

Further evidence of the vulnerability of DoD capital accounts comes from the Air Force, which has repeatedly failed to preserve positive balances in its Working Capital Fund, balances that are necessary to enable the flexibility that the fund was created to provide. In the early 1990s, DoD withdrew over \$1 billion from the fund's positive balance. That balance had accumulated as the Air Force drew down its inventory of reparable by selling them without replacement. More recently, the Air Force itself has used the fund as a source of last resort when the Air Force Program Objective Memorandum process shortchanged resources for spares.

Solutions

Of course, in establishing a carrier capital account, Congress could confer upon it protection against raiders. Language could be adopted restricting the funds in the account to the sole purpose of carrier construction, and such language might be effective against diversions by the Executive Branch. However, a similar declaration of purpose did not stop Congress from diverting NDSF funds. Congress can undo by majority vote in one year the language it has passed to protect funds in a previous year, although it is conceivable that explicit antidiversion language passed with broad support could carry moral weight in future years.

The propensity to reprogram (raid) could be constrained by obligating as much as possible of the unspent balance in the account, which

could be challenging: Appropriations that would be allocated to portions of several projects could be coming into the account every year. A capital account providing for full funding could be even more problematic in this regard, because funds are being accumulated until they can be committed in a lump sum. Of course, full funding itself also usually entails unspent appropriations, and full funding has not immunized shipbuilding programs from reprogramming. Nonetheless, a substantial fraction of the unspent appropriations can be obligated through multiple-year contracts. The same ought to be possible with advance appropriations, for which the appropriation profile would match that under full funding (only the budgetary profile would differ). And advance appropriations would leave much smaller potentially unobligated balances exposed than does full funding. Incremental funding bears the lowest reprogramming risk: In principle, at least, all funds appropriated for a given year are spent that year and thus must be obligated that year.

Our principal interest in this study is carrier funding, but we acknowledge that there is another side to the unobligated-balance story. What looks like risk or vulnerability from the carrier-funding viewpoint may look like flexibility from the viewpoint of those higher up the command hierarchy in the Navy or DoD or from those in Congress. We have pointed out that carrier-capital balances may be reprogrammed for other purposes, but that is not necessarily to say that those other purposes are less deserving from a national-security perspective.

CONTRACTORS WOULD TRY TO COMPENSATE FOR INCREASED RISK

Risks

For a ship to be fully funded does not guarantee its construction. However, full funding represents a commitment from Congress that, based on the historical record, is highly unlikely to be reversed. In making such a commitment, Congress is taking on a degree of risk: The threat environment may change, rendering the ship less important, or the broader policy environment may change, rendering other things more important.

Moving from full funding to any of the alternative strategies shifts such risks from Congress to the shipbuilding contractor, where these risks take the form of increased probabilities of project delay or early termination. Such a move also increases the fiscal-management burden on the Navy.² Incremental funding inevitably increases the risks that planned future-year appropriations might not be achieved on schedule.³ Every budget request runs a gauntlet, first when the military services and DoD draft their budget requests and then in Congress. With only annual funding commitments, Congress is in a better position than in full funding to pull the plug on a project if the need for it is overtaken by events, if it seems badly managed, or for any reason at all. It is thus more likely in the absence of full funding that the “cancellation for convenience” clause, which is written into every government contract, will be effected. This clause allows the government to unilaterally cancel a contract whenever it wants to, whether or not the contractor is performing.

As a consequence, contractors would have to consider a broader range of contingencies in planning under incremental funding than they do with full funding. More specifically, contractors would perceive this greater uncertainty as more likely to increase their costs or decrease their profits. However, contractors generally care about not only the mean return on their investments in large projects but also the variance of outcomes associated with such projects. Their management of large projects reveals that they tend to be risk-averse, giving greater attention to avoiding downside outcomes than to pursuing unusually good outcomes.⁴ The more risk-averse the contractor, the greater the perceived loss of moving away from full funding will be.

²But replaces it with other risks to Congress. See “Incentives to Contain Costs Might Be Weakened,” below.

³This is not to say that contracts will be restricted to annual batches of work. Procurements under incremental funding or capital accounts could be accomplished through multiple-year contracts asserting that in any year beyond the first, performance is contingent on appropriation of funds (see 10 U.S.C. 2306b, “Multiyear Contracts: Acquisition of Property,” paragraph [k]).

⁴For example, T. K. Glennan et al., in *Barriers to Managing Risk in Large Scale Weapons System Development Programs*, Santa Monica, Calif.: RAND, MR-248-AF, 1993, use case studies of eight weapon system developments to examine how the Air Force and its contractors assess and manage risk in technology-development projects.

The concept of an incrementally funded capital account, which entails a steady stream of funding into the foreseeable future, would shift less risk to the contractor than would incremental funding. However, as pointed out above under “Capital Account Balances Might Be Raided,” a capital account is not as solid a commitment to a program as is full funding. Advance appropriations would appear to be closer in reliability to full funding, although some risk must accrue in response to annual increments of budget authority. A fully funded capital account would be closest of all, as there would be no need to spread out the budget authority for specific projects.

Contractor Response to Risk

What actions would contractors take in response to the increased risk they would bear under some of the alternatives considered in this section?

- Most obviously, because higher risks imply higher costs, contractors would probably tender higher bids for a given amount of work.⁵ Such bids might incorporate higher cancellation fees.
- Senior management would be likely to pay greater attention to keeping the program sold in Congress. This possibility warrants sufficient discussion to treat separately (see the next section).
- Contractors might shift resources into getting and keeping *other* business as a fallback if a program is cancelled.

Some of these actions are obviously detrimental to government interests. But they are all detrimental in the sense that they mean reduced contractor attention to the program (i.e., building an aircraft carrier) and more attention to managing the perceived increase in risk.

⁵Costs under incremental funding might also be higher for reasons not directly related to risk. For example, Congress might provide an incremental-funding stream resulting in less efficient production than the contractor would have planned under full funding.

Mitigating Factors

Two factors might act to mitigate these ill effects somewhat. First, contractors working with the government have probably already accounted in their business plans for the vicissitudes of government work. Some analysts argue that government contracting is riskier than other contracting, precisely because congressional behavior is not always predictable. Others point to the basic cost-plus nature of government contracting—even with so-called fixed prices—and say that risk is lower in government contracting than elsewhere. Contractors have probably already decided on the basis of such beliefs to shun or seek government work, suggesting that current contractors are better able to handle congressionally induced risks than other contractors would be. They would thus be likely to attach less cost to such an increase in risk than would a typical commercial contractor.

Second, disconnecting funding from specific ships, as in a carrier capital account, could work against subsequent cancellations. A principal rationale for establishing full funding, after all, was to give Congress a more meaningful chance to say “no.” A capital account removes that kind of single-ship focus.

The overall thrust of our argument here still holds: Splitting lump-sum funding into annual increments gives Congress more opportunities to cut the program. And Congress could simply reduce the Navy’s requested annual funding level for a capital account, leaving difficult management and allocation decisions to be made by the Navy. However, smaller amounts—and particularly amounts less clearly connected to specific ships—might draw less attention than multibillion-dollar lump sums.⁶

Of course, while the government will have to recognize and pay for legitimate increases in contractor costs, tools are available that can help ensure that contractors keep costs as low as practicable. Through incentives, the Navy can encourage and reward the shipyard for production efficiencies that lead to cost savings. The Navy can also motivate the shipyard to offer similar incentives in

⁶From the congressional point of view, lower visibility represents a drawback; see “Options to Change Funding Strategies Might Be Narrowed,” later in this chapter.

its subcontracts and otherwise keep procurement efficiency high—for example, through quantity buys.

Quantity buys by the government could also raise shipyard efficiency. A fully funded purchase of two aircraft carriers at a time might lower costs through lowering risk and providing economies of scale and scheduling efficiencies. The latter two sources of savings might also be realized to some degree under incremental funding or a capital account, if contracts are let for two ships simultaneously.

DoD AND CONTRACTORS WOULD SPEND MORE TIME SELLING THE PROGRAM

Someone unfamiliar with defense contracts would be surprised at how much time and energy defense contractors spend in selling their programs. In fact, contractors see selling as one of their primary activities.

Fully funded aircraft carriers represent an exception to the practice of continual program promotion. Defense contractors use a variety of techniques in their efforts to keep a program sold. They deploy agents to lobby Congress (members and staff), DoD, the Office of Management and Budget, news media, and others. They try to get favorable articles, op-ed pieces, and advertisements placed in such influential newspapers as *The Washington Post* and *The New York Times*. They sponsor favorable reports in general-circulation magazines, such as *Time* and *Newsweek*, and in trade magazines, such as *Aviation Week & Space Technology*. Managers of major defense programs often spend a majority of their time on the road, trying to keep the program sold, while their deputies stay at home and run the program. Once the carrier is fully funded, no further congressional action is required, nor is any adverse action, such as cancellation, typically taken.

Incremental funding is a different story. Program managers would have to spend substantial time preparing and defending budgets each year, rather than once, when a ship is fully funded. Continuous interaction with key legislators and their staffs will be needed to ensure favorable consideration of funding requests in future years. Despite good-faith congressional assurance that a multiple-year project will be supported in future budget legislation, inevitably the

political processes involved make such future actions risky. Ensuring continued support can be a significant drain on senior management time over the early years of the project, as was certainly the case for the SSN-23 program.

All this assumes that the shipbuilding project is authorized to begin with. Congresses are reluctant to impose specific obligations on future Congresses. Thus, a Congress might be more reluctant to authorize a ship under a funding strategy that requires future Congresses to appropriate funds to complete it than it would be if it were appropriating all necessary funds itself under full funding or advance appropriations.⁷ As a result, program managers might spend more time not only in keeping the program sold but in selling it in the first place.

A move to incremental funding might induce contractors to intensify their program-selling activities beyond the sphere of public relations. They might, for example, try to team with subcontractors that have facilities in key congressional districts. In doing so, they might multiply the number of subcontractors beyond what is efficient or choose subcontractors that might not necessarily present the most favorable mix of cost and qualifications for the task at hand.

A carrier capital account presents similar problems. Its challenge is not keeping a specific carrier funded but maintaining a consistent level of funding for carriers in general. This more abstract demand may be even more difficult to justify than that for incremental funding, particularly in years when a large surplus accrues to the account. If the carrier account were to provide full funding, this problem might be mitigated somewhat, all the more so if the Navy were willing to dedicate the incoming funds to specific hulls.

Once again, advance appropriations represent an intermediate case between full funding in the strict sense and alternatives such as incremental funding or a carrier capital account. The same full-funding commitment is made up front, but contractors might wish to

⁷Under advance appropriations, a Congress would be restricting the budgetary flexibility of future Congresses, because the budgetary authority is invoked year by year. This restriction could raise some second thoughts in the Congress making the appropriation.

hedge their bets a bit with an elevated profile in Washington. Although further congressional approval is not required following the initial appropriation, there is always the possibility of adverse action, and the Navy needs to put the ship in its budget each year. Still, the risks of outlay failure are fairly small and contractor responses are likely to be limited; therefore, the government would probably not have to bear egregious inefficiencies, such as those noted above for subcontracting.

INCENTIVES TO CONTAIN COSTS MIGHT BE WEAKENED

Switching to incremental funding, either directly or through a capital account, might reintroduce risks that Congress sought to avoid when it established the requirement for full funding.

The most important risk would be that the Navy would have less of an incentive to be forthcoming about eventual program costs, because those costs need not all be declared up front. This problem, avoided with full funding, should also be avoided with a fully funded capital account. Theoretically, advance appropriations should resemble full funding in the predictability of the total project cost. However, it shares with incremental funding one risk in this regard: The annual series of budgeted amounts by project's end might make it easier for the Navy to come back to Congress for an add-on appropriation than if the most recent budgetary action were several years back.⁸

Congress might be able to structure program funding to mitigate the risk of cost growth. A simple and thus likely approach to accomplishing such risk-mitigation would be through a cost cap. Congress would build into the authorizing legislation a provision that the obligation authority for the next carrier was not to exceed a specified amount.

⁸It is also possible that the contractor (or even the Carrier PEO) would come to believe that, with an annual line in the budget for a number of years, a request for an additional year might be forthcoming. This belief might lead to looser cost controls, although only if the contractor were more risk-tolerant than we have been assuming so far in this discussion.

Another approach would be to work with the Navy to establish an account funding all carrier lifetime costs. This would be an ambitious and complex approach, but one that might generate advantages in efficiency and effectiveness.

Funding of the full program cost, including ultimate disposal, would place a premium on very careful initial planning. Ultimately, it might allow a central force manager to balance all elements of the program's full cost to provide a specified level of defense capability (such as 12 aircraft carriers) at minimum overall cost. It would ensure that information on the total program cost, required of acquisition program managers by DoD regulations, be developed by, and become an active, evolving part of, force acquisition and management. Lifetime funding might provide more flexibility than the current scheme, in which acquisition, operations and maintenance, and R&D are entirely separate accounts. Finally, it would encourage acquisition agents and operators to work closely to achieve the needed capability at minimum overall long-term cost.

Such a protocol would have the benefit of directing Congress's attention to high-level issues, such as the amount of money being spent and the gain to the nation's security that it was buying. The more technical issues relating to the nature, quantity, and timing of carriers built would be left to the Navy and the Carrier Program Executive Office.

OPTIONS TO CHANGE FUNDING STRATEGIES MIGHT BE NARROWED

Full funding imposes no budgetary constraint on the ability to shift the funding strategy to any of the other approaches discussed here. In fact, as discussed above (in connection with Table 3.3), shifting to another funding scheme would create a onetime apparent "surplus," a loan against future budgets that would not have to be paid off until a point when carriers are no longer being built. (However, in a carrier capital account providing full funding, the apparent surplus would be consumed periodically as funds are obligated.)

The reverse is not the case: Once the Navy has shifted to any scheme that provides budgetary authority in annual increments, changing back would require several years in which the loan against the future

would be paid off. For advance appropriations, for example, had the “surplus” been spent and were the Table 3.3 assumptions to hold, an amount equivalent to 35 percent of a fully funded ship would have to be paid off over a 3-year period. That amount would be in addition to the spike for the first carrier built under the restored full-funding scheme. Such a penalty might not be viewed as onerous. Instead of a full-funding profile of 100, 0, 0, and 0 percent for years 1 through 4, respectively, it would be 115, 10, 10, and 0 percent under the new regime, where 100 percent is the \$3.8-billion fully funded carrier budgetary authority. The draw on SCN budgetary authority during the “payback” years would be a little larger if the Navy were shifting back from incremental funding and a little smaller if the switch was from a carrier capital account providing incremental funding.⁹

SUMMARY

Risks of the three alternatives to full funding are summarized in the columns of Table 4.1, which correspond to the preceding sections in order. Column 2, for example, summarizes the risk of reprogramming, from the viewpoint of the Carrier PEO, the contractor, and carrier interests in Congress. Thus, moving from full funding to incremental funding decreases the risk that appropriated funds will be diverted to some other purpose. Moving to a carrier capital account raises that risk, and advance appropriations yields a risk similar to that for full funding. For simplicity, we summarize risks from only one viewpoint in each column. From other viewpoints, the risks will be different. For example, from the senior DoD leadership’s point of view, the flexibility inherent in the potential for reprogramming could look like a benefit.

Nonetheless, most of the other risks summarized in the table apply generally. One minor exception is that the contractor’s interest in the budgetary shuffling attending a funding-strategy change is

⁹If the Navy converted *all* shipbuilding programs from full funding to another scheme, shifting back would be much more difficult, if the apparent surpluses had been spent: Those surpluses would be much larger for ship programs with more-frequent starts and shorter build periods. (See Blickstein and Smith, 2002.)

Table 4.1
Summary of Risks of Alternative Funding Mechanisms

Funding Mechanism	Risk Relative to Full Funding				
	Reprogramming Risk ^a	Contract Cost to Cover Risk of Termination	Resources Allocated to Selling Program	Loss of Cost Controls ^b	Cost Barrier to Changing Funding Strategy
Incremental Funding	Lower	Higher	Much more	Much greater	Somewhat higher
Advance Appropriations	Similar	Similar	Slightly more	Slightly greater	Somewhat higher
Capital Account (Incremental)	Higher	Higher	More	Greater	Somewhat higher
Capital Account (Full)	Much higher	Same	Somewhat more	Same	Same

All risks accrue generally, except:

^aFrom the viewpoint of carrier interests.

^bFrom the viewpoint of Congress.

RAND MR1526-T4.1

unclear. One major exception is that Congress would clearly be most concerned with the loss of multiple-year vision of the carrier-funding stream that would come with incremental funding or, to a lesser extent, a capital account.¹⁰

It is tempting to try to compare rows in the hope of gaining insight into which funding mechanism might be the least risky overall. Such comparison is not practical. A party interested in doing so would want to attach weights to the different risks. And different parties would attach different weights; we cannot speculate what those would be.

However, it is evident that all alternative funding mechanisms would be viewed by all parties as risky relative to full funding, which should not be surprising. Aircraft carrier construction entails a major investment. And many carriers have been built over a number of

¹⁰Blickstein and Smith (2002) provide a more comprehensive analysis of the responses of different parties to one of the alternatives discussed here—advance appropriations.

decades, providing ample opportunity for all parties involved to arrive at an allocation of risk among themselves with which they feel comfortable.

CONCLUSION

Full funding was a way for Congress to decrease the risk of cost growth while decreasing the Navy's risk of project termination. Switching away now from full funding would increase those risks, and it will do so in the future until either of the following occurs: Some funding alternative emerges that redistributes risk in a manner that is mutually attractive, or the context changes enough that the current allocation of risks by full funding looks unattractive. Until then, if the parties seriously consider shifting away from full funding, it would be for some other reason—for example, because the budgetary advantages discussed in Chapter Three are judged to outweigh the increases in organizational risk-bearing addressed in this chapter. That judgment is a subjective one that must be made by Navy decisionmakers.

BIBLIOGRAPHY

- Blickstein, Irv, and Giles Smith, *A Preliminary Analysis of Advance Appropriations as a Budgeting Method for Navy Ship Procurements*, Santa Monica, Calif.: RAND, MR-1527-NAVY, 2002.
- General Accounting Office (GAO), *Department of Energy: Opportunity to Improve Management of Major System Acquisitions*, Washington, D.C.: GAO/RCED-97-17, November 1996.
- Glennan, T. K., S. J. Bodilly, F. A. Camm, K. R. Meyer, and T. Webb, *Barriers to Managing Risk in Large Scale Weapons System Development Programs*, Santa Monica, Calif.: RAND, MR-248-AF, 1993.
- Grasso, Valerie Bailey, *Sealift (LMSR) Shipbuilding and Conversion Program: Background and Status*, Washington, D.C.: Congressional Research Service, 96-257F, March 19, 1996.
- Office of Management and Budget (OMB), *Budget of the United States Government, Fiscal Year 2001, Historical Tables*, Washington, D.C.: U.S. Government Printing Office, 2000a.
- _____, *Planning, Budgeting, and Acquisition of Capital Assets*, Circular No. A-11, Part 3, Washington, D.C., July 2000b.
- United States Congress, House, Office of the Law Revision Counsel, *United States Code* (U.S.C.), Washington, D.C.: U.S. Government Printing Office, various years.
- U.S. Department of Defense, *Mobility Requirements Study—2005*, Washington, D.C., n.d. (not available to the public).

_____, *Defense Acquisition Management Policies and Procedures*, Washington, D.C.: DoD Directive (DoDD) 5000.2, February 26, 1993.

_____, *The Defense Acquisition System*, Washington, D.C.: DoDD 5000.1, October 23, 2000.

U.S. Department of Defense, Comptroller, *Financial Management Regulation*, Volume 2A, *Budget Formulation and Presentation*, Washington, D.C., June 1993.

U.S. House of Representatives, House Armed Services Committee, *Statement of Ronald O'Rourke, Specialist in National Defense, Congressional Research Service, Before the House National Security Committee, Subcommittee on Military Procurement, Hearing on Littoral Warfare Protection and Ship Recapitalization, March 9, 1999*, Washington, D.C., 1999.