Chapter One

INTRODUCTION

The U.S. Navy and the U.S. Maritime Administration (MARAD)\(^1\) together oversee an aging fleet of inactive military and merchant ships that increase in number each year and must be disposed of. Some of these ships end up in museums (about 51 now serve as museum exhibits); others become the subject of foreign or domestic donations, sales, or leases. The remainder of this inactive fleet, as of November 2000 and considering those ships to be added through the year 2005, comprises about 358 ships, all of which have to be disposed of by other means.

We have assumed for this study that additions to the Navy and MARAD inactive fleet beyond 2005 will equal subtractions via sales, sinking exercises, and donations. For the Navy, these three disposal means have recently averaged about 30 ships per year as the fleet has been downsized.\(^2\) The DoD is envisioning a Navy fleet of about 300 ships in the future, and the building rate and corresponding ship retirement rate to sustain such a fleet is about 10 ships per year, well within the figure of 30 ships per year.\(^3\) For MARAD, the picture is not as clear; it depends on future decisions regarding the size of the reserve fleet designated for “indefinite retention.” Should this fleet be downsized faster than can be accommodated by sales or transfers, the 358-ship figure will grow. Figure 1.1 summarizes the numbers and types of ships in the Navy and MARAD inactive fleet. Appendix A provides a comprehensive list of ships and explains how the inventory of 358 ships was developed.

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\(^1\)MARAD is the U.S. government’s disposal agent for merchant-type vessels of 1,500 gross tons or more. This currently includes Navy noncombatant ships, which have come to be loosely interpreted as Navy merchant-type ships. The Department of Defense (DoD) must dispose of all combatants itself.

\(^2\)See Chapter Three, Table 3.1, for a summary of Navy ship disposals since 1974.

At issue is the appropriate course of action for disposal of these ships. They might be maintained in indefinite long-term storage, they might be recycled\(^4\) in a U.S. Navy or commercial shipyard, they might be recycled overseas, or they might be reefed—i.e., sunk at carefully selected coastal sites to provide artificial reefs as habitat for marine life or attractive destinations for recreational divers.

Various concerns attend these four options, however. Long-term storage raises fears of accidental sinking through hull corrosion or severe storms or environmental damage from spills or leaks. Maintenance costs are also a factor in long-term storage, especially if mounting corrosion problems or environmental incidents prompt more frequent or more extensive maintenance. And, of course, long-term storage does not actually dispose of the ships—it only delays the problem of disposal until some future time. As for recycling, it raises cost-efficiency concerns when dismantling is to take place in U.S. yards, environmental impact and worker safety concerns when recycling is done either in the United States or overseas, and issues of international traffic in and export of highly controlled waste materials when done overseas. Like recycling, reefing raises questions about necessary environmental protections.

Our study entailed assessing the four courses of action just outlined. The first chapter describes the disposal problem and the fleet of ships awaiting disposal.

\(^4\)Many texts refer to ship recycling as “shipbreaking” or “ship scrapping.” We use the term *recycling* because it more accurately conveys that most of the materials in a ship are reused in some way.
Chapters Two through Five deal, respectively, with long-term storage, domestic recycling, overseas recycling, and reefing. We considered the use of ships for military target practice, called *sinking exercises*, or *SINKEX*, only as a way to dispose of Navy ships entering the inactive fleet after 2005, when retirements to the fleet could be accommodated by SINKEX, sales, and donations. Chapter Six provides a comparative analysis of all four options and concludes with recommendations.

Because the Navy funds both Navy and MARAD inactive fleet expenses, we have for the most part estimated only total program costs. In a few instances, we provide both the Navy and the MARAD “share” of the total costs as information for those in each agency who are responsible for administering inactive ship programs. We express all costs in constant FY00 undiscounted dollars, in many instances also giving the discounted net present value for total program costs.\(^5\)

### ORIGINS OF THE INACTIVE FLEET

Upon the Secretary of the Navy’s decision that a ship is no longer needed in active service, the ship is inspected by the Navy’s Board of Inspection and Survey to determine whether it is still physically fit for service. A fit ship may be offered for lease to a foreign government, inactivated and placed in the inactive fleet for future mobilization, or declared excess and stricken from the U.S. Naval Vessel Register (NVR). An unfit ship is also stricken from the NVR, but then it is either offered for foreign military sale (FMS) to governments that wish to restore it to service, retained as a source of spare parts for operating ships of its class, or otherwise disposed of. MARAD maintains the Ready Reserve (RR), a fleet of merchant ships ready to carry military cargo in times of national emergency. When these ships are no longer serviceable, they are added to the inventory of unfit ships awaiting disposal. Occasionally, a few ships from sources such as the U.S. Coast Guard also find their way to the inactive fleet where they await disposal.

Ships awaiting final disposal are held at one of the Navy’s four Naval Inactive Ship Maintenance Facilities (NISMFs) or at one of three MARAD inactive ship facilities pending completion of disposal arrangements. Stricken Navy ships determined to be merchant or merchant-type ships or capable of being converted to merchant use are transferred to MARAD for final disposal; warships are disposed of by offices of the DoD. In the 1960s and 1970s the U.S. government sold hundreds of ships from the Navy and MARAD inactive fleets for scrap both domestically and internationally, relying on the private sector to perform

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\(^5\)A discount rate of 4.1 percent was used, per Office of Management and Budget Circular A-94, available at [http://www.whitehouse.gov/OMB/circulars/a094/a094.html](http://www.whitehouse.gov/OMB/circulars/a094/a094.html).
the work. In the 1980s the number of ships stricken declined because of the Reagan-era naval buildup. In 1991 the Navy, through such government agencies as the Defense Logistics Agency, resumed ship recycling to deal with the influx of ships to the inactive fleet that resulted from the post−Cold War military downsizing.

However, between 1970 and 1990 a fundamental change in the world’s ship recycling industry took place: the industry, which now recycles about 700 ships per year, migrated from the United States, Spain, Portugal, and Italy to India, Pakistan, China, the Philippines, and Bangladesh, where labor is cheap and environmental restrictions are minimal. The U.S. recycling industry generally contends that it is now more difficult to recycle ships and to make a profit because U.S. environmental laws and worker health and safety laws have become more protective. Additionally, U.S. scrap metal prices are currently significantly lower than those on the Indian subcontinent, and the supply of ships to be recycled in the United States is small and unstable. As a result, between 1991 and 1997, only 34 Navy and MARAD ships were recycled domestically, down from a total of approximately 980 ships between 1970 and 1982. Twenty ships sold for U.S. recycling had to be recovered by the Navy because of contractor default.

Concerns About Navy Recycling

In 1997 members of Congress and some environmental groups raised concerns about Navy ship recycling that focused on U.S. environmental, health, and safety violations and poor overseas environmental, health, and safety conditions at recycling sites.6 On December 9, 1997, the Secretary of the Navy suspended any efforts to sell U.S. Navy ships overseas for recycling. Concerns about safety and health at overseas recycling yards are not limited to U.S. interests, however. International civilian shipping and environmental communities have shown growing concern about the conditions in overseas yards, and international environmental regimes such as the Basel Convention on Hazardous Wastes have made efforts to regulate overseas recycling.7

Overseas recycling has now effectively become unavailable to the Navy and MARAD. As a result, some 252 ships of Navy origin, about 99 ships of MARAD origin, and seven ships originating from other agencies await recycling in Navy and MARAD facilities. Detailed information on this inventory of 358 ships is

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provided in Appendix A, Table A.2. These 358 ships cumulatively represent a backlog of approximately 2,772,000 light ship weight (LSW) tons.

The backlog of ships poses several problems. There are increased environmental risks associated with an aging, inactive fleet; there is the ever-present potential for ships to sink at their anchorages. Some incidents of discharged hazardous materials have already occurred, and the potential for more may grow as the ships age. Maintenance costs also increase as ships age. And the inevitable need to shuffle ships among available facilities to meet emerging needs adds further to the expense.

The use of ships to build artificial reefs, a largely unexplored way to reduce the backlog, has been encumbered in part by the recent discovery of residues of polychlorinated biphenyls (PCBs) in many shipboard materials for which there are few clear management rules. Consequently, the Navy is concerned about the long-term liability attached to reefed ships.

The backlog may be helped by the Navy’s having recently obtained EPA concurrence to expend a few ships each year for SINKEX. These exercises provide valuable training to fleet units as well as useful opportunities to test ship and weapons system designs. We assumed that SINKEX plus occasional donations and FMS would keep the inventory from growing above 358 ships beyond 2005.

**Environmental and Worker Safety Considerations**

Some of the environmental considerations about ship disposal are very obvious (spills and leaks) while others are less so. Ships often contain many fuels, oils, solvents, refrigerants, halons, and chlorofluorocarbons (CFCs) necessary for their operating systems. In older ships, electrical transformers and many nonmetallic materials often contain PCBs, and most such ships are insulated with asbestos. Lead-based paint that may also contain PCBs covers many of the steel surfaces. These materials present both environmental and worker safety hazards. For example, lead-based paint chips are a toxic waste in the environment, but lead-based paint also poses a potential health risk to any worker who in attempting to burn the paint off steel being recycled accidentally inhales the resulting fumes. PCBs and asbestos pose safe-handling and health problems for

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8 Table A.2 is not intended as a specific list of ships but as a tool accounting for ship leases, donations, sales, and SINKEX that we can use to arrive at an approximate number and tonnage of ships for our analyses.

9 In January 2001, just as this report was being finalized, we were advised that 17 of the 358 ships were disposed of by recycling, transfer to the General Services Administration for sale, or some other means. Nearly all were small ships and vessels amounting to no more than 1 percent of the total LSW in the working inventory. These recent changes thus have a negligible impact on our cost estimates.
workers who must remove these substances from ships during the dismantling process—especially overseas, where safety equipment is often minimal. U.S. export of PCBs is presently strictly prohibited, which severely restricts the exporting of ships for recycling because most of them contain PCB residues. Finally, some officials have expressed concerns about the appropriateness of exporting ships that may contain hazardous materials to developing countries. Indeed, since 1992, 130 countries have embraced the Basel Convention, which (among other things) allows export of hazardous wastes only under carefully specified conditions with full disclosure between the parties to the transfer and only among countries that are party to the convention. Whether ships destined for recycling are hazardous wastes under the terms of the Basel Convention remains an unsettled issue, as does the ultimate impact of any such determination and the attendant regulations on the world’s merchant marine industry.

Cost-Effectiveness

The volatility of prices for scrap metal\(^{10}\) and other by-products of ship recycling, variations in labor costs, and the differing environmental, safety, and health rules make cost-effectiveness a notable issue. Compared to their U.S. counterparts, overseas firms, especially those that dismantle ships on beaches, enjoy huge advantages in terms of low wage scales, low overhead costs, and high scrap prices. The calculus becomes more complicated, however, if cost-effectiveness must also take into account workers killed and maimed in the ship recycling business, or the environmental and public health consequences arising from improper disposal of large quantities of hazardous materials.

EVALUATING THE OPTIONS

The cost model built for this study is described in detail in Appendix E. We used it in estimating the net costs associated with each of the four options.

In the following chapters, the baseline estimates given for the four options each represent a point estimate produced by the cost model from inputs accurately representing the cost and revenue factors prevailing at the time. However, many of these factors (e.g., scrap resale prices) are subject to substantial and sometimes sudden variation that could invalidate a point estimate. We sometimes had very limited data sets to work with, and we did not want to generalize from them in mathematically unsound ways. The cost estimates for the options thus reflect these circumstances. We concluded that given the limitations, un-
certainty, and volatility attending some of the cost and revenue factors, the best way to represent the costs of the individual options was as a range. Each cost estimate thus is represented graphically as a wide bar, with the best-case cost and revenue factors defining the lower boundary of the estimate and the worst-case cost and revenue factors defining the upper boundary. We concluded that such a presentation—a range of costs with the baseline cost highlighted within it—was the best way to establish a robust estimate for each option.