Thinking **Total Cost** Requires **Thinking Up Front**

By **ADAM B. SIEGEL**

America has developed a 99-cent shopping obsession that has turned Benjamin Franklin's adage "a penny saved is a penny earned" on its head. A price of $100 gives us pause, but $99.99 seems like a bargain. Combined with easy access to revolving credit and a disposal culture, our focus on purchase price overshadows the *total* cost of many of our purchase decisions. We tend to focus on the "cost to buy" rather than the "cost to own." More often than we care to admit, we are—to trot out another axiom, which predates Franklin—"penny wise and pound foolish."

This is true, for example, when it comes to U.S. Navy shipbuilding where, despite the best intentions, the process seems focused on sticker price and today's bill (the *cost to buy*) rather than the full-system cost (the Navy's and Nation's *cost to own*). The most intense public scrutiny is given to the sticker price, even though most ships conceal the vast majority of their cost in the post-purchase phase: in operations, maintenance, and modernization.

Realities of Cost

The Navy's planned shipbuilding program seeks to increase capabilities while trying to lower—or at least manage and contain—the true (long-term) cost to the Nation of the fleet and its capabilities.

To achieve lower total ownership cost (TOC) often requires investing more dollars up front in areas such as:

- additional decision support analysis
- higher quality materials and construction
- technology to reduce manning requirements.

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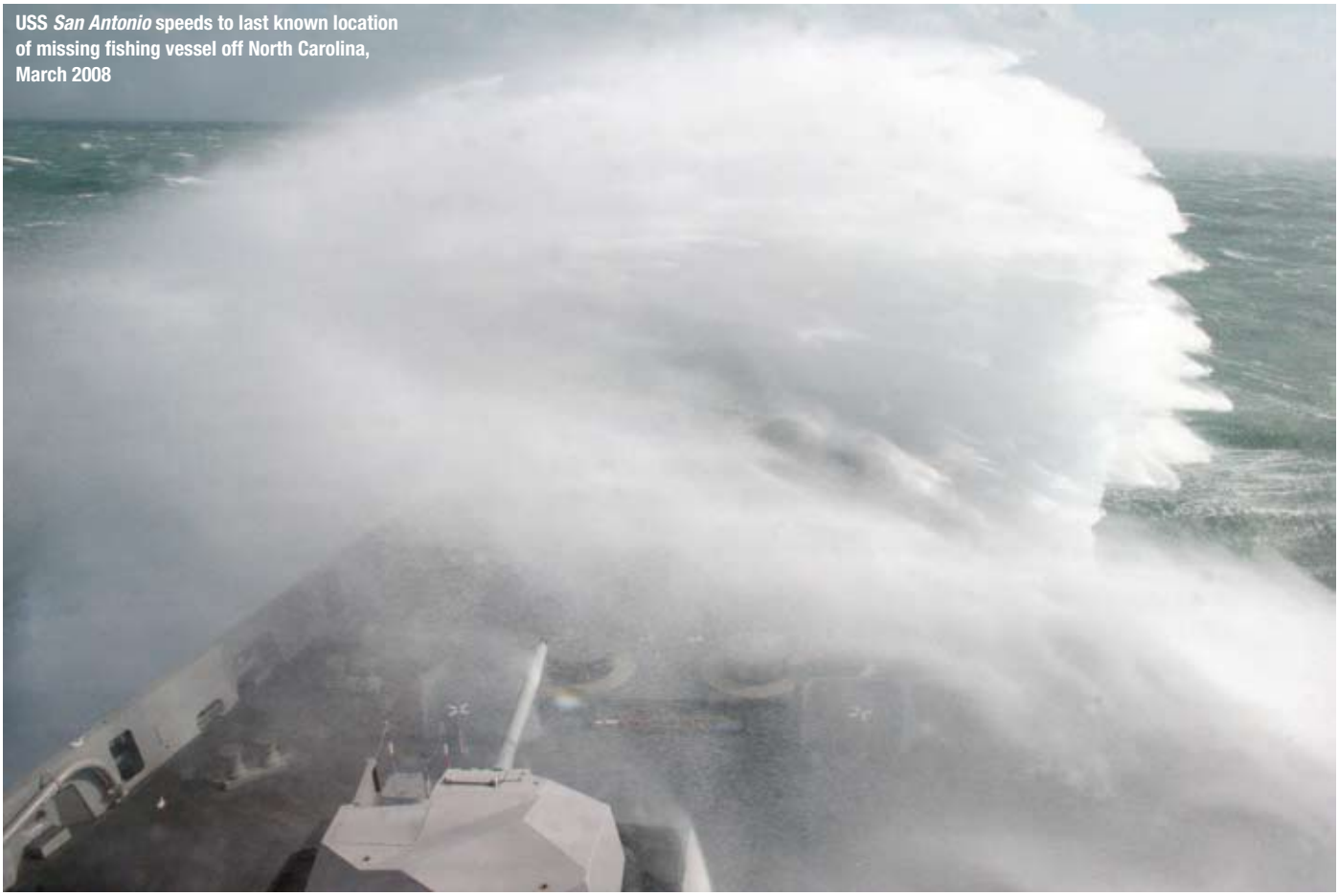

USS *San Antonio* speeds to last known location of missing fishing vessel off North Carolina, March 2008

U.S. Navy (Erik N. Hoffman)

These can contribute to higher upfront costs even while fostering much lower TOC.

Additional decision support up front can raise tradeoffs between capability requirements, acquisition costs, and life cycle costs. For example, in *net present value* terms, does it make sense to invest in computing technology to reduce the number of Sailors required to man engine rooms, understanding that the computing technology will have to be sustained through its life cycle? This more intense analysis to help frame a better long-term result, by definition, creates a higher upfront cost.

When buying a television or refrigerator, we can run to the nearest store and listen to the salesperson and walk out with a new appliance, or we can read *Consumer Reports* and take time to make a reasoned choice based on price comparisons combined with understanding preferred features, repair history, and energy use. The first certainly takes less upfront investment (time) while the second is more likely to have a longer-term positive result.

Higher quality construction also can contribute to higher procurement costs[1] through designing for the incorporation of future technology upgrades less expensively and using higher quality materials to lower future maintenance requirements.

Investment in technologies (frequently, information technologies) enables reducing manning requirements. For most Navy ships, the 30, 40, or 50 years of manning are the largest single life cycle cost. Each Sailor taken off a ship represents roughly $150,000 in lowered costs every year.

When buying a home, it would be less expensive not to have a washing machine or dishwasher. But considering the adage "time is money," those acquisition savings would quickly be eaten up by either the time and cost for buying all these systems or the cost of time and water for washing clothing by hand. But how do we value our time against the capital and operating cost of automatic washing? There was a tremendous impact from such labor-saving devices in American society. Many suggest that the washing machine was one of the key inventions that enabled the move of women from the home workplace to the salaried one. The labor-saving device thus opened opportunities for transformational change.

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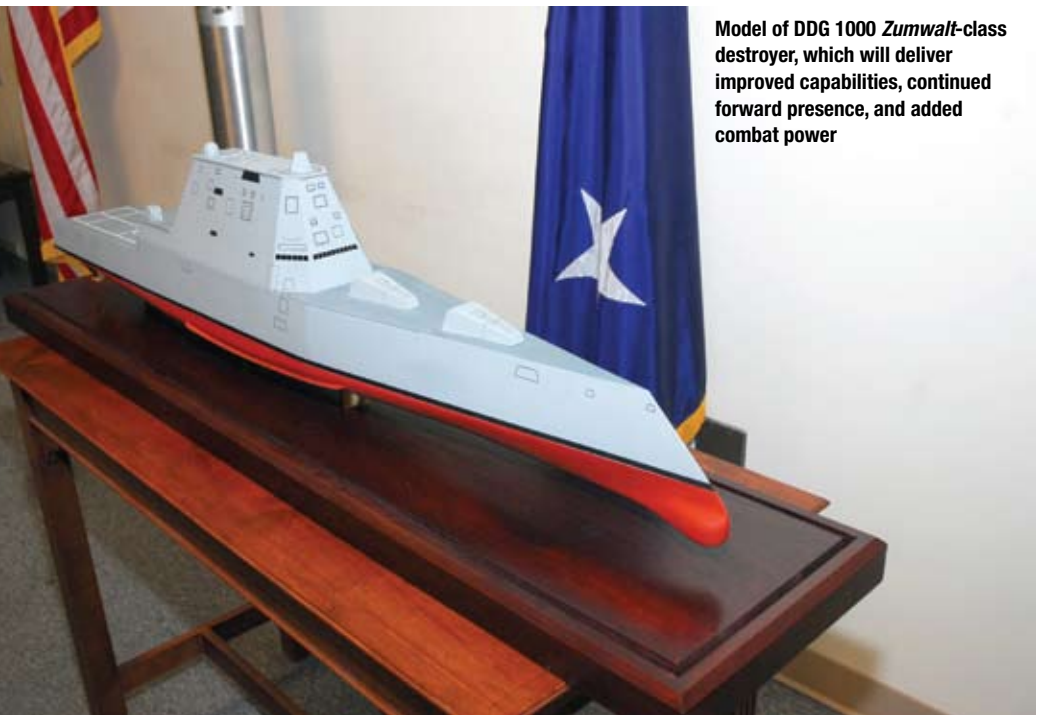
What, then, are the potential nonmonetary gains of freeing Sailors from doing tasks that technology can perform at a lower cost? If it does not take a Sailor off the ship, might it free time for him to train, pursue education, or otherwise become more valuable to the Navy?



U.S. Navy (Dustin Gates)

Model of DDG 1000 *Zumwalt*-class destroyer, which will deliver improved capabilities, continued forward presence, and added combat power

In addition to other reasons for ship-cost growth (such as reduced procurement numbers and ever-expanding capability requirements), these paths toward reducing TOC contribute to increased sticker prices that affect the debate over what and how many ships to buy.

The 21st-century Challenge

The cost-to-buy versus cost-to-own challenge has existed from the first days of the U.S. Navy. For that Service, the challenge today is particularly difficult: how to pay for tomorrow's force while paying the costs of fighting the war on terror. More extensively, this represents the challenge of developing transformational systems, with leap-ahead capabilities effective across the warfighting spectrum as part of the *Cooperative Maritime Strategy for the 21st Century* (from chasing down al Qaeda suspects in a speedboat in the Indonesian archipelago to fighting a major war). These systems should be able to grow, adapt, and transform at an affordable price through their decades of service. They should also be able to further the acquisition of scalable, flexible, and adaptable 21st-century warfighting systems while conducting and paying for today's fight.

While balancing today with tomorrow is always difficult, this challenge is heightened by a number of issues:

- Budgetary pressures suggest overall limitations to discretionary government spending, including within the Department of Defense (DOD).
- Within DOD, a number of external factors, such as mounting health care and fuel costs, increase fiscal pressure.
- The Nation is at war, which requires resources.
- Recapitalization requirements continue to increase.[2]

Thus, there are real requirements for increased procurement funding at a time when such funding will be increasingly difficult to secure.

Efforts to reduce total operating/life cycle costs, as per the above, can contribute to increased "purchase"/acquisition prices even as the Navy is expressing sticker shock at increased platform costs. Thus, the Navy and the Nation have choices in seeking to address that shock while lowering long-term costs.

Answering the Challenge

One track might be to seek procurement of "cheap" ships, a path toward building ship numbers through less capable, seemingly less expensive ships. The Littoral Combat Ship (LCS) somewhat represents this track. Another approach might seek to cut platform costs through stripping capabilities from platforms as they develop to deal with program cost growth. A third path might be to de-emphasize the implications of future costs while taking steps to lower today's prices. All of these tracks respond to the system's focus on sticker price—on today's bill rather than the full system cost and long-term implications of today's decisions.

Tomorrow's operations and maintenance (O&M) expenses are by far the higher cost. While the acquisition community understands this and works to include future cost as part of the life cycle cost/TOC portions of acquisition work, decisionmaking often does not fully address all implications of tomorrow's costs. For example, personnel costs have consistently outpaced inflation since the introduction of the all-volunteer force, yet future costs are typically set, in procurement decisions, at today's costs.[3] Similarly, energy costs have been rising sharply, and most analysts suggest that future liquid fuel costs will keep growing (which will drive ever-higher costs as oil production peaks and declines in the face of ever-higher demands for it).[4] Related to the liquid fuel challenge, DOD has included the "crude" rather than fully burdened fuel in procurement decisions, which understates the full cost of fuel use by the acquired platform. Not fully involving these costs in decisionmaking risks—hobbling tomorrow's fleet with unaffordable operating costs and fostering an ever-worsening death spiral of today's costs inhibiting investment in tomorrow's capabilities as avoidable O&M costs—robs investment accounts.

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There are no easy answers as we seek to solve multiple issues at the same time: procuring transformational systems at affordable costs while lowering tomorrow's O&M bills

Amphibious transport dock ship USS *New York* being constructed with steel from World Trade Center

U.S. Navy (Santos Huante)

through sensible investment today. Yet there are programs that have seriously worked toward balancing these challenges.

The CVN–21 *Ford*-class program, for example, has striven to enable best decisionmaking as to which upfront investments make sense for reducing the full total ownership cost.[5] In comparison to *Nimitz*-class carriers, the *Ford*-class' light-emitting diode lights might cost more than incandescent light bulbs up front but will use far less electricity and possibly outlive the five decades the carriers will serve the Nation. Phased Array Radars cost more than rotating radars up front but require less maintenance while also improving capability. The Electromagnetic Aircraft Launch system costs more to acquire than a steam catapult but will demand far less manpower while providing improved capability (such as by enabling more precise launch power settings by aircraft and more flexibility in aircraft launch patterns). And due to the upfront investment in understanding and developing improved industrial processes, *Ford*-class ships will be less expensive to procure than *Nimitz*-class carriers due to better procurement processes and design improvements.

With the Amphibious Transport Dock (LPD)–17 *San Antonio*–class, better materials are being used throughout the ship that will enhance warfighting capabilities and reduce maintenance requirements. For example, LPD–17s have composite decking material rather than wood on the sides of the well deck area. This composite will not rot or contribute to rusting of the hull, nor will it splinter and injure Sailors. The *San Antonio* composite antenna mast enclosure will lead to more reliable radar systems and reduce radar cross section and maintenance requirements. Just in the LPD–17, there are many other examples of procurement investment to lower TOC, from titanium seawater pipes and high-solids paint in ballast tanks to eliminate huge implications of rusting to use of composite hatches and bulwarks topsides (which lowers signature but also greatly reduces maintenance/repair requirements).

Thus, there are cases where life cycle cost implications have driven decisions to pay more money up front to lower TOC. These decisions, however, face the barrier of Americans' tendency to look at the 99-cent sticker price and concerns that something is "too expensive." But it is clear that sensible investment today can lower tomorrow's O&M costs as well as total ownership cost.

There is no magic wand we can wave to guarantee optimal total ownership cost decisionmaking, whether for refrigerators in our homes or the future Navy's ships. One ameliorative path might be if the Navy would even more forthrightly discuss the need to invest today to lower tomorrow's operating costs as part of its conversation with the Nation and with Congress when it discusses shipbuilding issues. **JFQ**

NOTES

[1] Note that increasing attention to "quality processes" (Lean/Six Sigma) and design for producibility, which is "quality construction," serves to reduce (or at least constrain growth in) ship costs. For example, within the DDG–1000 program, there is larger space assigned for each deck that provides additional space between decks for wiring, pipes, and other infrastructure. This will both lower the manpower for wiring the ship and enable lower costs for any future work in those spaces because it will be an easier space to work in.

[2] Much of the Navy's force structure dates from the administrations of Ronald Reagan and George H.W. Bush. In shipbuilding terms, these ships are approaching the end of their active service life. Thus, procurement growth must occur, or Navy force structure will continue to shrink.

[3] These costs have often not been fully loaded (counting recruitment, training, and retirement costs). Analysis of fully burdened personnel costs has become more sophisticated in recent years. For example, the CVN(X) (now CVN–21) program did detailed analysis of Sailor cost (including indirect costs such as training infrastructure) to support Navy decisionmaking as to investments to reduce manning requirements in the new aircraft carrier costs.

[4] See "Peak Oil Primer," *Energy Bulletin*, available at <http://energybulletin.net/primer.php>.

[5] Due to dismantling of the *Nimitz*-class industrial base, even the first CVN–21 will cost less to build than it would cost to return to building *Nimitz*-class carriers. Thus, the *Ford*-class will have a lower acquisition cost, as well as lower TOC, than the ships it will replace.