

THE STRATEGIC IMPLICATIONS OF OBSCURANTS

History and the Future

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Throughout history, smoke has been used in various forms to obscure naval forces at sea. During prominent naval battles in the twentieth century, from Jutland in World War I to the U.S. Navy's clash with imperial Japanese forces off Leyte in 1944, smoke literally contributed to "the fog of war" and added to the complexity and confusion of battle.¹ But is there a role for smoke or other obscurants at sea in the radar-saturated, cyber-linked maritime environment of the twenty-first century? And what, if any, are the strategic implications of obscurants? This article will explore the latter question, leaving the tactical and operational opportunities of "making smoke" for separate inquiry.

The application of obscurants on the modern battlefield has been widely examined by U.S. Army strategists and operators for over a decade and a half;² obscurants are firmly imbedded in U.S. Army doctrine.³ Moreover, the

effectiveness of obscurants against a panoply of terminal homing systems, from the visual to the millimeter-wave spectrum, is proven. In simple terms, the particles suspended in the medium of smoke can be adjusted in size to absorb and diffuse radar waves emanating from the seeker heads of incoming antiship missiles, thereby denying any homing information to the missile. In the modern naval battle space, where antiship cruise missiles (ASCMs) are a principal threat, adapting obscurant systems and developing tactics and operational schemes for their use

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at sea is prudent. Given the stark potential of antiship ballistic missiles (ASBMs), this adaptation may be essential.⁴

The challenge, then, for naval strategists, operators, and acquisition professionals is to “navalize” obscurants for use at sea, either developing new systems or adapting existing ones. One such system that appears primed for adaptation is the U.S. Army’s M56E1 Coyote smoke-generating system. The Coyote spews out large, radar-absorbing, carbon-fiber clouds that can prevent a radar-guided ASCM from detecting its target, thereby neutralizing the missile’s terminal homing capability.⁵ It is an attractive system, since the cost of generating a single obscurant cloud covering several square nautical miles is in the tens of thousands of dollars. Also, depending on environmental conditions present, the Coyote’s cloud can be quite persistent. Effective in virtually the entire spectrum, such millimeter-wave obscurants show great promise in thwarting the terminal radar seekers in many modern ASCMs.

The fundamental assumption underpinning this article is that regardless of which system is acquired, thoughtful obscurant employment will significantly reduce the risk to surface ships from missile strikes. With this in mind, there are four key areas where obscurants have strategic implications: strategic competition, influence and balancing, deterrence, and escalation control.

STRATEGIC COMPETITION

Obscurants represent a relatively low-cost augmentation to current missile defense strategies and have the potential to tip the cost-exchange ratio, which now favors the offense, back to the defense.

Calculating the exact unit cost of offensive and defensive missiles is a challenge due to the multitude of direct and associated costs of bringing a missile system on line. It becomes even more problematic when researching the cost of missile programs in countries with opaque accountability laws and public information standards. But the approximate, relative cost differences between offensive and defensive missiles are sufficiently large enough to give a clear advantage to the offense. For example, a comparison of the Navy’s primary defensive missile, the SM-2, against the service’s own ASCM, the AGM-84 Harpoon, reveals a cost ratio of \$2,560,000 to \$474,000—an advantage to the offense of five to one.⁶ A “shoot doctrine” that takes into account a defensive probability of kill of anything less than one (i.e., $P_k < 1$) requires, at a minimum, two defensive missiles for every one incoming offensive missile, raising the cost ratio to almost eleven to one, with a resultant cost disadvantage to the defense of \$4,600,000 per exchange.

Full comprehension of the “game changing” potential of the Chinese DF-21 ASBM and its impact on operations is slowly emerging among strategists and

planners. Applying this analysis to the emerging threat posed by antiship ballistic missiles yields somewhat different results. While it is problematic to estimate accurately the cost of the DF-21, sources place the unit price, in U.S. currency, between \$5,000,000 and \$10,500,000 per missile.⁷ This seems a reasonable estimate in light of the cost of a similar weapon, the U.S. Pershing II, which adjusted for inflation would be roughly twelve million dollars per missile. In comparison, the ballistic-missile-defense-capable SM-3 costs roughly ten million dollars per missile. At first blush, the nearly equal prices of interceptor (SM-3) and ASBM (DF-21) suggest near parity in cost ratio, but a “shoot two to kill one” doctrine means a differential of nearly ten million dollars per exchange. However, even this is misleading, as the launch platform—essentially a big truck—of the DF-21 is far less expensive than that of the SM-3, a warship. This estimate also ignores the operational and developmental challenges of intercepting an ASBM; nor does it fold in the things like purchasing power disparity, labor costs, and government controls, which all favor China. Nonetheless, this simple cost comparison is striking.

The strategic challenge, then, is to reverse this disparity and tip the cost back in favor of the defense. The application of obscurants can help with this in two very significant ways. First, developing and deploying a navalized obscurant capability would be—especially if based on the M56E1—inexpensive in comparison to defensive missile systems. The entire mission package for the Coyote costs from \$130,000 to \$150,000 per unit; the expendable obscurant boxes cost about a thousand dollars per thirty-pound box, each capable of generating four minutes of radar-absorbing smoke. Place these mission packages on the Littoral Combat Ship, on an SH-60 helicopter, or even on an unmanned aerial vehicle, and for relatively little money both naval and merchant surface vessels can be obscured from radar-homing ASCMs and ASBMs. Admittedly, for this to work effectively, more testing and experimentation must be done; in any case, obscurants in themselves represent not a panacea but part of a layered passive defense. But in light of the challenging operational issues involved with intercepting ASBMs, obscurants merit increased consideration.

As with any new system, there will be additional costs to ensure that other shipboard and aviation systems will not be adversely impacted by the use of smoke and millimeter-wave fibers. Also, resources would be needed to develop operational and tactical doctrine and procedures to employ this capability effectively. That said, it is hard to imagine that the combined unit cost per obscurant system plus the very low expendable costs of making the smoke, even coupled with any additional developmental and compatibility costs, would approach anything near the two billion dollars spent on the SM-2/SM-6 program.

A rational approach is to couple obscurant systems with current shipboard passive and active defensive capabilities. The blanket coverage afforded by obscurant systems would reduce the burden on defensive missile systems to intercept every incoming missile. This would reduce the cost per kill of incoming offensive missiles to a level that shifts overall costs in favor of the defense. An endogenous strategic effect of this coupling would be an increase in capacity for theater ballistic missile defense, as missiles and their launch tubes that would otherwise be used for ship defense would be freed to intercept ballistic missiles threatening targets ashore. Admittedly, that would not reduce the overall, programwide costs of developing effective theater missile defenses, but it clearly would lessen the cost of protecting the “protectors” in a missile exchange.

Second, employment of a relatively low-cost obscurant system would prompt potential opponents to reexamine and adapt their current missile systems to ensure effectiveness in an obscurant-laden environment, thereby driving up the real unit cost per offensive missile. This too begins to tip the cost differential back in favor of the defense. Moreover, even if the technical and physics challenges of getting infrared and millimeter-wave homing systems to “see through” obscurants are surmounted, it will have taken several years to do so. Potential adversaries would therefore have to reexamine and reengineer current systems and delay the introduction of future systems to ensure their effectiveness to reduce the risk of failure—which in itself would contribute to deterrence in the short run.

It is important to appreciate the strategic disaster that would ensue if even one antiship missile were to make it through. Here the strike of one \$500,000 ASCM or twelve-million-dollar ASBM would result in hundreds of millions of dollars in damage and significant loss of personnel. While a missile strike against a relatively hard target like an aircraft carrier might not sink that ship, the destruction of multimillion-dollar aircraft parked on the flight deck by dispersed munitions would instantaneously and drastically tip the cost-ratio exchange in favor of the offense.⁸

When applying the logic used in both of the cases outlined above, an underlying element should be understood. That is, current antiaccess strategies are based on using relatively low-cost weaponry to counter high-cost expeditionary assets. In this case, obscurants would need to be significantly less expensive to develop and deploy than the missiles they are designed to counter to have any strategic impact. That said, employing an asymmetric obscurant strategy provides a significant amount of “headroom” to develop new, more effective kinetic or other passive systems or to adapt current weapons continuously. Offsetting this concern somewhat is that meeting symmetrically a sizable U.S. naval force would be impractical and costly enough to force nations to adopt an asymmetrical strategy.

Nations may have no other option but to expend resources to ensure this asymmetrical strategy is credible and effective. Thus low-cost obscurant systems that make it more complicated and costly for a potential adversary to operationalize his strategy affect the strategic competition.

In Beijing all of these factors are well understood. The Chinese have based their entire antiaccess strategy on developing systems that are less expensive to produce and operate than the U.S. expeditionary forces they are designed to counter. Moreover, a considerable number of these systems are specifically designed to counter the most potent persistent striking force possessed by the U.S. Navy—the aircraft carrier. The introduction of fully operational obscurant systems, coupled with well-thought-out operational schemes, will start to flip this asymmetry around.

INFLUENCE AND BALANCING

The leitmotif of arms sales is that nations who sell arms gain influence with nations purchasing those weapons. The extent to which this is broadly true is beyond the scope of this article, but it is reasonable to assume that besides the tangible benefit of generating capital, some positive relationship will emerge from the arms transaction and some influence will be garnered. For this argument it is sufficient to note that for a country to gain any influence with another from the sale of arms, two conditions must exist. First, the system or capability being sold must produce some military effect relevant for the receiving country; second, the system must actually work, or be perceived to work, as advertised. Thus it can be anticipated that for any reduction in either the desirability or efficacy of a given system, there would be some reduction in influence.

Granted, countries often provide a number of different weapons systems and capabilities to client states in order to foster influence, and the impact of degradation in the performance of one of them may be limited. But in the case of obscurants, which would render significantly less effective an entire class of antiship weapons, the implications for the delivering state cannot be ignored. This is not just diminishing the role of an ancillary system but muting what is perhaps the most prominent class of modern antiship weapons, the radar-homing missile.

The implication for the United States is that delivering low-cost, low-tech obscurant systems capable of providing significant protection for surface ships may produce some increase in influence for Washington. (The effect would likely be marginal, as obscurants are easily produced indigenously.) More significantly, whether through transfer or internal development, wide distribution of obscurant systems would blunt the potent military capability of any aggressor

country whose advantage rests with its ability to coerce or pressure its neighbors through use of radar-guided missiles aimed at ships at sea.

In 2009 China extended its global influence through a variety of means, including raising its profile in international arms sales.⁹ For example, the Chinese recently delivered a Type 53H3 Sword-class frigate, PNS *Zulfiqar*, to Pakistan, replete with eight C-802/CSS-N-8 antiship cruise missiles. This transfer in itself represents only a marginal operational increase for the Pakistani navy, as the four Type 53H3s involved replace six older, ex-British *Amazon*-class frigates scheduled to leave the fleet in the next decade. However, the arrival of *Zulfiqar* “marks the first time in Pakistan’s history in which it has received a new-build major frontline warship.”¹⁰ An underlying strategic goal here for China is to strengthen its influence with Pakistan to ensure that the relationship of the United States with Islamabad does not go unchecked.

But perhaps as important, this sale affects China’s other strategic rival in the region, India. The Indian Navy must acknowledge the increased capability the arrival of these Type 53H3s and their C-802s represents by obtaining more platforms or more capable systems, thereby exacerbating an already tense regional arms race. Should the DF-21’s constituent technologies migrate to Pakistan or to other countries in the region, that too would exacerbate regional competition. Any country, not only India, that relies on its naval force as an element of its security would be threatened and thus prompted to seek either additional or more capable systems or expand its operational plans to target this potent neutralizer of its surface combatants.

Obscurants have the potential to reduce the strategic impact in both of these cases. The overall strategic and operational value of *Zulfiqar* for Pakistan is lessened, and the potential “game changing” nature of an ASBM is reduced.

There is a latent danger here. Obscurant systems must be effective enough, either alone or in concert with other systems, to neutralize a sufficient number of incoming missiles in the aggregate to make it obvious to a potential opponent that increasing missile stockpiles would not result in a tactical advantage. Marginally effective obscurant systems could have the reverse effect of encouraging an arms race, by prompting opponents to field large numbers of missiles in the hopes of overwhelming defenses—much as is the case now. The whole point of obscurants is that they will defeat nearly all incoming warheads, no matter how many missiles are launched, the “leakers” to be handled with other defensive systems.

With regard to balancing and influence, obscurants can affect the way allies operate with the U.S. fleet and how they configure their forces. An explicit goal of the Navy’s “Cooperative Strategy for 21st Century Seapower” is fostering cooperation with other maritime nations. While the initiative is aimed at the

quotidian task of strengthening maritime security, the ultimate expression of cooperation is a nation's decision to join a coalition. That decision is ultimately a political one, based on an assessment of benefits and risks. Among the considerations is the ability to operate effectively in the anticipated tactical environment without undue exposure to damage or destruction. In a heavily saturated antiship-missile environment, allied ships would be more survivable operating with obscurants, producing a corresponding reduction in risk and of the political pressure that inevitably results when a unit is lost or destroyed. Moreover, the strategic risk to a nation with a relatively small fleet, for which the loss of even one ship can have significant impact, is reduced.

There may be the undesirable second-order effect of making nearly all radar-guided missiles less effective—including rendering U.S. weapons impotent—which raises two salient considerations. First, if employment of obscurants reduces the effectiveness of offensive antiship missiles and influence of countries selling offensive missiles, then the influence gained by the United States through the sale of those missiles would be lessened as well. Second, and more important, the employment of obscurants could substantially affect the current reliance on, and efficacy of, precision radar-guided missiles at sea to a point where a major reformation in the way naval forces are structured and operated would occur. Here the operational and strategic advantage is accrued by those countries agile enough to adapt to the changed environment.

DETERRENCE

A central tenet of international relations theory, as echoed by the Department of Defense, is that “deterrence operations convince adversaries not to take actions that threaten US vital interests by means of decisive influence over their decision-making.”¹¹ Increasing the level of perceived risk increases the ability of one player to deter another. Obscurants can raise the risk an opponent perceives in two principal ways.

First, while obscurants in themselves may not deter, their use injects a high degree of uncertainty and unpredictability that in turn increases risk. Any antiaccess strategy predicated on sea denial through the threat or use of antiship missiles must estimate the numbers of missiles needed and types of targets to be engaged. By making it harder to predict the number of missiles required for a desired effect, obscurant systems will increase the risk for that opponent and, concomitantly, deterrence. Conversely, obscurants that create a tactical situation where an offensive antiship missile strike will nearly always fail produces a near certainty that in itself deters.

Second, obscurant systems and other kinetic or electronic defenses increase the number of missiles needed per target. If this increased expenditure of

missiles significantly draws down an adversary's missile inventory, at some point this reduction will have strategic consequences. In regions where the relative balance of forces between nations is close, adversaries who rapidly deplete their offensive missile inventory and yet fail to achieve the strategic benefits they were seeking will degrade their relative strategic positions, regardless of whether this conflict was with intra- or extraregional opponents.

The uncertainties that obscurants inject into calculations of the chance of success and into the strategic risks of aggressive operations can be significant. And uncertainty can deter. However, there are two instances in which obscurants may have a neutral or negative impact on deterrence. First, as obscurant systems are relatively inexpensive and low-tech, they are likely to proliferate. If both sides employ this capability, obscurants can reduce the effectiveness of all offensive missile systems. In this case, the side that can accrue tactical or operational advantages by other means—for example, through weapons that do not rely on millimeter-wave or infrared homing, or through stealth or maneuverability—will likely be more difficult to deter. Here, the deterrent effect of obscurants is neutral.

However, in an *ad bellum* (approach to war) scenario where one side's operational plan relies heavily on precision antiship missiles launched from transporter-erector-launchers on land, a large first strike without warning would be tempting, as the relative advantages of a land-based antiaccess plan would evaporate once off-shore naval forces started using obscurants, resulting in a negative impact on deterrence. However, if obscurants are deployed on warning or used preemptively, as a nonprovocative means of defense, deterrence is in fact increased. This is where escalation control plays a role.

ESCALATION CONTROL

Should deterrence fail, the use of obscurants can contribute to controlling escalation and expanding the strategic options available. This is most evident in the transition from an *ad bellum* to an *in bello* situation. Once an adversary strikes a target, especially a high-value unit such as an aircraft carrier or "big deck" amphibious ship, there is tangible pressure to respond by striking an opponent's countervalue or a counterforce target. While conventional escalation does not neatly conform to the notions of "countervalue" and "counterforce" options as commonly understood in connection with nuclear deterrence, the conventional challenges associated with each of these types of responses are useful to explore.

First, against an adversary who launches missiles from mobile transporter-erector-launchers ashore, the direct counterforce options are limited to strikes on fixed radars and supporting infrastructures—strikes that, these targets being ashore in an opponent's homeland and possibly having multiple uses, would

likely be viewed as significantly escalatory. That is fine if it is the desired effect; however, it becomes problematic when the effect is to respond in kind, without significant escalation. Finding other conventional counterforce options would mean expanding the target set to other military assets, preferably naval targets, such as ships at sea or deployed submarines, or airborne aircraft operating over land or water. If these assets are unlocated or untargetable and the only other counterforce targets are on land, the risk of escalation will increase.

Second, against an adversary who has successfully struck a high-value naval unit, finding an equivalent countervalue target would be a problem. However, there are two options. One would be to strike unrelated military targets that are of equal value in the aggregate. But dispersed naval assets like small boats, submarines, and surface ships would be challenging and time-consuming targets to strike and might not really add up to the value of the high-value unit originally attacked. Most nations view strikes against naval combatants as lower on the escalation ladder than strikes against homeland targets, even though naval vessels are considered sovereign territory. Thus responding to a strike against a naval unit offshore with collectively equivalent countervalue strikes to military targets onshore would likely be perceived as escalation. In the extreme case, where no military target or groups of targets of equal value exist, other national assets would need to be considered, including space-based military or commercial systems or certain military-related civilian facilities. Again, in either case the conflict would escalate.

Consider, then, a case in the transition to war where an adversary launches a first strike using missiles against high-value targets at sea but fails, due in large part to the effective use of obscurants. In this situation, strategic space is created that lessens the need for an in-kind response and expands the range of options. The targeted side can use this opportunity to give an adversary time to reconsider the chances of success, having failed in a first strike. This creates the opportunity for de-escalation.

Once *in bello*, controlling escalation without the use of obscurants becomes particularly challenging, for three reasons. First, countering incoming antiship missiles primarily with defensive missiles and other kinetic systems will eventually deplete the defenders' magazines, encouraging the adversary not to de-escalate but to sustain or even increase its efforts. Second, moving beyond the ranges of shore-launched missiles plays, in effect, into the adversary's antiaccess strategy. While such withdrawal may be viewed as de-escalatory, it is de-escalation through capitulation. Lastly, tactics that target subsystems that support the entire missile "enterprise," such as surrounding and distant infrastructure, command-and-control nodes, or satellites, prior to a missile launch (the so-called left-of-launch options)—are all intrinsically escalatory.

However, when obscurants effectively counter missile strikes by simply denying the incoming weapons' homing ability, causing them to miss, there is less requirement to expend defensive missiles, no need to reposition outside of offensive missile ranges, and reduced justification for escalatory "left of launch" options.

OBSTACLES AND OPPORTUNITIES

A full examination of how to bring obscurants to the fleet is beyond the scope of this article. However, as with any new concept, there would be organizational, cultural, and programmatic obstacles to overcome.

Organizationally, bringing any obscurant system to the fleet through a "program of record" will require intense collaboration across multiple communities and commands as integrating any new concept has always proved to be a challenge. Recently, the Chief of Naval Operations signed an instruction that codifies how the U.S. Navy will generate and develop new concepts. Obscurants appear ripe for examination under the process described in this document.¹² Moreover, the U.S. Army's experience with making obscurants safe for personnel and compatible with other fielded systems represents insights with encouraging potential for adaptation by the Navy.

Culturally, the Navy is oriented toward active defense. This can be seen historically in destroying incoming B5N Kate torpedo planes with F4F-4 Wildcat fighters and shipboard anti-aircraft batteries off Midway in 1942, or in the contemporary practice of intercepting incoming ASCMs with the SM-2 and Mark 15 Phalanx Close-In Weapons System in 2010. There have been many passive defense systems—including electronic countermeasures, radar-spoofing chaff, and electronic decoys—but the preference, as measured by program dollars, is overwhelmingly in favor of active defense. There are several good reasons for this preference, not the least of which is the value of a positive kill and the accurate battle-damage assessment that allows.

But perhaps the most significant obstacle is programmatic. In the intense competition for funds, programs live and die by the perceived salience and immediacy of their necessity. At present, in the absence of pressing need for them, there is scant chance that obscurants will receive the attention and funding needed to make them operational. But this may be changing. With the increasing recognition that key elements of conventional naval striking forces may soon be held at greater risk, the recognition that obscurants could reduce this risk may also increase, thereby prompting greater interest in developing a program of record to bring obscurant systems to the fleet.

It is worth noting here that systems fielded to counter new threats are often highly classified, known only to a limited number of planners and operators.

Such systems clearly have their place, but they have no impact on deterrence or influence. To deter, systems must be known, and to influence, they must be transferable. Highly classified systems are neither.

However, even with these obstacles there are opportunities. In the near term, obscurants can serve as a system of “last resort.” With modest compatibility and impact testing and minimal adaptation to the maritime environment, existing obscurants could be used as a balancer to the DF-21 threat. Cloaking major combatants in obscurants at first warning, whatever the impact on other ship and aircraft systems, would be justifiable given the grave strategic consequences of losing a major combatant to an ASBM strike.

As obscurant systems are introduced and tactical procedures and operational doctrines are developed, any potential adversary will have to respond, adjust, and counter them. This represents a clear midterm opportunity, as keeping potential adversaries “off balance” causes them to expend time and resources. A critical element of achieving this “off-balancing” effect would be a thoughtful strategic communication effort to highlight the operational and strategic implications of the obscurant system. Likewise, even committing a reasonable effort to making obscurants operational and openly trumpeting their existence will create uncertainty and induce a recalculation of risk. An example of this is the “buzz” generated by the impending introduction of the DF-21. Though there has been no at-sea, operational demonstration of this missile, so much uncertainty has been created by the Chinese press, with a consequent dialogue by U.S. navalists and arms experts, that concern over the “game changing” nature of this missile is emerging. This public discourse extends even to the official military television channel in China, where a discussion of the DF-21’s predicted lethality includes an animated cartoon of the sinking of an aircraft carrier—complete with a hapless sailor and vexed commanding officer.¹³ This discussion targeted audiences on both sides of the Pacific. Notable is the absence of any portrayal of passive defenses.

Perhaps the greatest opportunity for obscurants is in their long-term effect on the evolving character of naval warfare. In a future operational concept based on the speed, maneuverability, and stealth of small, numerous missile-launching surface platforms, obscurants can add to the difficulty of striking these platforms, contribute to uncertainty on the part of adversaries, and establish a “tipping point” in favor of U.S. forces. Fielding systems and formulating tactical and operational doctrine today can lay the foundation for obscurant use in the future.

While the obstacles are not trivial, the operational and strategic opportunities that obscurants represent merit increased attention and a greater effort to explore all the ways in which they can be brought to the fleet. Obscurants will

have come full circle from October 1944 when a twenty-first-century destroyer captain gives the order to “make smoke.”

NOTES

1. The indomitable Cdr. Ernest Evans famously shouted the command “Make smoke!” as he steered the destroyer USS *Johnston* toward the approaching Imperial Japanese Fleet during the battle of Leyte Gulf. USS *Johnston* (DD557) Action Report, DD557/A 16-3, serial 04, 14 November 1944, Subject: Action Report—Surface Engagement off Samar, P.I., 25 October 1944.
2. For the purposes of this article, the term “obscurants” describes any material that blocks any electromagnetic or visible-spectrum wavelength; “smoke” is meant to describe a medium that suspends obscurant material in the atmosphere.
3. U.S. Army Dept., *Battlefield Obscuration*, Field Manual 3-11.50 (Washington, D.C.: Headquarters, Department of the Army, 31 December 2008).
4. Andrew S. Erickson and David D. Yang, “On the Verge of a Game Changer,” U.S. Naval Institute *Proceedings* (May 2009), pp. 26–32.
5. Using the Army’s Coyote system was proposed and examined by Brett J. Morash, “Naval Obscuration” (research paper, U.S. Naval War College, Warfare Analysis and Research Department, Newport, R.I., 2006). Lieutenant Commander Morash effectively described the applicability and adaptability of the M56E1 system for use in the naval environment.
6. The figure of \$2,560,000 was derived from www.defenseindustrydaily.com/raytheon-standard-missile-naval-defense-family-updated-02919/, taking the total listed production costs from fiscal years 2005–10 (\$915,100,000) and dividing by the total number of missiles produced (357). This is a conservative estimate, as it does not include research, development, testing, and evaluation, costs of which drive the total per-missile cost closer to \$6,000,000.
7. Qiu Zhenwei and Long Haiyan, “A Discussion of China’s Development of an Antiship Ballistic Missile (Combat Scenario),” *Modern Ships*, quoted in “Ballistic Trajectory: China Develops New Anti-ship Missile,” *Jane’s*, www.janes.com/news/security/.
8. For instance, costs for the F-18 range between \$29 and \$57 million per aircraft, depending on variant. From U.S. Navy sources, www.news.navy.mil/.
9. Stephen Blank, “China’s Rising Profile in International Arms Sales,” *China Brief* 9, no. 25 (16 December 2009), pp. 10–12, www.jamestown.org/.
10. Usman Ansari, “First Sword Class Frigate Arrives in Pakistan,” *Defense News* (13 September 2009), available at www.defensenews.com/.
11. U.S. Defense Dept., *Deterrence Operations Joint Operating Concept*, version 2.0 (Washington, D.C.: U.S. Strategic Command, December 2006), p. 3, available at www.dtic.mil/futurejointwarfare/concepts/do_joc_v20.doc.
12. Chief of Naval Operations, “Navy Concept Generation and Concept Development Program,” OPNAVINST 5401.9, Washington, D.C., 24 February 2010.
13. This video can be viewed at www.youtube.com/watch?v=R-nNVvtacXU&feature=related.