

Cost-Benefit Economics

Enhancing National Security and Air and Space Power

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Editorial Abstract: The changing calculus of direct and indirect costs associated with warfare implies a need to alter strategy and doctrine. New technologies, the varying character of competition between states, and the proliferation of nonstate actors increase the difficulty of defining the effects desired during military operations. Viewing such strategic elements through a cost-benefit lens helps refine critical decision-making tasks for those who participate in the process.

To defeat this [terrorist] threat we must make use of every tool in our arsenal—military power, better homeland defenses, law enforcement, intelligence, and vigorous efforts to cut off terrorist financing. The war against terrorists of global reach is a global enterprise of uncertain duration.

—President George W. Bush
*The National Security Strategy
of the United States of America*

THE LATEST VERSION of the national security strategy is a sweeping document that lays the groundwork for traditional defense roles as well as the campaign against terror operations and terrorists.¹ After the Bush administration published its new security strategy, the mainstream press focused on the idea of preemptive action.² Michael Kelly referred to this new strategy as “nothing less than a re-imagining of the American role in the world.”³ Although this idea of preemptive action may be new to the words of the security strategy, it is certainly not new to the deeds. The actions in Grenada and Panama were preemptive in nature but did not spur this level of debate. Even Kelly admits as much when he says that “preventive wars are not new, and neither is the American impulse to better the world by air power.”⁴ The preemptive aspect of the strategy might not be completely new; nevertheless, the preemptive nature of the strategy, as well as other aspects of the document, should spur



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some reflection. If this new national strategy is going to better the world through the use of airpower (in the context of joint operations), how might we airmen contribute to this cause?

The new strategy also reflects some current realities. Technological improvements have lowered the costs of warfare for developed nations, both in terms of dollars and human lives, but they have also lowered the costs for terrorists.⁵ This economic situation requires that we reexamine how we decide on appropriate courses of action—especially in situations that have traditionally resulted in long-term sanctions. National security decisions are not necessarily economic in nature; however, an economic framework can provide a clearer picture for analysis of the choices inherent in many security dilemmas. This article examines how the use of an economic view can help develop air and space power doctrine to support the national security strategy. Toward that end, it examines direct costs, indirect costs, marginal costs, and investments.

The Evolution of Doctrine

Do not let us split hairs. Let us not say, "We will only defend ourselves if the torpedo succeeds in getting home, or if the crew and the passengers are drowned." This is the time for prevention of attack.

—President Franklin D. Roosevelt
11 September 1941

Modern concepts of the application of airpower are represented in *The Air Campaign: Planning for Combat* by Col John A. Warden III, USAF, retired.⁶ Technological advances have meant that even a relatively recent book such as this one, with its discussion of the serial destruction of centers of gravity, has become somewhat dated. However, *The Air Campaign* laid the groundwork for more refined doctrine that uses effects-based warfare. Maj Gen David Deptula, for example, advocates a forceful case for parallel warfare with precision weapons.⁷ Further work fo

cuses on General Deptula's idea that absolute destruction may not be necessary to achieve the effects required for the campaign.⁸ Despite widespread discussion of these ideas, US forces have not applied such concepts with any degree of consistency.⁹ As technology improves, the ability to make more precise decisions with more reliable results means that our doctrine must continually evolve.

Direct versus Indirect Costs

General Deptula's work reflects the natural evolution of doctrine, given the technical progress made in all areas of warfare. The nuclear age gave us the ability to annihilate an enemy completely, yet that power has been held in check for over 50 years. The paradox of the nuclear age stemmed from the perception that using nuclear weapons spelled doom—not only for the enemy, but also for the entire world. Improved targeting technologies have led to a reduction in the collateral damage of conventional warfare. The next step is a more careful examination of the desired effects of a given action. Is complete destruction required, or will incapacitation be sufficient to achieve the desired objective?

Frequently in the past, only destruction could assure incapacitation, but that may not always be the case as we move forward technologically. We must make new assessments of our capabilities and consider both direct and indirect costs. In this context, direct costs are the traditional costs of war, including those for equipment, transportation, and human casualties that always accompany war's violence. Indirect costs include such items as improved homeland-security initiatives and lives lost through the actions of totalitarian regimes. Collateral damage of direct military action could be considered either a direct or an indirect cost, depending upon one's perspective.

Improved targeting accuracy brings two dilemmas of warfare to the forefront. The first is the fact that improvements in technology lower the direct costs of warfare. For example, we require fewer bombs and sorties to achieve a given objective. The traditional economic

consequence is that lower cost increases demand. The fact that we can do much more with fewer resources may lead to hasty decisions to use military force—a situation akin to the risk of “moral hazard” presented by many types of commercial-insurance situations. The reduction in collateral damage (indirect costs) may have the same effect. Moreover, the lower direct costs of warfare also mean that, when it needs to, the United States can take action (preemptive or otherwise) against enemies who have formerly remained inviolable.

Unfortunately, technological advances that lower the costs of warfare for developed nations do the same for terrorists, which causes the second dilemma. Because terrorists have the ability to wield massive destructive power with very few resources, the indirect costs of inaction for developed nations have increased dramatically. In other words, because most terrorist groups operate without the constraints of legal conventions that govern war between states, they can achieve potentially greater indirect effects against the societies they target. Terrorist attacks can cause widespread damage but also create huge ancillary costs—for example, the massive expenditures necessary for improving airline security in the United States.

Doctrinal Implications

The changing calculus of the direct and indirect costs of warfare means that our strategy and doctrine must evolve. The [Caspar] Weinberger- [Colin] Powell Doctrine requires overwhelming force as a prerequisite for action, but new technology has changed our perceptions of overwhelming force. With precision weapons, we can achieve more effective results with less cost than was possible a mere 10 years ago. Even if one commits to the overwhelming-force doctrine, one must continually reevaluate what constitutes the threshold for overwhelming force.

Even though technology has improved dramatically since the Gulf War of 1991, we now face a problem that is common in some high-technology industries—the fact that technological advances outrun the organization’s

ability to harness the new capabilities. For example, Intel continues to improve micro-processor technology in line with Moore’s Law;¹⁰ however, many customers find that new processors do not help them improve the performance of common business applications such as spreadsheets and word processing.¹¹ Similarly, our modern Air Force has the ability to target with extreme precision in all-weather conditions. Future improvements in weapons-delivery technology are not likely to pay the large dividends that we have reaped in the past few decades. We can already put a 500-pound bomb through a window; will choosing a particular windowpane within the window improve our performance? Further, potential adversaries have devised new countermeasures that thwart some of the advantages of stealth and precision. For example, some states have opted to place their most important resources in deeply buried facilities, thus reducing the effectiveness of conventional aerial attack. Work remains to be done with precision weapons, but future results are unlikely to have the transformational effects of the past. Previously, improvements in precision weapons have driven the revolution in military affairs, but as we move into the twenty-first century, improvements must come from other fronts.

In order to continue our advance as a fighting force, the principles of effects-based warfare must also move forward to achieve our objectives. Improved targeting technologies demand that we also improve data-collection and data-processing capabilities (i.e., intelligence and command/control) in order to make the right decisions at the right time, as well as meet the demands of the modern geopolitical environment and the new national security strategy. As previously mentioned, we have the ability to put a bomb through a particular window. What we don’t always have is the technology to decide which window we should choose. We talk of information dominance, but we have yet to find a way to truly achieve it.¹² Clearly, this area must become a priority for future doctrine efforts.

Evolution of the National Security Strategy

We no longer live in a world where only the actual firing of weapons represents a sufficient challenge to a nation's security.

—President John F. Kennedy
Cuban missile crisis

Some of the concepts that we need to develop in order to use this economic view include direct and indirect costs (mentioned earlier), as well as marginal costs and investments. During the Gulf War, the US administration identified its objectives (among them, the liberation of Kuwait) and sought to achieve them with overwhelming force. Such limitations on the war's purpose created a postwar situation that left Saddam Hussein in power, still able to threaten both the region and the world.

Thus, during the course of the war, the United States had a clearly articulated goal of removing Iraqi forces from Kuwait. Its objectives did not include a regime change in Iraq, which did not seem necessary for accomplishing US aims in the region, even though the Iraqi leadership clearly constituted a center of gravity. Indeed, Warden points out that "command is a true center of gravity and worth attack in any circumstance in which it can be reached."¹³ Moreover, Gen H. Norman Schwarzkopf, commander of the coalition forces, makes the point that, although killing or removing Saddam was not an aim of the war, he "wouldn't have shed any tears" if the Iraqi dictator had been killed during the course of the war.¹⁴ However, the concept of limited war that prevailed at the time meant that, once the coalition had liberated Kuwait, it could not set its sights on Saddam.

At the time, risking military and civilian lives to remove the Iraqi regime seemed unnecessary. After all, we had established our objective and achieved it. Why risk destabilizing the region and setting ourselves up for a nation-building responsibility? The first Bush administration took what appeared to be the sensible approach. We would contain Iraq

through the use of international sanctions, which would weaken Saddam and, hopefully, lead to his downfall or at least keep him in check. Unfortunately, we miscalculated. A rigorous economic examination of the situation might have resulted in a different outcome.

First, we erroneously believed that sanctions would weaken the regime's power over the Iraqi people. Sanctions have rarely affected a totalitarian regime enough to force its capitulation. North Korea has endured sanctions for 50 years, but its fundamental form of government remains unchanged.¹⁵ Sanctions against Cuba have yielded similar results. Such dictatorial regimes become stronger because the general populace—weakened by famine, lack of access to medical care, and other problems brought about by sanctions—can neither resist nor overthrow the oppressing government.

Coercive economic measures can have other perverse effects, such as the creation of smuggling activities and black markets. In fact Gen Wesley Clark, supreme allied commander Europe during the Balkans campaign, points out that "in the Balkans, for example, the economic sanctions implemented against Serbia during the early 1990s are widely credited with helping Serb President Slobodan Milosevic strengthen his control through the encouragement of black market and smuggling activities. At the same time these sanctions imposed burdens on neighboring countries like Bulgaria, Macedonia, and Romania, whose leaders were unanimous in opposing any extension of the sanctions regime."¹⁶

Second, we mistakenly counted on sufficient consensus to ensure international compliance with the sanctions program. Evidently, the sanctions had some effect on Saddam's ability to maintain his weapons programs, but his constant search for sources yielded some fruit—specifically, the revelation that the Ukraine supplied antiaircraft systems to Iraq.¹⁷ Although such systems are not weapons of mass destruction, it seems that, given enough time and money, the determined dictator was able to find sources for such materiel.

The third miscalculation assumed the effective monitoring of developments within Iraq. But Saddam's government, willing to lie at every turn, easily manipulated the inspection plan. Germany also circumvented the utility of sanctions after World War I by using many of the same tactics.¹⁸

Rogue States and Preemptive Action

As noted previously, the media focused on the apparent sanctioning of preemptive action by President Bush's national security strategy. Such action certainly seems an attractive strategic option in some cases to ensure national security. The rise of nonstate actors (i.e., terrorist organizations) means that unless our containment efforts with "rogue states" are effective, the release of weapons of mass destruction into the wrong hands could happen quite easily.

The efficacy of containment operations is extremely difficult to predict; therefore, once we decide to take action (preemptive or otherwise) we should have a strong bias toward regime change as a necessary condition for success. If a regime's actions are so provocative that they require armed intervention by the United States, we should give strong preference to removing that regime as part of the intervention. Clearly, every case does not call for regime change, but it seems to be a good "default" position. The British did not force a regime change after the Falklands War, but neither did they see a need to continue sanctions in order to contain Argentina in the future. A discussion of the costs of the Gulf War later in this article will explain how an economic view can lead to this proposition.

What defines provocative actions? The *National Security Strategy* spells out five attributes that rogue states tend to share. Specifically, they

- brutalize their own people and squander their national resources for personal gain of the rulers;

- display no regard for international law, threaten their neighbors, and callously violate international treaties to which they are a party;
- are determined to acquire weapons of mass destruction, along with other advanced military technology, to use as threats or offensively to achieve their aggressive designs;
- sponsor terrorism around the globe; and
- reject basic human values and hate the United States and everything for which it stands.¹⁹

These actions give a clearer understanding of which countries may provoke the United States to action. However, it is extremely unlikely that the war on terrorism would lead us to armed intervention in every state that shares many, if not all, of the above attributes.

If we are to make efficient decisions about where to intervene, we must be able to assess the costs and benefits of such actions. Which countries pose the greatest threats and are likely to require intervention? Those countries that have access to valuable natural resources are the most probable candidates since they are likely to have the ability to finance their operations and make an impact beyond their borders. Countries with significant natural resources may also threaten modern economies (especially within a region) by withholding access to those raw materials. We also should assess potential threats on economic as well as moral and foreign-policy grounds. Nevertheless, totalitarian regimes whose countries lack natural resources are not likely to produce smoothly functioning economic systems that generate substantial wealth; therefore, most of these rogue states will not have the means to pose a substantial threat to the United States.²⁰ We may choose to engage these countries on moral grounds (e.g., to prevent genocide) or to help friends in the region, but a direct security threat to the United States is less likely in these cases. On the other hand, countries that do have access to valuable natural re-

sources such as oil can use them to sponsor mayhem around the globe.

Costs versus Investments

As we implement this new security strategy, we must take the long view of the consequences of our actions. For example, one argument for terminating the Gulf War of 1991 prematurely was that we did not want to destabilize Iraq and be forced into bearing the cost (in terms of both money and personnel) of a lengthy nation-building effort. This concern, however, turned out to be a false economy. Instead of conducting a nation-building campaign that could lead to a self-sufficient country, we had to maintain large numbers of troops in the region to contain Iraqi actions. The United States needs to clarify its analysis of the debate over containment versus nation building. Containment actions result in costs, whereas nation-building expenditures are more akin to investments that pay dividends in the future. But we need not go on a massive nation-building campaign throughout the world. We should simply clarify our analysis of the costs of nation building versus sanctions, especially regarding containment operations. This dilemma demonstrates the differences between costs and investments. Costs tend to maintain the status quo, but investments provide increased returns and economies of scale in the future.²¹

Marginal versus Containment Costs

The crux of this argument is that the marginal costs of forcing a regime change once an armed conflict occurs are almost always less than those of a shorter campaign followed by a containment strategy. This assumes that the costs of undertaking the first part of the conflict are "sunken" once the decision for armed intervention is made. The following conflict scenarios illustrate this point:

Scenario one: regime change is forced during the course of the initial conflict. Additional marginal

losses occur in both the military and civilian populations. Postconflict losses are minimal but still happen due to incidents that arise during nation-building efforts. The costs of nation building are significant, but the total expense is likely to be less than that of the other scenarios.

Scenario two: minimal objectives are met for the conflict and a long-term containment strategy is adopted afterward. Initially, marginal losses are nil for both the military and indigenous civilian populations. However, containment costs are extensive in terms of both fiscal resources and human lives. Fiscal costs are easy to visualize, especially if the containment period is lengthy. The cost in human lives is not as easy to predict since it includes not only losses to the civilian population from direct actions of the totalitarian regime, but also indirect losses from the hardships produced by sanctions. Military losses include both increased training losses and those due to terrorist actions that become feasible when forces are placed in high-risk environments for long periods. Examples include the losses associated with the bombing of the barracks in Dhahran, Saudi Arabia, and of the USS *Cole*.²²

Scenario three: minimal objectives are met for the conflict and a containment strategy is adopted afterward; however, at some later date, a regime change occurs due to the actions of internal forces. The marginal costs of this strategy can be minimal, but the type of regime that replaces the original government may be just as problematic for American interests as the original antagonist.

Scenario four: minimal objectives are met for the conflict and a containment strategy is adopted afterward; however, at some point in the future, the actions of the totalitarian regime become so provocative that regime change becomes necessary. Obviously, this is the most costly of all the scenarios.

These scenarios are not necessarily comprehensive, but they provide a fairly good view of the possibilities in many potential conflicts. In algebraic terms, $MC + NBC < CC$ reflects the idea that the marginal costs (MC) of regime change plus the nation-building costs (NBC) are frequently less than the containment costs (CC) for many scenarios. This assertion is especially true for scenario four, in which the containment-costs term consists of the expense of a new campaign for regime change plus that for nation building as well.

The formula is not meant to describe some sort of “natural law.” The four scenarios are all predicated on the fact that the decision to engage in armed conflict has already been made. The formula represents some of the assessments that must be conducted to determine the appropriate course of action; it is certainly within the realm of possibility that the marginal costs of regime change could be greater than the potential containment costs. The primary point is that we should make a full accounting of the elements in the equation in order to arrive at the appropriate decision.

The United States has used containment strategies successfully in the past, especially during the Cold War with the Soviet Union. In this situation, the marginal costs of regime change likely would have been complete nuclear war. Clearly, these costs would exceed the containment costs—even though the containment period lasted for almost 50 years.

Implications for the Future

The new security strategy relies upon continued development of effects-based warfare doctrine—especially since difficult regime-change operations may become more likely in the future. The question then becomes, How do we continue to develop our doctrine and capabilities as we reach the limits of improvements in precision targeting?

Previous research makes a powerful argument that much of our success in the Gulf War of 1991 stemmed from our ability to project an image of omniscience, omnipresence, and omnipotence to the Iraqi forces.²³ Of course we were none of these, but many of the Iraqi soldiers on the ground (remember, there were none in the air) felt otherwise. Our responses to Iraqi battlefield movements were so quick and overpowering that most soldiers realized that resistance was futile. In fact, we were unprepared for the large numbers of surrendering Iraqi soldiers.

If we move our effects-based doctrine forward with the idea of dominating the battle space, how does that affect our cost-benefit analysis for the future? Two possibilities come

to mind. The first is an investment in improved information-processing capabilities, and the second is an investment in education for our most important resource—our people. I use the term *investment* very deliberately here. Both of these strategies should provide dividends and increased economies of scale for the future force.

If we are to dominate future adversaries, our information-processing capabilities must continue to improve. This is especially true as we try to engage decentralized, nonstate actors such as terrorist organizations. Our rapid improvement in precision-targeting technologies has provided great benefits, but we are reaching a point of diminishing returns. In what types of technologies should we invest? Three stand out: visual recognition, speech recognition, and artificial intelligence. In order to maintain the “full-spectrum dominance” called for by *Joint Vision 2020* with smaller, more agile forces in the future, these technologies will be essential.²⁴ Speech recognition and artificial intelligence are especially critical. Our data-collection technologies have advanced to the extent that we cannot hope to analyze all of the collected information with traditional human analysis. Language-screening programs that do the initial analysis would better enable us to target our resources worldwide. Of course, these programs must work in a variety of languages and dialects—a task not currently feasible. Nevertheless, successful investments in these areas could pay huge dividends.

Improved data processing and artificial intelligence will go only so far, however. We must improve our understanding of other languages and cultures in order to make effective use of these technologies. Precision targeting requires precision knowledge of the local environment—especially the language and culture. We currently develop our leaders (both officer and enlisted) with a superb system of professional military education (PME). Recently, Gen John P. Jumper, chief of staff of the Air Force, implemented a broadened concept for PME called developmental education. This is a necessary leap as we seek to groom leaders for the more complex environments of the future;

however, we can expand recent movements toward developmental education even more.²⁵

For one of the more successful efforts at achieving enhanced military education, one need only look to the School of Advanced Air and Space Studies (SAASS) at Maxwell AFB, Alabama. Lt Gen Donald A. Lamontagne, commander of Air University, recently observed that "SAASS graduates have always been in high demand for key staff and command positions, but the day after Sept. 11, my phone was ringing off the hook. People responsible for planning for this new kind of war wanted to know where the SAASS grads were."²⁶ SAASS is a great example of successful investing in our people. When commanders must consider serious actions, they want graduates with high-level expertise in doctrine and planning.

Unfortunately, finding people with expertise in the local language and culture is more difficult. In 1996 the Air Force set a goal that 10 percent of officers should have proficiency in a foreign language by 2005.²⁷ Recent figures show that we are only halfway there, and it seems unlikely that we will achieve this target by the specified deadline.²⁸ Programs such as those for foreign-area officers and Olmsted scholars help achieve this goal, but they fall outside the normal military developmental-education process. We should add foreign-language instruction to our traditional PME programs, thereby merging language and culture studies with doctrine studies. Currently, exposing our people to both types of knowledge environments is difficult. Moreover, we should consider creating a similar program for selected enlisted personnel. "Study abroad" programs, offered by most undergraduate institutions, represent a wonderful opportunity for some of our enlisted personnel who are seeking an undergraduate degree.

These expensive education programs may seem extravagant, but we should view them as investments. One can acquire such precise cultural knowledge only through experience—we must invest as much in this type of knowledge as we do in technical knowledge. A more integrated approach to our developmental-education efforts would mean that such in-

vestments in education would be more likely to pay dividends when commanders find themselves involved in planning complex operations. In addition to the foreign-language instruction at in-residence PME, we could add a more advanced course to the curriculum, thus complementing SAASS. One could call the new program the School for Advanced Language and Culture Studies (SALCS), offering intensive language instruction followed by study abroad at a university. Commanders can readily locate SAASS graduates, but we need to increase the number of officers with extensive doctrine knowledge, coupled with an understanding of local language and culture.

If we are to move forward with effects-based concepts, we must develop precision knowledge of the environment to complement the other advances. The actions mentioned here should help with all steps of the effects-based planning model developed by Col Edward Mann, USAF, retired; Lt Col Gary Endersby, USAF; and Tom Searle. Those steps include researching the strategic environment, determining policy goals, parsing and integrating the mission, and assessing effects.²⁹

Limitations of the Economic View

As with any economic approach, the conclusions depend heavily upon the assumptions made to develop the arguments. Ironically, one of the most problematic assumptions of this idea is that one can calculate the costs of warfare and national strategy with any precision. Certainly, we can't put some sort of economic value on human lives; furthermore, moral decisions must override economic decisions.

Thus, the economic approach presented here does not imply that we can calculate all of the costs and benefits of our actions with perfect certainty—especially in the fog of war. However, the difficulty of calculating costs and benefits does not mean that we gain nothing from this approach. Even chaotic systems tend to behave within some boundaries.³⁰ Understanding the cost-benefit structure that shapes these boundaries should prove a useful exercise for decision makers now and in the future.

Another underlying assumption of an economic approach also merits some discussion in this context. Typically, economic models are based on an assumption of rational behavior by the relevant actors in the situation. Certainly, many tyrants do not adhere to our notions of rational behavior. However, we can still derive advantages from this model if the behavior of the antagonist is reasonably rational. The model can in fact provide some insight without an assumption of rational behavior. Indeed, irrational behavior by the enemy can make a much more compelling case for action in some situations. Even by assuming rationality on only one side of the situation (ours), we can nevertheless undertake an assessment of costs and benefits that will have significant value for decision making.

Conclusion

This article does not imply that the United States has used cost-benefit analysis unsuccessfully in the past. The primary point is that we must reassess how we calculate those costs and benefits in the future due to the imperatives imposed on us by the new national security strategy, and we must use that analysis to make our doctrine more effective. Moreover, we must increase our investments in resources that allow us to make more effective assessments of those costs and benefits.

Technology has radically changed the face of warfare in the modern age—with significant consequences for decision makers. New technology allows the United States to use force with more precision and less cost in terms of fiscal resources and lives. However, improved technology also enables terrorists to wreak havoc with very few resources. These changes have led to a new national security strategy that reflects these problems. An economic view of these new realities can clear a sometimes muddy picture, leading to two conclusions: (1) we must continue to develop our notions of effects-based warfare, and (2) technological improvements in the future are likely to come from sources other than precision weapons. Further development of the eco-

omic view can help us use our resources effectively to meet the challenges of the modern world.

Postconflict containment by means of sanctions is mostly a failed policy, and its costs are enormous. We should consider such containment a preconflict—not postconflict—strategy. As in all things strategic, this is not a hard-and-fast rule. Sometimes the costs associated with regime change will prove too great, but we must be more realistic in calculating those costs.

Finally, in order to further develop our concepts of effects-based warfare, we must improve our information-processing capabilities, which include strategies for both collection and analysis. Traditional evaluations of potential targets must provide a richer picture of the total environment in order to see further gains in our application of effects-based doctrine. Improvements in our PME system are necessary to provide this enhanced picture.

Clearly, some of the ideas articulated in this article fall into the realm of national-strategy decisions that are not traditionally the purview of military officers. We implement the strategy decided upon by our civilian leadership. However, as key players in the development of security strategies, we frequently provide an opinion and a likely outcome from a given course of action. It is in this role as “trusted advisors” and participants in developing strategy that these ideas can enhance our national security.

Postscript

Currently, the cost-benefit question of Operation Iraqi Freedom, which occurred after this article was written, is receiving great attention in the press. The costs of the conflict proved generally less than anticipated, but the benefits also seem to be less than expected—at least at this early stage. Specifically, US forces have not yet found conclusive evidence of weapons of mass destruction (WMD) in Iraq—a problematic situation since the Bush administration used the near-certainty of finding them as a central argument for going to war. Despite its treatment in the press, this

lack of evidence does not necessarily mean that we erred in using WMDs as the basis for the decision to remove the Iraqi regime.

Once again, an economic framework proves useful here. Economists frequently use a tool called "expected value" to assess situations of uncertainty. The idea is relatively simple. If an investment has a 90 percent probability of paying \$100, then the expected value of the investment is \$90. For simplicity's sake, let's assume that the other 10 percent probability is that the value of the investment will be \$0. It makes economic sense to choose the investment for all costs less than \$90 (this also assumes that we will play the investment "game" repeatedly). However, choosing the investment at a cost less than \$90 doesn't necessarily mean we will make money. Chance may dictate that our actual return on the investment is \$0. (Variations exist on how one chooses to approach a situation such as this one, based on risk tolerance, but I have chosen one of the simplest strategies to keep things straightforward.) If our actual return is \$0, did we make a bad decision? No. It is easy to fall into the "bad outcome equals bad decision" fallacy here, but in this example we made a sound decision, based on the available information.³¹

One can apply the expected-value analysis to the question of WMDs as well. Available intelligence pointed to an extremely high prob-

ability of finding such weapons in Iraq. Even if we never find them, an expected-value analysis suggests that we made the correct decision. The costs of the conflict were less than the expected value of finding WMDs. Further, given the size of Iraq, it is still very possible, even likely, that we will find the evidence we seek.

What lessons can we learn from this expected-value viewpoint? The most obvious is that the reliability of our probability function is critical. Achieving an accurate assessment of the probabilities of various outcomes further strengthens the "precision knowledge" arguments made previously in this article. Effective use of these cost-benefit tools, even in uncertain environments, requires the best possible intelligence. Second, although intelligence information will never be perfect, we can still base our decisions on sound reasoning. An unexpected outcome does not necessarily mean that we have made a bad decision. After the conflict, we can assess our actions carefully to see where we might improve in the future. We tend to conduct this process well, in both our successes and failures. Currently, low-level conflict continues in Iraq, and it is probably a little early to make conclusive judgments about Iraqi Freedom; nevertheless, in terms of the economic viewpoint outlined in this article, it would be difficult to declare it anything other than a success. □

Notes

1. George W. Bush, *The National Security Strategy of the United States of America* (Washington, D.C.: The White House, September 2002), on-line, Internet, 4 December 2002, available from <http://www.whitehouse.gov/nsc/nss.pdf>.

2. See, for example, D. Milbank, "Cheney Says Iraqi Strike Is Justified," *Washington Post*, 27 August 2002, A1; and J. A. Mayer, "A Doctrine Passes," *New Yorker*, 7 October 2002, on-line, Internet, 11 October 2002, available from <http://www.newyorker.com>.

3. Michael Kelly, "A Doctrine of Armed Evangelism," *Washington Post*, 9 October 2002, A31.

4. Ibid.

5. See Maj Gen David A. Deptula, "Air Force Transformation: Past, Present, and Future," *Aerospace Power Journal* 15, no. 3 (fall 2001): 85-91, on-line, Internet, 4 December 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/phifal01.html>.

6. John A. Warden III, *The Air Campaign: Planning for Combat* (San Jose, Calif.: toExcel, 1998).

7. See Brig Gen David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (Arlington, Va.: Aerospace Educa-

tion Foundation, 2001), on-line, Internet, 4 December 2002, available from <http://www.aef.org/pub/psbook.pdf>.

8. See Col Edward Mann, Lt Col Gary Endersby, and Tom Searle, "Dominant Effects: Effects-Based Joint Operations," *Aerospace Power Journal* 15, no. 3 (fall 2001): 92-100, on-line, Internet, 4 December 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/vorfal01.html>.

9. See Maj T. W. Beagle Jr., *Effects-Based Targeting: Another Empty Promise?* (Maxwell AFB, Ala.: Air University Press, December 2001), on-line, Internet, 8 December 2002, available from <https://research.maxwell.af.mil/papers/ay2001/saastheses/beagle.pdf>.

10. Gordon Moore, one of the cofounders of Intel, formulated Moore's Law, which states that the number of transistors on a chip (and, consequently, the processing power) will double every 18-24 months.

11. See David Coursey, "Does Intel Still Matter? Yes, but . . ." *ZDNet AnchorDesk Online*, 24 February 2003, on-line, Internet, 24 February 2003, available from <http://www.zdnet.com/anchordesk/stories/story/0,10738,2911357,00.html>.

12. See Prof. George J. Stein, "Information Warfare," *Airpower Journal* 9, no. 1 (spring 1995): 31-39, on-line, Internet, 8 December 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/apj/stein.html>.

13. Warden, 46.

14. H. Norman Schwarzkopf with Peter Petre, *General H. Norman Schwarzkopf: The Autobiography: It Doesn't Take a Hero* (New York: Bantam Books, 1992), 319.

15. The North Korean situation illustrates the difficulty of maintaining comprehensive sanctions. In the early 1990s, as the sources of support (especially the Soviet Union) for the Korean regime evaporated, we provided some aid to North Korea in return for concessions concerning its nuclear-weapons program. New evidence reported in the press seems to show that this deal had little or no effect on reducing that program.

16. Wesley K. Clark, *Waging Modern War: Bosnia, Kosovo, and the Future of Combat* (New York: Public Affairs, Ltd., 2001), 11-12.

17. A. Karatnycky, "Ukraine's Rogue President," *Wall Street Journal Online*, 9 October 2002, on-line, Internet, 9 October 2002, available from <http://online.wsj.com>.

18. George F. Will, "A Retrospective on Disarmament," *Washington Post*, 15 December 2002, B7.

19. Bush, 14.

20. Although oil is the most likely resource to provide rogue states significant income in the immediate future, other resources, such as diamonds or drugs, could do so in the future. One should also note that, as technology improves the threshold of resources required to sponsor terror, the threat is likely to become lower. North Korea seems to be the notable exception to this rule. That country, despite a crippled economy, has managed to assemble a credible threat largely due to cash generated from weapons sales and the support of other nations to help meet its goals.

21. This does not imply that investments carry no risks. Uncertainty exists, no matter the course chosen. Nevertheless, investments have a positive "expected return."

22. One could argue that the United States would have had these forces in the region, regardless of a regime change in Iraq. However, the number of forces could have been less had the region become more stable by means of a regime change.

23. Edward C. Mann III, "Inbound and Ready: Controlling an Adversary and Shaping the Battlespace for Decisive Operations" (unpublished paper, Maxwell AFB, Ala.: Airpower Research Institute, 2001).

24. *Joint Vision 2020* (Washington, D.C.: Joint Chiefs of Staff, 2000), on-line, Internet, 4 December 2002, available from <http://www.dtic.mil/jv2020>.

25. See "Chief's Sight Picture: Total Force Development," 6 November 2002, on-line, Internet, 25 February 2003, available from <http://afas.afpc.randolph.af.mil/pme/docs/Total%20Force%20Development.doc>.

26. "Strategy School Changes Name, Expands," Air Education and Training Command News Service, February 2003, on-line, Internet, 24 February 2003, available from <http://www.af.mil/stories/story.asp?storyID=22003482>.

27. "Air Force Provides Opportunities for Foreign Service," Air Force News Service, 31 August 1998, on-line, Internet, 24 February 2003, available from http://www.af.mil/news/Aug1998/n19980831_981311.html.

28. Amy Parr, "Opportunities Available for Officers to Expand Global Skills," Air Force News Service, 22 June 2001, on-line, Internet, 24 February 2003, available from http://www.af.mil/news/Jun2001/n20010622_0836.shtml.

29. See Mann, Endersby, and Searle.

30. See Maj Michael R. Weeks, "Chaos, Complexity and Conflict," *Air and Space Power Chronicles*, 16 July 2001, on-line, Internet, 24 February 2002, available from <http://www.airpower.maxwell.af.mil/airchronicles/cc/Weeks.html>.

31. See Robert H. Frank, *Passions within Reason: The Strategic Role of the Emotions* (New York: W. W. Norton & Company, 1989).

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