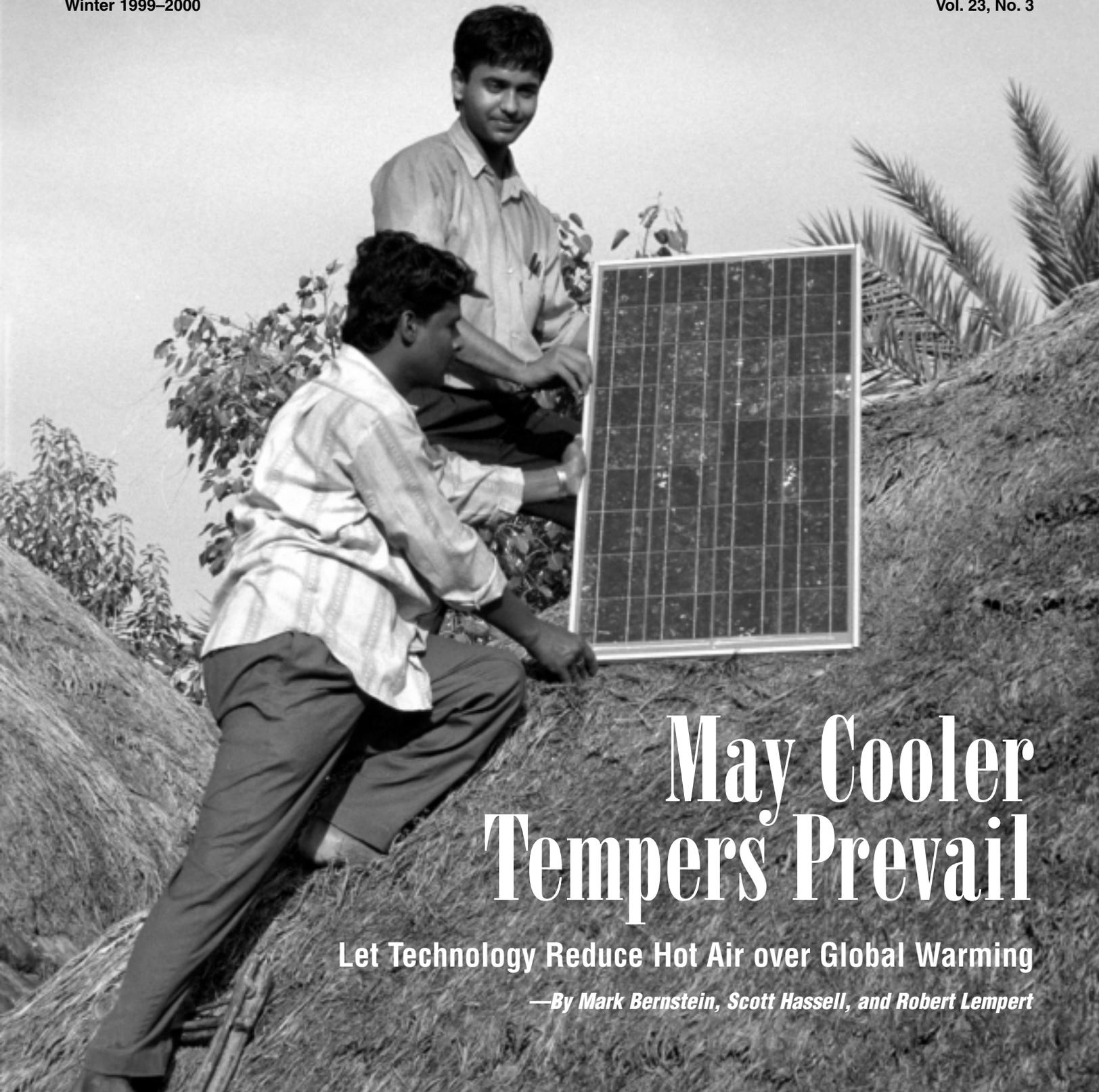


# RAND REVIEW

Winter 1999–2000

Vol. 23, No. 3



## May Cooler Tempers Prevail

Let Technology Reduce Hot Air over Global Warming

—By Mark Bernstein, Scott Hassell, and Robert Lempert

**SWEET AND SOUR: RECIPE FOR A NEW CHINA POLICY—BY ZALMAY M. KHALILZAD  
TROOP FORMATIONS: MILITARY PERSONNEL REFORMS CONTAIN ELEMENTS OF SURPRISE**

## Message from the Editor

**S**ometimes it takes hard work to keep our options open. It takes more than avoiding a decision or postponing a choice. Rather, it takes the diligent effort of laying a foundation to make future choices possible.

That's what our two lead stories are about in this issue. The cover story on global warming—or, more accurately, climate change—does not pretend to predict the environmental or economic consequences of continued global emissions of fossil fuel pollutants. What the story does argue, however, is that we don't have to continue emitting these pollutants into the atmosphere, we don't have to back ourselves into a corner in the event that the warnings about global climate change prove correct, and we don't have to compromise economic growth in developing countries or industrialized countries to ensure future environmental health. We can "grow clean," provided we take advantage of the flourishing opportunities to wean ourselves from our dependency on fossil fuels.

The need for all nations to eschew fossil fuels is far from scientifically certain at this point, and radical global reductions in the use of these fuels may never be required, say Mark Bernstein, Scott Hassell, and Robert Lempert. But now is not the time to revel in our nescience. Now is not the time to embrace either side of the climate change debate—either by wallowing in unbridled fossil fuel consumption, which could constrain our future choices, or by curtailing economic development, which could constrain our future capabilities. Instead, now is the time to work out the kinks in the alternative fuel technologies that could spare us from ever having to face an environmental or economic disaster of our own making in the first place. We can give ourselves the option to grow clean, if that proves necessary, if we lay the foundation today for energy choices tomorrow.

Our other lead story, on U.S. policy toward China, charts a similarly careful course. Zalmay Khalilzad rejects both the argument for engaging China and the argument for containing China. Both arguments could be equally self-defeating if the premises of either argument were to prove wrong. China is in the throes of transition, and it's too soon to tell how transpacific relations will evolve. Choosing between engagement and containment today is premature. Instead, we should plan for the best—engagement—but prepare for the worst—containment. Such a blended strategy is more difficult to pull off, but it might be the only way to keep our options open until the day comes when we really need to make the choice.

—John Godges

# RAND REVIEW

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Let technology reduce hot air over global warming



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Military personnel reforms contain elements of surprise

### On the Cover

Ramakrishna Mission staff trainees install a solar photovoltaic module in an isolated village of Gosaba in the Sundarbans region of West Bengal, India. The solar modules will bring light to 300 homes here as well as to health centers, youth clubs, and other village institutions. The work is supported by the Indo-U.S. Renewable Energy Project, a collaboration of Indian governmental agencies and the U.S. Department of Energy. India could be an ideal location for expanded use of renewable energy technologies, given its plentiful renewable energy resources, its limited capacity to generate electricity, the suitability of small renewable energy systems to the needs of remote villages, and the desire of Indian companies and agencies to work with U.S. organizations.

U.S. NATIONAL RENEWABLE ENERGY LABORATORY/HARIN ULLAL

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## News

### Experimental Drug May Be Linked to Gulf War Illness

Pyridostigmine bromide (PB), a nerve-gas antidote given to as many as 250,000 U.S. troops during the Persian Gulf War, “cannot be ruled out as a possible contributor” to the mysterious illnesses suffered by veterans of that war, according to a new RAND study.

PB was approved by the U.S. Food and Drug Administration in 1955 for treatment of myasthenia gravis, a disease that affects the muscles. During the 1991 Gulf War, PB was administered to U.S. forces as an “investigational new drug” for pretreatment against soman, a nerve agent, in anticipation of an Iraqi nerve agent attack. The RAND report also found that the effectiveness of PB in protecting humans against nerve agents is uncertain.

Commissioned by the U.S. Department of Defense, the report was prepared by Beatrice Alexandra Golomb, a RAND consultant who is also a staff physician at the San Diego Veterans Affairs Medical Center, assistant professor of medicine at U.C. San Diego, and research associate professor in the psychology department at the University of Southern California.

Golomb found evidence to support at least one hypothesis regarding how PB might lead to illness. PB inhibits the normal action of an enzyme, acetylcholinesterase, which regulates how nerve signals are sent to other nerve cells and muscle cells. These signals are

known to be vital to controlling normal muscle action, pain, sleep, mood, and cognitive function—domains that figure prominently in complaints of ill Gulf War veterans. Modest or high doses of PB and similar drugs in animals have proven to cause altered regulation of these signals. Golomb also found that there might be differences in susceptibility to PB from one individual to another.

The study (available as RAND/MR-1018/2-OSD) is the latest in a series of RAND analyses of the scientific literature relating to plausible causes of Gulf War illnesses. Previous studies have all but ruled out oil well fires and depleted uranium as causal factors. One study found inconclusive evidence to link Gulf War illnesses to wartime stress alone, but the latest report does find that stressful conditions may allow PB to penetrate the blood-brain barrier.

Still to come are reports on chemical and biological warfare agents, pesticides, immunizations, and infectious diseases.

### Lay Down the Law in Class Action Cases, Judges Urged

To eliminate abuses and improve outcomes in class action lawsuits for money damages, judges should scrutinize proposed settlements more closely and turn a steelier eye toward attorney fee requests, according to a new study.

“Judges hold the key,” say the authors of *Class Action Dilemmas*:

*Pursuing Public Goals for Private Gain, Executive Summary* (RAND/MR-969/1-ICJ). “The single most important action that judges can take to support the public goals of class action litigation is to reward class action attorneys only for lawsuits that actually accomplish something of value to class members and society.” The authors also urge judges to dismiss cases that have no legal merits and to reject unworthy settlements.

In response to increased litigation, business leaders have called for reforms of class action rules. Those in favor of drastic reform argue that “bounty-hunting” trial lawyers have dramatically increased the amount of litigation, imposing higher costs for business and greater burdens on the courts.

Proponents of class actions, meanwhile, contend that the lawsuits are necessary to right the wrongs suffered by consumers and other victims and to encourage corporate responsibility.

The researchers argue that these differences in perspective have stymied earlier efforts to reduce class action abuse. “Many of those on both sides of the political divide share concerns about current class action practices,” said lead author Deborah Hensler, a RAND senior fellow and Stanford University Law School professor. “By shifting the focus of the debate to improving the way these suits are litigated, the antagonists could find common ground.”

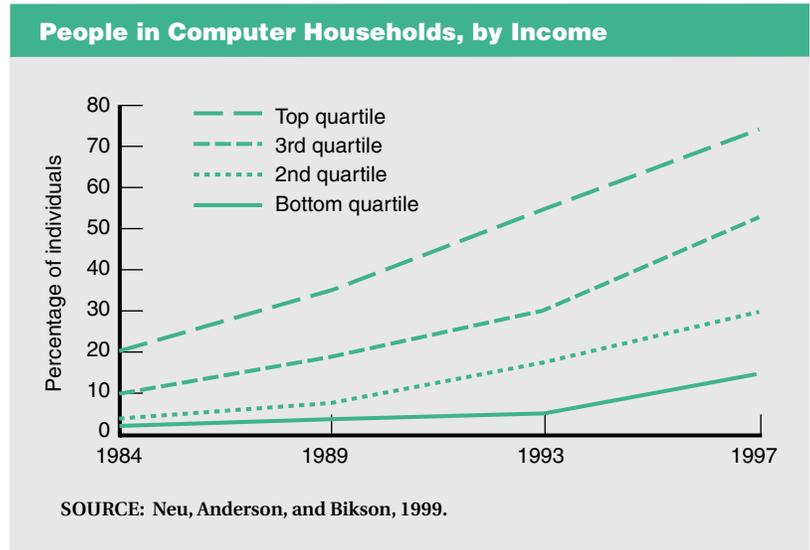
**Government E-Mail Could Cut Costs, Improve Service**

Government agencies that generate high volumes of personalized communications with citizens should immediately begin developing the means to use e-mail to supplement regular mail, the telephone, and office visits, a new study recommends.

As Americans have discovered with Internet banking, shopping, and entertainment, e-mail can be cheaper than postal mail or phone calls and a faster, more convenient way to obtain services. Government agencies would be wise to prepare for the day when U.S. citizens will demand e-mail communication with them, according to C. Richard Neu, Robert H. Anderson, and Tora K. Bikson in their report, *Sending Your Government a Message: E-Mail Communication Between Citizens and Government* (RAND/MR-1095-MF).

The U.S. government pioneered the Internet but now lags behind in capitalizing on the revolution it has wrought, and statehouses and city halls lag as well, say the authors. Although federal, state, and local government web sites provide plenty of reports and forms for downloading, the agencies “are failing to take advantage of what is perhaps the most important feature of these new communications technologies—the ability to communicate at very low cost and almost instantaneously” in a format that simplifies document processing.

The authors say the U.S. Health Care Financing Administra-



tion could reap huge savings by e-mailing a chunk of the 300 million Medicare summary notices that now get mailed in hard copy each month. Similarly, the California Employment Development Department could dramatically cut staff time and costs by giving citizens the option of e-mailing unemployment insurance claims, 28 million of which now get filed annually at field offices throughout the state.

The study finds that the main barriers are not technological ones; rather, they are security issues, investment costs, and the “digital divide” between those who have access to computers and the Internet and those who do not.

Secure communications will depend on the ability of “certificate authorities” or other institutions—such as banks, post offices, health insurance providers, motor vehicle departments, or the Social Security Administration—to issue digital “certificates” identifying each user, to grant each user various levels of

authority for obtaining information, to maintain certificate lists for verification purposes, and to replace lost or stolen certificates.

Meanwhile, the social gaps in home computer usage continue to widen. In 1997, fully 75 percent of Americans in the upper income quartile had access to a home computer, compared with only 15 percent in the bottom income quartile (see figure).

The authors advise that the U.S. Postal Service or a comparable national service provider create a unique e-mail address for every resident and organization in the United States. Messages sent to such an address could be either routed to an existing e-mail account or, for those without one, printed and delivered via regular mail. Public computer terminals—placed in accessible locations, such as libraries or community centers, with instruction and assistance for those who need it—would dovetail with a national system of e-mail addresses.

### Closing Education Gaps Could Pay Its Own Way

Unless aggressive steps are taken to alter current trends, the gap in educational attainment between whites and Asians compared with blacks and Latinos will widen in the next 15 years, but a national effort to narrow the gap could more than pay for itself, a new study has found.

Uneven rates of college enrollment and graduation figure to be most pronounced in California because of its many immigrants and Latinos. By 2015, blacks and Latinos will account for 40 percent of the state's population. If current trends continue, blacks and Latinos will account for an overwhelming majority—75 percent—of the state's high school dropouts, while whites and Asians will constitute an overwhelming majority—89 percent—of the state's college graduates. Other states will face similar disparities but to a lesser degree.

RAND researchers Georges Vernez, Richard A. Krop, and the late C. Peter Rydell developed the RAND Education Simulation Model to track these and other trends and to estimate the costs and benefits of adding the educational resources necessary to equalize educational attainment across ethnic groups. The estimates assume that there will be a marked increase among blacks and Latinos in their preparation and demand for high school completion and college entrance.

In California alone, taxpayers would need to contribute, in 1997 dollars, an additional \$9 billion annually—or 21 percent of the

state's education budget—to ensure that blacks and Latinos complete high school and college at the same rate as whites. In the rest of the nation, costs would need to increase \$14 billion a year, or 8 percent.

However, for each dollar spent in California, the long-term savings from reduced public health and welfare expenditures and increased tax revenues from higher incomes would be \$1.90. For the rest of the nation, the benefits would total \$2.60 on the dollar. The difference stems largely from the fact that California has relatively more Latinos, while the rest of the nation has relatively more blacks. Latinos tend to use public services less than average, whereas blacks tend to use them more than average.

More modest and less costly gains could be achieved with limited goals, according to the report, *Closing the Education Gap: Benefits and Costs* (RAND/MR-1036-EDU). For example, it would cost roughly half as much, in California and elsewhere, to add the educational capacity needed if only the high school graduation rates of blacks and Latinos were to be equalized with those of whites.

Although investments in education make sense, two factors could reduce the incentives for states to invest. First, a state that does not produce all the college graduates it needs could import them from another state or country at no immediate cost. Second, a state can lose its own graduates to another state or country before capturing the full benefit of the investment.

“The size of this phenomenon is not insignificant and is a strong argument for the federal government to play a leading role in promoting and funding efforts to close the educational attainment gap,” the authors conclude.

### U.S. Vocational Education, Instruction to Be Examined

Over the next two years, RAND will conduct a \$2-million study for the U.S. Department of Education to assess the quality of public vocational education in the United States, primarily at the high school level.

The RAND study, the largest of several studies mandated by Congress as part of the National Assessment of Vocational Education (NAVE), will examine whether federal efforts to improve vocational education throughout the decade have found their way into the classroom—and whether different results across vocational programs are associated with the quality of instruction.

Federal efforts have sought to integrate academic and vocational education, link vocational programs in high school with those for high school graduates, and broaden the instruction for careers and entire industries—not just for entry-level positions.

The study, directed by Cathleen Stasz, will include a national survey of teachers, case studies of schools and classrooms, and an examination of district, state, and federal policies. NAVÉ must submit a report to Congress on the outcome of all the studies by June 2002. ■

# Sweet and Sour

## Recipe for a New China Policy

By Zalmay M. Khalilzad

*Zalmay M. Khalilzad holds the corporate chair in international security at RAND and directs the Strategy and Doctrine Program for RAND's Project AIR FORCE. He served in the Bush administration as assistant deputy undersecretary of defense for policy planning.*

**C**hina's rise as a great power is beyond dispute. Its economic growth and potential, its current and future military capacity, the size of its territory and population, and its geopolitical location all make it likely that China will be a key player on the international scene in the 21st century. By 2020 China is likely to emerge as a formidable regional power capable of threatening U.S. allies in East Asia and posing an increased nuclear threat to the U.S. homeland. What is less certain is the role Beijing will choose to play in the world and how U.S.-China relations will evolve.

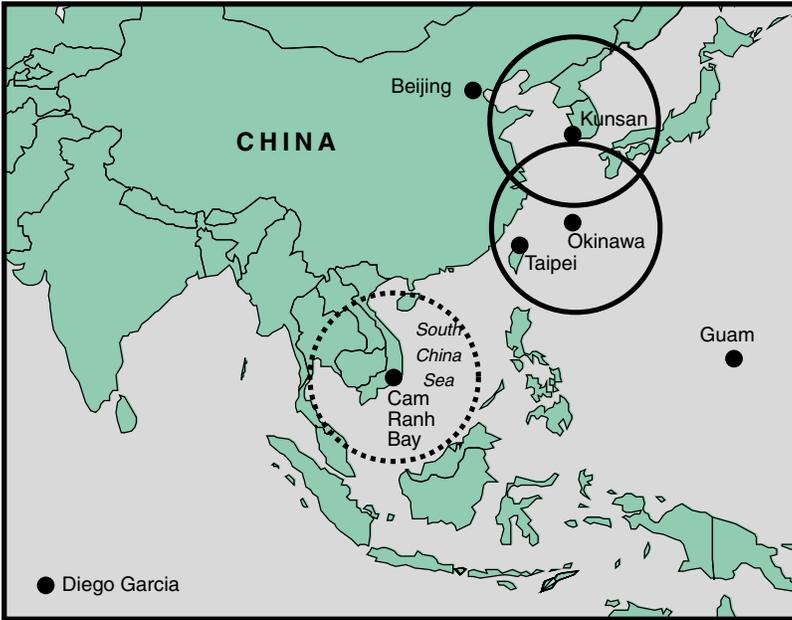
The last two administrations have both described their strategy toward China as one of engagement. However, there is a fundamental lack of consensus on what strategy can best achieve our purposes. Routinely every four years, and additionally whenever there is a crisis, our debate on China policy begins anew.

The central question in the current debate is whether the United States should abandon or modify its strategy of engagement. The Clinton administration believes that engagement has moderated Chinese behavior on international security issues, increased opportunities for trade and investment, and improved the situation in China itself. Congressional leaders, in contrast, have argued that Chinese efforts to acquire sensitive U.S. military technology, the absence of satisfactory progress on Beijing's human rights record, the

continued Chinese sale of missiles and nuclear-weapons-related technology to other states, and the increased number of Chinese missiles deployed across the Taiwan Strait demonstrate that the engagement strategy has failed.

Some on Capitol Hill believe that China is destined to become a major threat to the United States. Thus, they say, the goal of U.S. strategy in Asia should be to constrain the growth of Chinese power, both economic and military, and to oppose Chinese policies within its own region. In effect, these observers imply that we must move from engagement to containment.

But neither engagement nor containment is adequate for dealing with China, a growing power whose future remains highly uncertain. Engagement rests on the hope that economic, political, and military connections will either transform China into a cooperative democracy or, at minimum, produce convergence on some key interests. This is a supposition. In the meantime, it is a fact that U.S. engagement is helping China develop economically and militarily. Thus, should China become hostile, our current mode of engagement will merely have made China into a potentially more threatening adversary. But shifting to containment is equally troublesome. Such a strategy presupposes that China will ultimately become hostile, giving short shrift to the possibility that Sino-U.S. relations



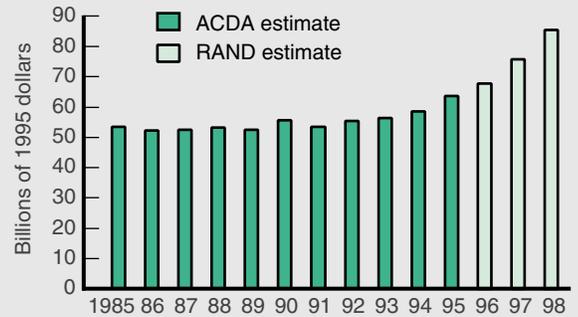
**BEYOND REACH**

U.S. Air Force bases in Kunsan, South Korea, and Okinawa, Japan, are situated too far northeast for today’s U.S. fighter aircraft to repel hypothetical Chinese military incursions in the South China Sea. The solid rings indicate the maximum unrefueled range of U.S. fighter aircraft now at the bases in South Korea and Japan. To close this geographical gap, a “conengagement” strategy might lead the United States to take preparatory steps toward forming new alliances with other nations in the region or establishing new military bases in Southeast Asia, such as at Cam Ranh Bay in Vietnam. In addition, by 2015 the Chinese could field hundreds of long-range cruise and ballistic missiles capable of hitting U.S. bases in the region and nearby U.S. allies, particularly Taiwan. One way to deter such missile strikes would be for the U.S. military to develop and deploy longer-range aircraft systems, such as medium-range bombers with standoff missiles; longer-legged fighters, bombers, tankers, reconnaissance aircraft, and other support platforms; and, over the very long term, space-based systems.

could evolve in a more cooperative direction. Containment could become a self-fulfilling prophecy, setting the stage for a confrontation where none existed.

Neither engagement nor containment balances the two key U.S. objectives, which should be to encourage China to become more democratic and cooperative while at the same time protecting U.S. interests in case China becomes more hostile. The next administration should transcend both containment and engagement and should embrace neither. Instead, it should adopt a new, blended strategy, which could be called “conengagement.”

**Estimated Chinese Defense Spending, 1985–1998**



NOTES: The 1985–1995 ACDA estimates of Chinese defense expenditures, expressed in constant 1995 dollars, are from U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers 1996*, Washington, D.C.: U.S. Arms Control and Disarmament Agency, 1997, p. 65. For 1996–1998, the real year-over-year increase in Chinese defense expenditures was calculated on the basis of the increase in the official Chinese defense budget, deflated by the implicit gross domestic product (GDP) deflator (which, in turn, was calculated by comparing the official figures for nominal and real GDP growth). Data for 1996 and 1997 were taken from China Statistical Publishing House, *China Statistical Yearbook*, Beijing, 1998, pp. 55, 58, 276. The official 1998 Chinese defense budget was taken from International Institute for Strategic Studies, *The Military Balance 1998/99*, London: Oxford University Press, October 1998, p. 178. The 1998 deflator was the increase in consumer prices, as given in The Economist Intelligence Unit, *Country Report: China, Mongolia*, London, 1999, p. 6. The real increases were then added to the ACDA estimate for 1995 to yield estimates for 1996 through 1998.

**The Limits of Engagement**

The engagement policy of the Bush and Clinton administrations has had three elements. Economically, engagement has meant opening Chinese markets to U.S. products, granting China “most-favored-nation” (MFN) trade status, reducing the number of goods and technologies covered by export controls, and allowing Chinese companies to operate relatively freely in the United States. Politically, Washington has tried to bring China into the various multilateral arms control regimes dealing with weapons of mass destruction, proliferation, and arms trade; to bring China into other



AP/WIDE WORLD PHOTOS/GREG BAKER

*Three Chinese women wait for customers at the California Wine Institute booth at the China Wine '99 exhibition in Beijing on Nov. 17, 1999. The four-day trade show of wine, spirits, beer, and related technologies coincided with the signing of a deal between the United States and China on China's entry into the World Trade Organization. Tariffs on foreign wines sold in China are expected to drop sharply if and when China joins the organization.*

international regimes dealing with such issues as human rights; and to include China in solving regional problems, from Korean tensions to nuclear proliferation in South Asia. Militarily, the United States has sought enhanced military-to-military relations to increase mutual confidence, agree on "rules of the game," promote cooperation, and avoid misunderstandings.

Enmeshing China in the international system can socialize Chinese leaders into international norms of behavior and increase their stake in the current system. China's cessation of the sale of long-range antiship cruise missiles to Iran is a good example. Initially this may have been a mere concession to the United States, but over time, as Chinese dependence on Persian Gulf oil grows, China may well become convinced that a global nonproliferation norm is actually in its best interest. Similarly, as China develops economically, it may see a global free-trade regime as useful and beneficial to itself and embrace the World Trade Organization (WTO) wholeheartedly, instead of attempting to

join the WTO while still protecting its state-owned enterprises from foreign competition. Increased Chinese interaction with the outside world can also promote democracy in China, and a democratic China will be less likely to

come into conflict with the United States and other democracies.

However, so far the results of our engagement policy have been less than advertised. On the one hand, it is true that China acceded to the Non-Proliferation Treaty (NPT) in 1992 and has played a helpful role in dealing with the North Korean nuclear problem. It supported the extension of the NPT, ratified the Chemical Weapons Convention, accepted limitations imposed by the Missile Technology Control Regime, and agreed to stop assisting Iran's nuclear program.

On the other hand, China has aided Pakistan with its nuclear weapons program and provided it with M-11 missiles. Despite publicly taking a position close to that of the United States on South Asian nuclear programs after the Indian nuclear explosions, privately China encouraged Islamabad to explode a nuclear device. Although China ratified the Chemical Weapons Convention and claims that it does not produce or possess chemical weapons, it in fact has an advanced chemical weapons program. Similarly, China is a party to the Biological Weapons Convention but pursues an offensive biological weapons program. And China continues to provide shorter-range missiles and other military assistance to Iran.

The problem with the engagement strategy is that it offers no guidance as to what should be done when Chinese actions conflict with U.S. interests or when China behaves badly. When China sells nuclear-related materials to Pakistan, no parallel responses are available. Engagement merely counsels that economic or diplomatic sanctions not be applied in retaliation. A trade ban imposed on the companies involved in selling sensitive materials would be consistent with engagement. But such sanctions would be hard to impose and enforce, and easy to circumvent, given the ability of the guilty parties in China to use front companies or other types of evasion.

More fundamentally, engagement rests on a bold assumption: that continued contact will eventually rectify Chinese behavior. The key weakness of the strategy is that it fails to outline what must be done to protect American interests should China become both more powerful and more hostile. In the meantime, the strategy helps China develop economically

**The results of our engagement policy have been less than advertised.**

and technologically, thus creating the base for future military strength.

### The Folly of Containment

Advocates of containment accept the claims of realist international relations theory: that rising world powers are likely to assert themselves and challenge the predominant power. These advocates interpret Chinese history—its tradition of regional dominance and its view of itself as having been victimized by the “West” during a century and a half of “national humiliation”—as proof that China will seek to exert at least regional hegemony in East Asia and to challenge the current system of international norms, which China sees as biased in favor of the system’s creators.

The goal of a containment policy would be to prevent an increase in China’s power relative to that of the United States. The policy would attempt to slow the growth of China’s power, both economic and military, and limit the expansion of Chinese influence beyond its borders. The United States would limit foreign trade and investment in China and prevent the transfer of any technology that might aid China’s military. It would end China’s MFN trade status and oppose the unification of Taiwan’s capital and technology with mainland China’s manpower. The United States would commit itself to defend Taiwan.

The United States would reorient its existing regional alliances toward the emerging Chinese threat. It would also need to forge new, anti-China alliances and build up the militaries of Vietnam, Indonesia, India, and other potential Chinese rivals. Besides maintaining its military bases in Korea and Japan, the United States would establish one or more new bases further south to be in a better position to respond to Chinese use of force against Taiwan, disputed areas in the South China Sea, or members of the Association of Southeast Asian Nations (ASEAN).

At present, containment is an inappropriate strategy for dealing with China. China is not seeking to dominate East Asia and is not in a position to do so. A Chinese threat to dominate the region is, to say the least, far from manifest. Adopting containment as a U.S. strategy would be costly, because U.S. trade and investment with China would suffer while others would gain

at our expense. Such a policy would also impede the operation of the United Nations Security Council, where China has veto power as a permanent member.

Containment is also unrealistic. First, it would be hard to obtain a domestic consensus to subordinate other policy goals (including trade), and it would be difficult to mobilize national energies on the basis of predictions that are not only extremely pessimistic but uncertain as well. Second, to be effective containment would require the wholehearted cooperation of regional allies and most of the other advanced industrial countries of the world; again, such cooperation would be difficult to obtain. Our allies in Western Europe may not believe that even a more aggressive China would pose a threat to them. The countries in the region by and large are not convinced that such a hard policy toward China is necessary.

In general, containment fatalistically projects an outcome that is far from inevitable. It unnecessarily resigns itself to unfavorable developments while overlooking the possibility that Sino-U.S. relations could evolve in a much more acceptable fashion. And whatever leverage over Chinese policies the United States might attain by means of engagement would be lost.

### The Merits of “Congagement”

Since neither containment nor engagement serves U.S. interests, a different strategy is needed. The best strategy must accomplish three things: preserve the hope inherent in engagement policy, deter China from becoming hostile, and hedge against the possibility that a strong China might challenge U.S. interests. Such a strategy could be called “conengagement.” It would continue to try to bring China into the current international system while both preparing for a possible Chinese challenge to this system and seeking to convince the Chinese leadership that any such challenge would be difficult to mount and extremely risky to pursue.

Under conengagement, we would enhance military, economic, and political relations with China. Recent contacts between the U.S. military and the People’s

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**Containment fatalistically projects an outcome that is far from inevitable.**



AP/WIDE WORLD PHOTOS

A Beijing vendor sells a newspaper on Aug. 12, 1999, with the headline, "High Tensions in the Taiwan Strait." The story includes an illustration of a mock dogfight between Chinese Su-27 and Taiwanese Mirage 2000 jet fighters and says China is sure to use force if Taiwan declares formal independence.

Liberation Army (PLA) have become controversial. However, under conengagement, military-to-military relations would be expanded. These contacts can provide the Chinese military with the opportunity to get to know the U.S. military—our capabilities and intentions—which may help curb any tendencies toward military adventurism. Such contacts could also increase U.S. knowledge of the PLA. Moreover, military-to-military contacts can lead to personal relations that are useful on a day-to-day basis and prove vital in time of crisis. In economic affairs, the MFN status would continue, and we would encourage Chinese membership in the World Trade Organization. However, we would criticize Chinese human rights practices more vigorously, without suggesting that sanctions be applied to change these practices. In military and economic relations, we would insist on reciprocity. When China behaves badly or threatens our interests, we must be prepared to respond.

As a hedge against potential conflict with China over issues such as Taiwan, the United States should move on three fronts. First, we should avoid doing anything that directly abets the growth of Chinese military power—especially the Chinese military's acquisition and development of systems that would prove difficult for the United States to deal with.

Second, we should encourage U.S. friends and allies not to contribute directly to the growth of Chinese military capabilities. Existing U.S. and allied

export controls that now restrict access to Western technology need to be strengthened by an agreement among the allies, including Israel, to further restrict a set of technologies relevant to the most dangerous systems, such as advanced ballistic and cruise missiles, advanced air-to-air missiles, advanced surface-to-air missiles, the latest fighter jets, counterspace capabilities, and increased capabilities for system integration.

Third, the United States should strengthen its own capabilities and those of its friends in East Asia to deter Chinese aggression and resist a potentially hostile China. China's military leaders are considering the possibility of a conflict with the United States over Taiwan. They recognize the overall superiority of the U.S. military but believe there are weaknesses that could be exploited. According to the Chinese, U.S. weaknesses include vulnerability of U.S. bases to missile attacks, heavy U.S. reliance on space, America's need to rapidly reinforce the region in times of conflict, susceptibility of U.S. cities to being held hostage, and America's sensitivity to casualties.

According to the emerging Chinese military doctrine, the local balance of power in the region will be decisive—because, in this new era, wars are short and intense. In a possible Taiwan conflict, China would seek to create a *fait accompli*, forcing the United States to risk major escalation and high levels of violence to reinstate the *status quo ante*. China might gamble that these risks would constrain the U.S. response. Such an approach by China would be extremely risky and could lead to a major war.

Dealing with such a potential challenge from China requires many steps:

- burden-sharing and enhanced ties with states in East and Southeast Asia. New formal alliance relationships—central to a containment strategy—are neither necessary nor practical at this time, but it would be prudent to take preparatory steps toward the formation of a new alliance or the establishment of new military bases should they become necessary. They would signal to China that any attempt on their part to seek regional hegemony would be costly.
- enhancing military-to-military relations between Japan and South Korea

- encouraging more political-military cooperation among the ASEAN states and resolving their overlapping claims to the Spratly Islands and the South China Sea
- fostering a Japanese-Russian rapprochement, including a settlement of the dispute over the Kuril Islands claimed by both countries
- enhancing military-to-military cooperation between the United States and the ASEAN states.

These steps are important in themselves for deterrence and regional stability, but they can also assist in shifting to a much tougher policy toward China should that become necessary.

Additional measures should be taken to correct the Chinese belief that China can confront the world with a *fait accompli* in Taiwan. The United States should expand joint exercises with states in the region, preposition stocks there, ensure access to key facilities in countries such as the Philippines, and increase Taiwan's ability to defend itself. The large distances of the East Asian region suggest that future U.S. forces must emphasize longer-range systems and standoff weapons. The United States must also increase its capabilities to protect friendly countries and U.S. forces in the region against possible missile attacks.

As long as there is a potential for China to become a hostile power, it is not in the interest of the United States for Taiwan to unite with China. Assuming that Taiwan completes its democratic transition successfully, its people will not want to join an authoritarian China, either. While containment may require the United States to encourage Taiwan to declare independence, under conengagement we would not do so. The growing economic interdependence between China and Taiwan should discourage Taiwan from unilaterally declaring independence, a move that could produce a crisis that would scare large sectors of the Taiwanese business community. If China were to become a friendly, democratic power, U.S. policy could become more favorable to reunification. The same is likely to be the case among most Taiwanese.

A conengagement strategy is noncommittal on some of the key judgments about China's future—for example, whether a China enmeshed in the international

system will modify its behavior, lean democratic, or challenge U.S. global leadership. Instead, this strategy sharpens the fundamental choice faced by China's leadership: either to cooperate with the current international system or to challenge the U.S. world role and pursue regional hegemony. By indicating that we are prepared to protect our interests, this strategy points out to China the costs of turning hostile.

The United States likes to decide up front whether a country is a friend or foe. However, China cannot and should not yet be categorized as partner or as adversary. Therefore, conengagement is the right policy at this time. It embodies a flexible approach during this period of great Chinese transition. If China chooses to cooperate with the current international system and becomes increasingly democratic, this policy could evolve into mutual accommodation and partnership. If China becomes a hostile power bent on regional domination, this policy can turn into containment. ■

### Related Reading

*China's Arms Sales: Motivations and Implications*, Daniel L. Byman, Roger Cliff, RAND/MR-1119-AF, 1999, 60 pp., ISBN 0-8330-2776-X, \$7.50.

*Chinese Policy Toward Russia and the Central Asian Republics*, Mark Burles, RAND/MR-1045-AF, 1999, 84 pp., ISBN 0-8330-2731-X, \$15.00.

*Congage China*, Zalmay M. Khalilzad, RAND/IP-187, 1999, 8 pp., no charge.

*Interpreting China's Grand Strategy: Past, Present, and Future*, Michael D. Swaine, Ashley J. Tellis, RAND/MR-1121-AF, forthcoming.

*Taiwan's National Security, Defense Policy, and Weapons Procurement Process*, Michael D. Swaine, RAND/MR-1128-OSD, 1999, 78 pp., ISBN 0-8330-2798-0, \$12.00.

*The United States and a Rising China: Strategic and Military Implications*, Zalmay M. Khalilzad, Abram N. Shulsky, Daniel L. Byman, Roger Cliff, David T. Orletsky, David Shlapak, Ashley J. Tellis, RAND/MR-1082-AF, 1999, 111 pp., ISBN 0-8330-2751-4, \$15.00.

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**A “conengagement” strategy would sharpen the choice faced by China’s leadership.**

# May Cooler Tempers Prevail

## Let Technology Reduce Hot Air over Global Warming

By Mark Bernstein, Scott Hassell, and Robert Lempert

*Mark Bernstein, an energy and environmental analyst at RAND, was senior energy analyst in the White House Office of Science and Technology Policy from 1996–1998. Scott Hassell is an associate engineer focusing on energy and environmental issues at RAND. Robert Lempert is a RAND senior scientist, climate-change expert, and professor at the RAND Graduate School.*

**For years,** the prospect of global warming has fired a debate dominated by two opposing camps: those who favor reducing worldwide emissions of greenhouse gases to 1990 levels, and those who favor minimal or zero restrictions in the near term. In the absence of incontrovertible scientific evidence to forecast the consequences of global warming—or the costs of preventing it—the debate over emissions targets has often been driven by personal and political interests.

Regardless of the merits of emissions targets, the heated debate surrounding them has threatened to derail progress on a much more effective and less contentious first step: developing cleaner technologies to harness the alternative energy sources that could serve us well whatever the future might bring. Efforts to develop new technologies will likely have little effect on the very-near-term emission of greenhouse gases allegedly responsible for global warming. But what really matters is how fast we can improve the alternatives to current fossil fuel systems and how readily those alternatives can be adopted throughout the world.

The argument for alternative energy technologies is not new, but today we know more than ever about

the promise they hold. Our research has shown that developing countries no longer need to choose between reducing pollution and expanding their economies, because new technologies can allow developing nations to “grow clean.” New technologies can relieve industrialized nations of many of the projected costs of reducing their own emissions. And new technologies would be vital if severe consequences from global warming—or from climate change, to be precise—force the world to vastly reduce its fossil fuel emissions over the course of the next century.

Everyone stands to gain from the promise of new technologies:

- Developing countries can enjoy cleaner-than-expected economic growth in the next 20 years.
- Industrialized countries can pay lower-than-anticipated costs to reduce greenhouse gases.
- The world as a whole can prepare to adapt to many different scenarios of future climate change.

Over the next decade, therefore, the goal of society should not be merely to reduce greenhouse gas emis-

sions. Rather, the goal should be to improve new emissions-reducing technologies, lower their costs, and give consumers and producers the information they need to move away from the current mix of fossil fuel technologies. To smooth this transition, industrialized nations should eliminate market-distorting oil and coal subsidies that discourage investment in cleaner fuels. Eliminating these subsidies would create an even playing field for alternative fuel technologies, such as natural gas turbines, cleaner coal systems, biomass gasification, fuel cells, solar photovoltaics, and wind turbines. If we determine that the environmental costs of continued fossil fuel consumption warrant market distortion in favor of cleaner fuels, we might even wish to *redirect* subsidies, tax credits, and purchases toward alternative fuel technologies. At any rate, we need to expand research on environmentally benign technologies to increase our array of future options.

### Developing Countries Can Enjoy Cleaner Growth

The 1992 earth summit in Rio de Janeiro began discussion of the “emissions-stabilization” goal of capping annual emissions of global greenhouse gases at 1990 levels. At the United Nations climate-change conference in Kyoto in 1997, diplomats from industrialized and developing nations negotiated their respective burdens and timelines for holding emissions close to 1990 levels through 2060. Known as the Kyoto Protocol, the agreement stipulates that industrialized nations, responsible for most of the greenhouse gases already added to the atmosphere by human activity, bear most of the initial responsibility for stabilizing global emissions. For example, the agreement requires the United States to reduce its emissions by seven percent *below* 1990 levels for the period 2008 to 2012.

The question remains, however, whether the United States will implement the accord. When delegates from 168 nations gathered in Bonn in November 1999 to conclude the Kyoto agreement, many saw Washington



PHOTO COURTESY OF SIEMENS SOLAR INDUSTRIES

as the chief obstacle. The U.S. delegation would not approve a deal unless developing nations also committed themselves to specific emissions targets.

But developing nations face the greatest increase in energy demand in the century ahead, and the possibility of near-term caps on emissions threatens their chance to share in the riches of economic growth. For that reason, the Kyoto Protocol also proposes a “Clean Development Mechanism,” a market-based approach to promote alternative technologies, sustainable development, and cost-effective emissions reductions in developing nations. Under this approach, a company from an industrialized country might help build a highly efficient power plant in a developing country rather than a less efficient plant previously planned. The company would receive credits at home for reducing emissions abroad while also reducing pollution and boosting economic growth in the developing country. However, the details of the Clean Development Mechanism are yet to be determined.

Without these kinds of alternatives, economic growth in developing countries could lead to further environmental damage. Any type of growth will bring new power generation facilities, rising industrial activity, and increased automobile usage. And if conven-

*When roads in Ethiopia were destroyed during the civil strife of the past decade, camels transported refrigerated vaccines across the desert by carrying coolers powered by photovoltaic panels, which produce electricity directly from the sun.*

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**What really matters is how fast we can improve the alternatives to current fossil fuel systems.**

tional technologies continue to be used, the increased air pollution will degrade air quality, increase mortality, diminish worker productivity, reduce visibility, decrease agricultural production, damage the built environment, and significantly increase greenhouse gas emissions.

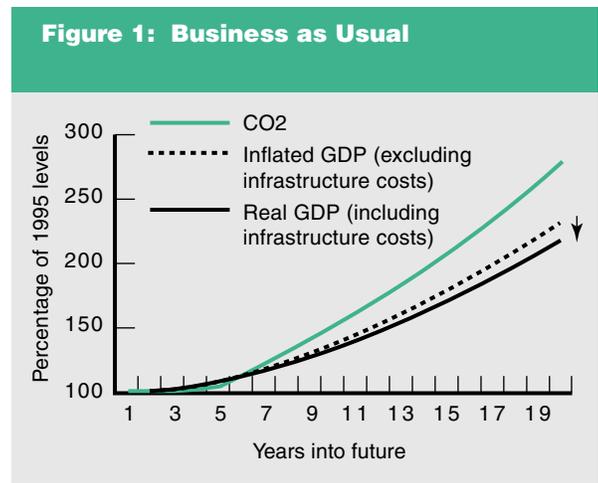
Carbon-based energy sources lie at the heart of global climate change and at the root of the dilemma facing developing countries. Large amounts of carbon dioxide and other air pollutants are emitted from conventional electric power plants. Whereas less than a third of global carbon dioxide emissions from electric

plants came from developing countries in 1995, fully half of all new electric power generation capacity between 1995 and 2020 will be in developing countries. In the next 20 years, economic growth is expected to more than double in these countries, but their carbon dioxide emissions may nearly *triple* (see Figure 1). These trends will also lead to sharp increases in local air emissions of sulfur oxides, nitrogen oxides, and particulate matter. But all trends

depend on the technologies used. The technologies selected to generate electric power in developing countries today and in the near future will determine, in part, the fortunes of these nascent economies, the annual amount of global carbon emissions, and even the strength of the global economy well into the 21st century.

Developing countries can use two simple strategies to expand their economies and sustain the global environment at the same time. The first, accounting for all the costs associated with building and operating electric power plants, is both necessary and feasible. The second, promoting new technologies, is nearly as feasible.

First, infrastructure costs should be included in new energy investment decisions. Many traditional planning methods steer investments toward technologies that *generate* electricity for the least cost rather than technologies that *deliver* electricity to customers for the least cost. The traditional methods ignore the considerable infrastructure costs of electric power plants, such as:



**HAVING THEIR CAKE AND EATING IT, TOO . . .**

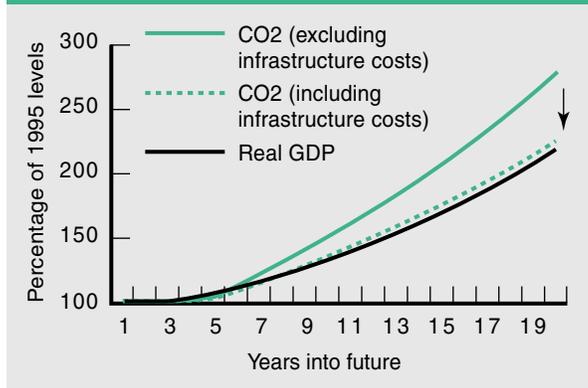
- transmission and distribution equipment to deliver electricity from often distant generation sites to consumption sites
- reserve capacity to deliver high-quality electricity during peak periods and outages
- construction of new (or retrofit of existing) pipelines or railroads to deliver primary fuels (such as natural gas, oil, and coal) to electric power plants
- backup and storage systems for electricity from “intermittent” technologies, such as solar or wind technologies.

A 1990 World Bank study found that infrastructure costs represent, on average, 40 percent of total capital expenditures on new electric power plants in developing countries. Traditional planning methods that overlook these expenditures seriously overestimate the benefits of new electric power plants—and underestimate the competitiveness of other technologies. Once the infrastructure costs are factored into the equation, either less power can be delivered for a given level of investment or more spending must be allocated to achieve the same level of capacity. Either way, the result is lower-than-expected economic benefits.

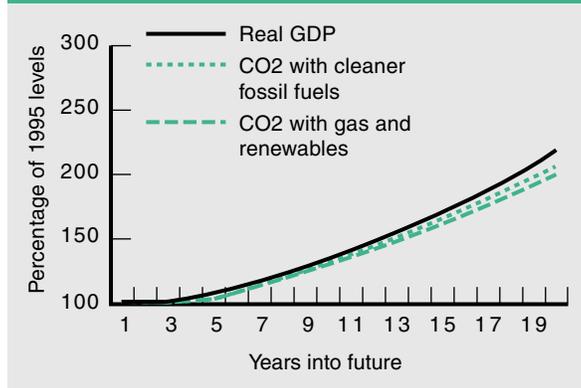
According to a model developed at RAND, including the infrastructure costs may drop the expected increase in annual economic benefits from new electric power plants by as much as 10 percent after 20 years (see Figure 1). There would be an even larger

**Developing countries could shift half their new energy investments toward cleaner technologies and still double their economic growth.**

**Figure 2: Include Infrastructure Costs in Investment Decisions**



**Figure 3: Shift to Alternative Technologies**



*Developing countries can reduce their new greenhouse gas emissions in the next 20 years without compromising economic growth. The countries can cut emissions by accounting for the infrastructure costs of new electric power plants and by shifting energy investments toward alternative technologies. Meanwhile, economic growth, measured in terms of gross domestic product (GDP), can remain exactly the same.*

drop in carbon dioxide emissions, because investors who consider the infrastructure costs would have incentives to shift investments away from dirty coal-burning electric power plants and toward cleaner technologies. This shift would reduce annual increases in carbon dioxide emissions by roughly 30 percent after 20 years (see Figure 2). By including infrastructure costs, alternative technologies could compete more fairly.

Second, the RAND model also portrayed the effect of shifting half of the subsequent energy investments in developing countries toward cleaner technologies. Replacing half the investments slated for coal-fired electric plants in the next decade with investments in cleaner fossil fuel technologies, such as fluidized-bed coal plants rather than conventional pulverized coal plants, could reduce new carbon dioxide emissions an additional 15 percent or more and still allow as much economic growth. Better yet, shifting the same level of investment toward natural gas and renewable fuel technologies—such as solar photovoltaics, wind turbines, biomass gasification, and small hydroelectric plants—could reduce new emissions by more than 20 percent and again allow identical economic growth (see Figure 3). Intensive use of natural gas and renewable technologies might even provide developing countries more economic benefits than conventional fuel alternatives could.

Consider the combined effect of accounting for infrastructure costs and shifting to alternative tech-

nologies. Business as usual would compel developing countries to nearly triple their carbon dioxide emissions from electric power plants over the next 20 years; in contrast, these countries could less than double their emissions by making wiser investment choices. At the same time, developing countries could still match the real growth projections of business as usual. In our analysis, we did not include all the potential new technological options, and it is likely that countries could achieve even greater reductions in emissions.

Yet there are many barriers, particularly financial ones, that can obstruct the path toward cleaner technologies; and many developing countries will need upfront financial help to make these investments. The Clean Development Mechanism is one obvious vehicle for such financing. Developing countries could also participate in an international emissions trading program, should one be established. By selling the rights to future emissions, developing countries would be able to finance new investments in cleaner, more efficient technologies.

### **Industrialized Countries Can Pay Lower Costs**

Initial cost estimates for reducing many types of pollution in the United States have been much larger than the costs actually incurred. For example, in 1989 the cost estimates for abating sulfur dioxide emissions in the United States ran over \$1 billion a year. Today's



AP/WIDE WORLD PHOTOS/RICH PEDRONCELLI

*Ferdinand Panik, senior vice president of DaimlerChrysler, left, shows California Gov. Gray Davis the engine compartment of a fuel-cell-powered vehicle in Sacramento on April 20, 1999. Davis used the occasion to announce a state-industry partnership to road test up to 50 cars and 20 buses powered by fuel cells, which create no pollution.*

costs are half that. Since 1993, sulfur emissions have been regulated by a permit trading program, in which companies bid for and sell the rights to emit sulfur dioxide. The 1989 price estimate for sulfur permits went as high as \$1,500 per ton of emissions. One year later, the estimate dropped to \$750 per ton. Since 1993, shortly after the permit trading program went into effect, the actual prices have been \$70 to \$200 per ton.

In the early 1980s, experts estimated that just 33 percent of global chlorofluorocarbon (CFC) emissions could ever be

eliminated. By 1988, the estimated cost to achieve a 50 percent cutback by the year 1998 stood at \$3.55 per kilogram. By 1992, the estimate for a *complete* phase-out of *all* CFCs by 2000 fell to \$2.20 per kilogram. Today, CFC emissions are on the verge of being eliminated from the industrialized nations of North America, Western Europe, and Japan and could be eliminated from developing nations within two to three years.

Why did the initial estimates end up being so inaccurate? In the case of sulfur dioxide, competition for permits drove emitters to invest in technological improvements. Improvements in scrubber technology made the job of controlling emissions more reliable and efficient. Furthermore, deregulation of the U.S. railroads, which began in the early 1980s, eventually made the shift toward low-sulfur coal more economical by eliminating old cost structures that had effectively restricted shipments of low-sulfur western coal to eastern power plants. Combining the new scrubber technology with the new low-sulfur fuel allowed plants to reduce emissions at lower costs than expected and therefore reduced the market price for permits. In the case of CFCs, the cost analysts had assumed it would take many years of research to find substitutes for products that spewed CFCs into the atmosphere. But new and existing chemical substitutes were found quickly, some even cheaper than their predecessors, others leading to new production processes that even *increased* profits.

There is a deeper analytic explanation as well. Many cost estimates become artificially inflated because they rely on deterministic mathematical models that ignore three dynamic variables:

- early adopters of technological change
- government policies that can accelerate technological change
- productivity gains from technological change.

Faced with the uncertain future costs of reducing emissions, some private firms invest early in technological improvements as a hedge against enormous costs later on. The greater the number of early adopters, the faster the innovation occurs. Typically, the innovations reduce the amount of emissions and thus cut the cost of complying with environmental controls.

Government policies can accelerate the process. The very threat of regulation spurs some early adopters to take action. The government also dangles “carrots,” such as tax credits or subsidies for research and development, and wields “sticks,” such as carbon taxes or emissions permits. A combined strategy of “carrots” and “sticks” often works best to induce technological change.

Technological improvements increase labor productivity, which drives economic growth. More than half the growth in the U.S. economy since the 1980s has been attributed to technological innovation. Theoretically, at least, investments in new fuel technologies may also increase productivity and economic benefits.

All three factors—early adopters, government policies, and productivity gains—lower the costs of technological change. Technological advances do require investments in new equipment and procedures, and most benefits accrue only over the long term of 20 years or more. But if recent history is any guide, the short-term investments pale in comparison to the long-term returns.

### **With New Technologies, the World Can Adapt**

The two sides of the climate change debate embrace opposite visions of the future. Those who wish to stabilize emissions predict severe environmental damage from climate change—and small costs for abating the damage. Those who argue for minimal or zero reductions in emissions predict minor environmental damage—and exorbitant abatement costs.

The problem is that both sides point to a perilous policy if their assumptions prove incorrect. Stabilizing emissions will provide some insurance against severe damage—but may prove too costly if the damage turns out to be small. Holding near-term reductions to a minimum will certainly limit near-term costs—but will risk huge damages if climate change becomes severe. Given the uncertainty we face, neither side of the debate offers the world an adequate solution.

Rather than choosing between these two world-views, we propose that the United States and other nations pursue an adaptive strategy that would be robust, meaning that it would perform well against a wide range of plausible scenarios. Either we will have to make very large reductions in greenhouse gas emissions over the course of the new century, or we will not. Because we do not know which future will transpire, we need to prepare for both.

We can prepare for the widest possible range of climate-change futures by following a strategy that evolves over time in response to observations of the climate and economic systems. Such a strategy would emphasize three near-term steps: (1) supporting the research, development, demonstration, and deployment of new technologies that could make any drastic action, if necessary, more feasible and less costly, (2) building the institutions that might become necessary to tax or regulate the emission of greenhouse gases, and (3) reaching consensus on the key scientific and economic indicators that, if observed, should trigger drastic action to curtail greenhouse gas emissions. Such an adaptive strategy would promise reasonable outcomes no matter whose view of the future proves correct.

At RAND, we have developed a set of computational methods to help devise adaptive strategies for highly unpredictable situations such as global climate change. Collectively, these methods are called exploratory modeling. In the conventional approach to computer modeling, analysts look for an optimum strategy to solve a specific problem deemed likely to happen in the future. In exploratory modeling, we begin with a problem that can still unfold in many different ways. First we conduct a large number of computer simulations that represent the widest possible range of future scenarios. Then we look for strategies that are robust across the entire range—rather than a strategy that might work best for just one isolated part of the range.

According to our models, an adaptive strategy for climate change performs better on average than either of the standard approaches, because the adaptive strategy can make midcourse corrections and avoid substantial errors. An adaptive strategy consists of three parts: shaping actions, hedging actions, and signposts. For climate change, the pursuit of new technologies is a powerful shaping strategy, because it can greatly expand our ability to respond to whatever changes in global climate might ensue. Near-term efforts to stabilize emissions could qualify as hedging strategies as long as they do not constrict economic growth. And the signposts are the scientific observations that can tell us if we are on the right track or have veered off course.

Even without accurate or widely accepted predictions of the future, national and international policymakers can make reasonable and defensible choices about climate change policy today. Policymakers can craft an adaptive strategy in which developing and industrialized nations explicitly plan to make midcourse corrections based on forthcoming observations of the climate and economic systems. But for such a strategy to work, it presupposes the early investment in innovations that will make massive reductions in future emissions possible. In that regard, alternative fuel technologies offer real promise. Moreover, they represent a strategy that can be embraced by both sides of the current debate on climate change and by developing and industrialized countries alike. All could agree that to prevent climate change tomorrow, we must induce technological change today. ■

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**An “adaptive strategy” would promise reasonable outcomes no matter whose view of the future proves correct.**

### Related Reading

*Developing Countries & Global Climate Change: Electric Power Options for Growth*, Mark Bernstein, Pam Bromley, Jeff Hagen, Scott Hassell, Robert Lempert, Jorge Muñoz, David Robalino, Arlington, Va.: Pew Center on Global Climate Change, 1999.

“When We Don’t Know the Costs or the Benefits: Adaptive Strategies for Abating Climate Change,” *Climatic Change*, No. 33, 1996, pp. 235–274, Robert J. Lempert, Michael E. Schlesinger, Steve C. Bankes. Also available as RAND/RP-557, no charge.

# Troop Formations

## Military Personnel Reforms Contain Elements of Surprise

**L**ess than a decade after the stunning success of the Persian Gulf War, the U.S. military is battling to attract and keep enough good people. Some of the services are failing to meet their recruiting goals for the first time in two decades. And all the services report low reenlistments in technical fields, where civilian opportunities have been unusually attractive throughout the economic boom under way since 1992.

Throughout the 1990s, career personnel also voiced growing discontent with the military retirement system, arguing that changes put in place in 1986 shortchanged those who joined afterward. In August 1986, the system became two-tiered, and those who had joined before were slated to receive a more generous retirement payout. Many said this disparity, addressed by recent legislation, lowered morale and discouraged retention.

But for the military to reverse all its personnel fortunes, it has had to ferret out the most significant causes of the shortfalls from an array of apparently interacting factors: demographics (the growth in college attendance among youth), economics (the strongest U.S. economy and lowest civilian unemployment rate in three decades), military workloads (more duties for fewer people), social attitudes (fewer military role models among parents and teachers), and military pay and benefits packages. Only by getting to the root of the personnel problems could the military determine which factors were most important and craft real solutions.

To help pinpoint the problems and recommend reforms, RAND has conducted dozens of personnel studies, mostly for the Office of the Secretary of Defense and the U.S. Army. Many of the studies coalesce into a story about the “three R’s” of the military

personnel life cycle: recruitment, retention, and retirement. The research has debunked some myths about the origin of personnel problems, revealed that some of the problems stem from policies internal to the services themselves, and produced recommendations that have prompted policy changes to enhance each phase of the life cycle (see table).

### Recruitment: More Than a Few “Good Men”

By 1994, the U.S. Department of Defense found it increasingly difficult to recruit enough “high-quality” youth: those with high school diplomas who also scored well on written aptitude tests. Recruiting resources had been cut after the 1991 Gulf War as part of the post-cold war military drawdown, recruiters struggled to meet their quotas, and young people appeared less interested in the military.

Yet RAND found the supply of potential recruits in 1994 to be adequate relative to the military’s demand, which also had been cut sharply during the post-cold war drawdown. The problem appeared to be in enlisting youth who were potentially interested in the military.

As the drawdown came to an end, the military raised its recruiting goals. By 1997, the goals rose 18 percent above the 1994 level overall, with some services facing even higher goals. The army, which had endured the deepest personnel cuts during the drawdown, had to boost 1997 enlistments 45 percent over 1994. The navy encountered a similar hurdle in 1998. These higher recruiting goals coincided with cuts in recruiting resources, declining recruiter productivity, and a burgeoning U.S. economy. Today, recruiting shortfalls continue to plague the services.

**Enhancing the Three Phases of the Military Personnel Life Cycle**

PROBLEMS	PROPOSED SOLUTIONS	POLICY CHANGES
<b>Recruitment</b>		
<p>Difficulty recruiting "high-quality" youth in the face of:</p> <ul style="list-style-type: none"> <li>Outbacks in recruiting</li> <li>Changes in management of recruiting resources</li> <li>Growth in college attendance among youth</li> <li>Declining youth interest</li> <li>Booming civilian economy</li> </ul>	<ul style="list-style-type: none"> <li>Hire more recruiters</li> <li>Improve recruiter incentives</li> <li>Increase advertising</li> <li>Increase educational benefits</li> <li>Recruit more women</li> <li>Accept more reenlistments</li> <li>Lower quality standards</li> <li>Target college-bound youth</li> </ul>	<ul style="list-style-type: none"> <li>Defense department and army increase recruiting budgets</li> <li>Army increases advertising budget</li> <li>Army increases budget for Army College Fund</li> <li>Army reaches beyond "high-quality" youth</li> <li>Some services formulate a "college-first" program</li> </ul>
<b>Retention</b>		
<ul style="list-style-type: none"> <li>Lower pay scales than civilians for some jobs</li> <li>Mismanagement of military careers</li> <li>Intensified peacetime operations</li> </ul>	<ul style="list-style-type: none"> <li>Target pay raises to mid-grade and senior personnel</li> <li>Offer reenlistment bonuses in critical areas</li> <li>Offer separation payments for management flexibility</li> <li>Offer tax-sheltered thrift savings plan for all members</li> <li>Spread burden of overseas deployments among personnel</li> </ul>	<ul style="list-style-type: none"> <li>Fiscal 2000 defense authorization bill includes 4.8% raise in basic pay plus additional, higher raises for senior grades</li> <li>Fiscal 2000 defense authorization bill includes thrift savings plan</li> </ul>
<b>Retirement</b>		
<ul style="list-style-type: none"> <li>Discontent with two-tier payout system</li> <li>Inefficiency and inequity of full benefits after 20 years (and no benefits before 20 years)</li> </ul>	<ul style="list-style-type: none"> <li>Create payout system similar to Federal Employees Retirement System with delayed payouts to save money, skewed pay raises to increase productivity, and separation payments to break "golden handcuffs"</li> <li>If bonuses offered with retirement, target higher bonuses to higher pay grades</li> </ul>	<ul style="list-style-type: none"> <li>Fiscal 2000 defense authorization bill reverts to pre-1986 retirement system as an option to bonus pay with current system</li> <li>Bonuses are dependent on pay grade</li> </ul>

But even before the goals were raised, even when the supply of potential recruits should have been adequate, recruiters still had trouble meeting their quotas. As early as 1994, recruiter productivity had declined. Two explanations seemed plausible. First, changes in social attitudes toward the military could have restricted the access of recruiters to high school youth or influenced the counsel that youth received from parents and friends about joining the military. Second, changes in recruiting processes or resource allocations during the drawdown could have made the recruiting system itself less effective.

RAND found that social attitudes toward the military did not deteriorate during the 1990s. There was no evidence of change in the attitudes of parents and friends advising youth about military service. And recruiters reported steady access to high school youth.

Fewer students, however, reported contact with a recruiter. There also were fewer high schools offering the Armed Services Vocational Aptitude Battery (ASVAB) and fewer students taking the test at those

schools where it was offered. These tests provide recruiters one of their most important sources of leads. The drops in high school contacts and ASVAB tests are probably interrelated and may reflect cuts in recruiting resources. The problems also could have stemmed from changes in the way the resources

were managed, such as incentive plans that began to reward recruiting stations rather than individual recruiters.

Researchers recommended a number of ways to improve recruiting:

- Increase spending for more recruiters, advertising, and educational benefits. These are the most cost-effective ways to increase the supply of high-quality recruits.
- Improve the incentives provided to recruiters to enhance recruiting effectiveness.
- Recruit more women, accept more reenlistments, and target “lower-quality” recruits (high school dropouts or those with lower test scores). Each

option, however, entails limits and costs, such as higher attrition rates for lower-quality recruits.

- Develop additional marketing strategies and enlistment options for college-bound youth. Success in this expanding market is crucial to the future success of recruiting.

The research has had a direct policy impact. Initial briefings in 1994 spurred the Office of the Secretary of Defense to increase its recruiting budget. In 1997, the army increased funding for recruiters, advertising, and the Army College Fund. The army also opened the door wider to women, reenlistees, and high school dropouts.

Most recently, some of the services have been formulating a “college-first” program that could help pay for newly enlisted personnel to attend college *before* they enter active duty. This program could target graduates and dropouts of two-year colleges. Alternatively, personnel might attend college after one term of service and then reenlist at a higher pay grade. Regardless of how such programs might operate, those who enter active duty with any college education would have to be paid more upon entering given the large college premium they could earn if they entered the civilian sector instead.

### Retention: Juggling Raises, Assignments, Separations

In recent years, defense policymakers and military officials have suspected that two factors—low pay and high workloads—have been responsible for problems not only in recruiting and retaining high-quality people but in managing the forces flexibly.

These observers have argued that military pay and retirement benefits have not been lucrative enough to attract or keep good people, that service pay has not kept pace with civilian pay, and that changes in the military retirement system have shortchanged those who joined after 1986. These observers also have alleged that the heightened pace and intensity of peacetime operations have made military careers even less attractive and that all these changes have hamstrung Pentagon managers trying to reconfigure their forces.

## Success in the college-bound market is crucial to the future success of recruiting.

But RAND showed that the relatively low pay and high workloads have had opposite effects on decisions to join or stay in the military. Between the economic boom years of 1993 and 1999, on the one hand, overall military pay did decline relative to civilian pay by 6.5 percent for enlistees and 10 percent for officers, and the vibrant economy did make civilian jobs all the more attractive. On the other hand, the pace of peacetime military work—which has indeed intensified since the Gulf War—has had mostly *positive* effects on retention. Most people assigned to some long or hostile duty have been more, not less, likely to reenlist.

The adequacy of military pay has been the subject of intense debate in recent years. A 1999 comparison based on the Employment Cost Index showed that military pay had grown 13.5 percent less than civilian pay over the longer time period since 1982, leading some observers to bemoan the civilian-military “pay gap” of 13.5 percent.

But this comparison was invalid, because military personnel do not match the civilian labor force with respect to age, education, occupation, gender, and race or ethnicity. RAND developed a new wage index to control for all these characteristics. The new index showed that military pay throughout the 1980s and 1990s kept pace with or outpaced civilian pay for some personnel (those with just a high school education) but lagged for others (those with a college education). From 1982 to 1997, basic pay for junior enlisted personnel grew about 10 percent *more* than pay for their civilian counterparts; basic pay for senior enlisted personnel grew 5 percent *less* than that of civilian counterparts; and basic pay for officers grew about 20 percent *less* than that of their counterparts. The latter two gaps reflect the rapid civilian wage growth of college-educated workers.

In this environment, the researchers concluded, the best way to retain the best people is through targeted pay raises, not across-the-board pay raises. The services should offer the highest pay raises and reenlistment bonuses to individuals in more senior grades.

Targeted pay raises alone, however, cannot make the forces any easier to manage. The current compensation system pays full retirement benefits to members after 20 years of service, creating what some call “gold-

en handcuffs.” Members with, say, 15 years of service incur a big financial loss if they leave before 20 years. The services recognize this loss and avoid separating individuals even when other factors—low productivity, new requirements, the need to promote junior personnel—make it desirable to do so.

To make the system more flexible, targeted pay raises need to be supplemented by other incentives: special bonuses to boost retention in critical areas, separation pay to break the golden handcuffs, and a thrift savings plan to allow all service members to save toward retirement on a tax-deferred basis. In combination, these incentives would help the defense department manage its forces flexibly and retain key people where needed.

The other matter of intense debate related to retention has been personnel tempo, or “perstempo”: the frequency with which personnel are sent on long or hostile assignments and the duration, pace, and intensity of the work. The effect of intensified peacetime operations on retention has been a matter of widespread speculation.

Contrary to common belief, a RAND analysis found that some perstempo—but not too much—actually promotes reenlistment. Defining perstempo as long duty of 30 days or more or as hostile duty of any duration, the study found that limited deployments—of, say, three months—tend to increase first-term reenlistment in the army and marine corps and early-career reenlistment in all services. The study covered the 1993–1995 period, which included deployments to Korea, Haiti, Somalia, and Bosnia. Apparently, personnel welcome the opportunity to put their skills and training into practice in real-world deployments.

The positive effect was especially strong for army first-term enlisted personnel. Army first-termers with no prior long or hostile duty were 28 percent more likely to reenlist if given an initial three months of non-hostile duty—and 13 percent more likely if given the same length of hostile duty. But adding an additional tour atop the first—such as another three months away from home—sharply reduced the likelihood of reenlistment, especially in the army and marine corps. The

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**The best way to retain the best people is through targeted pay raises.**

negative effect was strongest when the extra tour involved hostilities. For army first-termers, an additional three-month hostile duty assignment made them 17 percent less likely to reenlist.

While the relationship between limited deployments and retention is the opposite of what many observers expected, the researchers sent a warning: The services should spread the burden of peacetime operations to the maximum extent compatible with readiness, especially if perstempo levels have risen above those prevailing during the study period. If personnel are being used more intensively today, the net positive effect of perstempo on reenlistment could have declined and in some cases might have become negative.

### Retirement: Lessons from the Civilian World

RAND analyzed a proposal to replace the current military retirement system with one similar to the Federal Employees Retirement System (FERS) for civil service employees. If such a system were integrated with separation pay for selected personnel and with targeted pay raises, the defense department could improve the

quality and efficiency of the military workforce and better manage military careers. Under certain circumstances, the department could also save as much as \$2 billion a year with this approach.

Furthermore, if the new retirement system were patterned after FERS, the changes would be based on a system that is known and proven and thus easier to implement than competing proposals. Such a retirement system would be akin to private-sector retirement plans in which participants set aside part of their salaries, choose

from investment options, retain benefits when they change careers, and receive full benefits only after reaching a prescribed age, typically 62.

The current military retirement system differs from most private plans: It allows members to collect

full benefits after 20 years of service, regardless of age. Those who enter the service in their late teens or early 20s can retire with full lifetime benefits in their late 30s or early 40s. Private-sector plans, however, typically restrict full benefits to those who have reached a particular age, regardless of their length of service. The military system is also less equitable: It pays no benefits to those who serve less than 20 years.

Many critics have argued that the military retirement system simply be replaced with a private-sector plan, vesting members early in a benefit that does not begin until old age. However, switching to a pure civilian-like system without making any other changes would significantly reduce the value of the current compensation system to service members. Not only would they have to accept lower take-home pay because of contributing to their retirement funds, they also would have to accept a much later full-benefit retirement age. Such reductions would hurt retention and erode the quality and motivation of the forces. Consequently, the researchers concluded, if the defense department were to move to a civilian-like retirement system, the department would also need to raise pay to maintain the size and quality of the active force.

RAND evaluated three ways to offer this pay raise. The first option, a FERS-like system with an across-the-board pay raise, is unattractive. It would lead to drops in productivity and personnel quality, because an across-the-board pay raise would tend to flatten the payment structure that now rewards higher raises to individuals who climb in rank.

The second option, a FERS-like system with skewed pay raises (higher raises in higher grades), would lead to a more-productive and higher-quality force. But it would make total compensation even more lucrative than it is today for career personnel. As a result, this option would induce even more personnel to stay for 20 years—but no longer—and make it even tougher to manage the forces flexibly.

The third option, a FERS-like system with skewed pay raises and separation payments, is the best option. It would not only produce a more-productive and higher-quality force, thanks to the skewed pay raises, but it would also create new personnel management tools. A key purpose of separation pay is to induce vol-

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**Separation payments are flexible: They can be offered earlier for occupations requiring “youth and vigor” and delayed for occupations requiring experience.**

untary separation of some personnel at a point before they would otherwise leave. Separation payments are also flexible: They can be offered earlier for occupations requiring “youth and vigor” and delayed for occupations requiring experience.

### Legislation for the “Three R’s”

After completing the analyses described above, RAND was asked to evaluate several legislative proposals to improve military compensation. In late 1998, RAND examined the defense department’s “Triad” proposal, which would have given a 4.4-percent pay raise to all service members in fiscal year 2000; additional, higher raises to mid-grade personnel; and retirement benefits equal to 50 percent of basic pay, rather than the current 40 percent payout, to members retiring after 20 years. RAND found that the proposal would have increased overall retention by 6 percent and increased cost by 7 percent.

RAND staff outlined these findings in testimony before the Senate Armed Services Committee last March. At that hearing, the committee asked RAND to evaluate a competing Senate proposal—the Soldiers’, Sailors’, Airmen’s, and Marines’ Bill of Rights Act of 1999—to raise basic pay 4.8 percent, target higher raises to mid-grade personnel, and allow those with 15 years of service to choose to receive either the pre-1986 retirement benefits or a \$30,000 bonus to stay on the current retirement system. The Senate proposal also increased educational benefits under the Montgomery G.I. Bill and included a thrift savings plan akin to that available to many civilian workers.

RAND found that the Senate proposal would increase retention by 14 percent and increase cost by 12 percent, making the proposal costly but also cost-effective. RAND recommended minor changes—for example, making the bonus amount dependent on pay grade rather than one fixed payout—so that the most productive members would receive the greatest rewards. The revised Senate proposal appeared as part of the fiscal 2000 defense authorization bill that was signed into law by President Clinton last October. The basic pay raise took effect on January 1, and the targeted pay raises will go into effect on July 1.

Meanwhile, research continues to help the army inaugurate its “college-first” program, to identify other

ways of attracting college-bound youth to military service, to reevaluate the benefits of advertising for recruitment, and to gauge the success of new pay policies in retaining the forces necessary to meet the nation’s military demands. ■

### Related Reading

*Attracting College-Bound Youth into the Military: Toward the Development of a New Recruiting Policy*, Beth J. Asch, M. Rebecca Kilburn, Jacob A. Klerman, RAND/MR-984-OSD, 1999, 46 pp., ISBN 0-8330-2702-6, \$7.50.

*Does Perstempo Hurt Reenlistment? The Effect of Long or Hostile Perstempo on Reenlistment*, James R. Hosek, Mark Totten, RAND/MR-990-OSD, 1998, 110 pp., ISBN 0-8330-2659-3, \$15.00.

*Encouraging Recruiter Achievement: A Recent History of Recruiter Incentive Programs*, Carole Oken, Beth J. Asch, RAND/MR-845-OSD/A, 1997, 111 pp., ISBN 0-8330-2552-X, \$9.00.

*Enlistment Decisions in the 1990s: Evidence from Individual-Level Data*, M. Rebecca Kilburn, Jacob A. Klerman, RAND/MR-944-OSD/A, 1999, 108 pp., ISBN 0-8330-2708-5, \$15.00.

*Military Compensation: Testimony Presented to the Senate Armed Services Committee, Subcommittee on Personnel*, Beth J. Asch, James R. Hosek, RAND/CT-151, 1999, 14 pp., \$5.00.

*Military Compensation: Trends and Policy Options*, Beth J. Asch, James R. Hosek, RAND/DB-273-OSD, 1999, 59 pp., ISBN 0-8330-2742-5, \$6.00.

*Military Recruiting Outlook: Recent Trends in Enlistment Propensity and Conversion of Potential Enlisted Supply*, Bruce R. Orvis, Narayan Sastry, Laurie L. McDonald, RAND/MR-677-A/OSD, 1996, 68 pp., ISBN 0-8330-2461-2, \$15.00.

*A Policy Analysis of Alternative Military Retirement Systems*, Beth J. Asch, John T. Warner, RAND/MR-465-OSD, 1994, 144 pp., ISBN 0-8330-1565-6, \$15.00.

*Recent Recruiting Trends and Their Implications: Preliminary Analysis and Recommendations*, Beth J. Asch, Bruce R. Orvis, RAND/MR-549-A/OSD, 1994, 33 pp., ISBN 0-8330-1628-8, \$7.50.

*Reforming the Military Retirement System*, Beth J. Asch, Richard Johnson, John T. Warner, RAND/MR-748-OSD, 1998, 81 pp., ISBN 0-8330-2463-9, \$15.00.

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