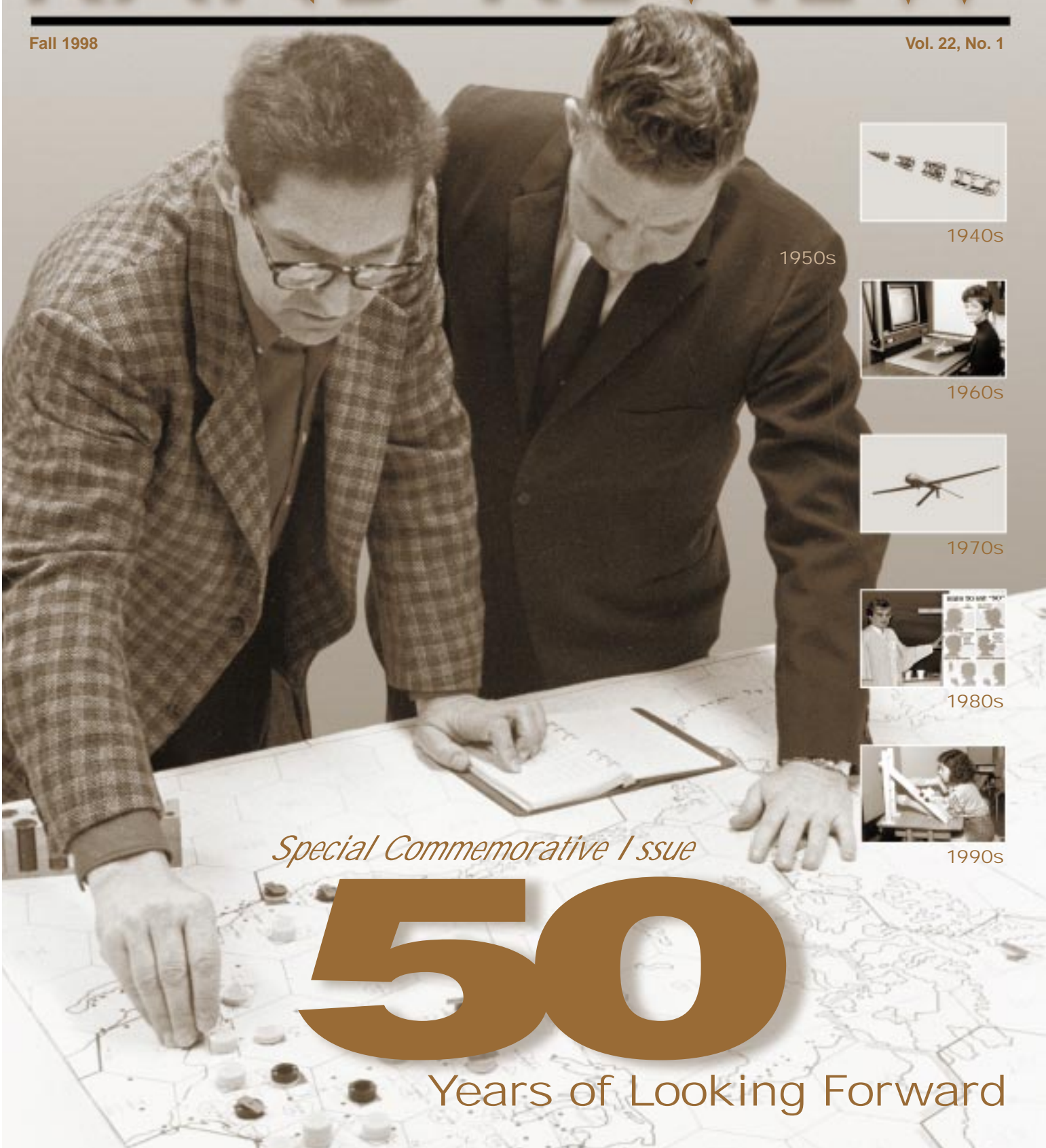


RAND REVIEW

Fall 1998

Vol. 22, No. 1



1940s

1950s



1960s



1970s



1980s



1990s

Special Commemorative Issue

50

Years of Looking Forward

OUT OF THE BLUE YONDER: How RAND Diversified into Social Welfare Research ■ By David R. Jardini

Message from the Editor

Welcome to the newly renamed *RAND Review*, heir to the *RAND Research Review* that has been published since 1977. Along with a leaner name, the *RAND Review* offers a new look, a new magazine format, a new outlet for guest authors with divergent points of view, and renewed attention to a breadth of topics in each issue—all designed to reflect the entrepreneurial spirit of a new RAND that is working to resolve problems in ever-expanding areas of the public interest.

In future issues, we hope to do more than report the latest findings of RAND research. We hope to improve policy and decisionmaking by addressing the most pressing public problems in as timely a fashion as possible. We hope to convey the benefits of multidisciplinary analysis of multidimensional problems. And we hope to elevate policy discourse through a lively exchange of ideas on topics that often extend far beyond the scope of funded research.

For this inaugural issue of the *RAND Review*—which celebrates the 50th Anniversary of RAND's incorporation as an independent, nonprofit organization—it is fitting that a commemorative look back on a half-century of cutting-edge research and inquiry coincides with a new look and strategy geared toward the future. We are building on our past, but we are changing for the better.

To all those who contributed to our past accomplishments, many of which are outlined on the following pages, rest assured that your work continues to lead in unforeseen directions.

At RAND, we wouldn't have it any other way.

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By Paul H. O'Neill and James A. Thomson

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On the Cover

Images across the decades portray
RAND ahead of the times



1940s A sketch of a rocket cutaway helps illustrate the feasibility of a space satellite.

1950s Researchers Olaf Helmer and Milton Weiner demonstrate the board gaming techniques typical of the era before computerization.

1960s The "RAND Tablet" was the first two-dimensional writing surface allowing instant communication with computers.

1970s Research on remotely piloted air vehicles led to unmanned surveillance aircraft, similar to the Predator Tier III shown here, used heavily 20 years later over Bosnia.

1980s Researcher Phyllis Ellickson introduces a drug prevention program that trains seventh and eighth graders to resist peer pressure.

1990s New science tests conducted in Los Angeles elementary schools aim to measure problem-solving skills rather than mere rote learning.

PHOTOS FROM RAND ARCHIVES

Out of the Blue Yonder

How RAND Diversified into Social Welfare Research

David R. Jardini completed his history dissertation, Out of the Blue Yonder: The RAND Corporation's Diversification into Social Welfare Research, 1946–1968, at Carnegie Mellon University in 1996. The dissertation, excerpts of which appear below, is the “only attempt to set out major portions of the full RAND story, warts and all,” according to Gustave Shubert, director of the RAND History Project, an effort begun under former RAND President Donald Rice to have an independent history written about the institution. Originally supported by the Alfred P. Sloan Foundation, Jardini has been awarded a National Science Foundation grant to round out his study of RAND and publish it in book form. The working title of the book, scheduled for publication in the year 2000, is Thinking Through the Cold War: The RAND Corporation in War and Peace, 1946–1973. The primary aim is to spread knowledge of RAND among other centers of science and policy analysis to help guide their work beyond RAND's first 50 years.

The story of RAND's diversification beyond military research into social welfare research during the 1960s illustrates the little-known linkages between defense and domestic policymaking in cold war America. RAND was formed at the conclusion of World War II as a means by which America's finest intellectual talent could be harnessed to national security research and policymaking in peacetime. Under a cloak of secrecy, the corporation hosted remarkable advances in such diverse fields as computer and software design, applied mathematics, space systems, and, especially, social science methodologies such as systems analysis. Yet, on July 14, 1966, RAND's board of trustees decided to terminate the exclusive

focus on military research and diversify into social welfare research. RAND quickly secured support from a wide range of public and private institutions, and by 1972 its research and methods had become central to many new social welfare initiatives. This meant that, ironically, the sophisticated methodologies developed at RAND to contemplate nuclear war became some of the nation's fundamental weapons against social injustice.

During the early 1960s, a constellation of forces—including the gradual migration of military concerns away from global nuclear warfare toward regional issues more contingent on social conditions; the reorientation of national policy priorities away from foreign and toward domestic problems; and the divisions introduced by the worsening Vietnam conflict—contributed to the decision to diversify. However, RAND alumni and methodologies already had become intrinsic to President Lyndon Johnson's social welfare initiatives by 1966. The decision to diversify, therefore, demonstrates more than a reaction to external forces. The decision demonstrates the complex interaction between national security and social welfare policymaking in cold war America. And it was the nonprofit research agencies like RAND, representing the most important institutional innovation in post-World War II policymaking, that both shaped the course of intellectual development and served as a conduit of expertise and methods between the defense and social welfare establishments.

Ironically, the sophisticated methodologies developed at RAND to contemplate nuclear war became some of the nation's fundamental weapons against social injustice.

Early RAND and the McNamara Revolution

During the late 1940s and 1950s, RAND mathematicians and mathematical economists made critical advances in game theory, linear and dynamic programming, network theory, modeling and simulation, cost analysis, and Monte Carlo methods in a quest to address military decision problems mathematically. All these mathematical developments contributed to RAND's signature methodological innovation: systems analysis. RAND researchers

envisioned systems analysis as a rigorous, "rational" means of comparing the expected costs, benefits, and risks of alternative future systems—such as weapons systems—characterized by complex environments, large degrees of freedom, and considerable uncertainty. Originally created to evaluate nuclear weapons scenarios, RAND's systems analysis techniques are quintessential of modern social science, incorporating quantitative methods, especially mathematical modeling, with qualitative analysis involving a diversity

of disciplines. Systems analysis became the basis for social policy analysis across such disparate areas as housing, poverty, health care, education, and the efficient operation of municipal services, such as police protection and firefighting.

In the early years, RAND's primary objective was to create a "science of war" through systems analysis. For example, researchers sought to calculate the efficiency of weapons systems as a function of time, and game theorists sought to mathematize conflict in two-person, zero-sum games. But the outcomes often were flawed because of the assumptions made to keep the mathematical problems manageable. For example, a 1950 report to the Air Force suggested three potential criteria to compare offensive weapons systems: ratio of system cost to damage inflicted, ratio of pounds of aircraft lost to damage inflicted, and number of aircrews lost per damage inflicted. Of these, the basis of comparison became the ratio of system cost to damage inflicted, largely because it was most easily calculated. Critics within the Air Force, virtually all of whom were former aircrew

John and Jacqueline Kennedy ride the campaign trail from New York City to Camelot. The 1960 presidential election of Kennedy and his selection of Robert McNamara as secretary of defense opened the door to great influence for RAND.



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members, questioned RAND's apparent reduction of human life to a quantifiable factor that was given, at best, equal weighting with machinery. Some analyses of strategic bombing systems and air defense systems in the early 1950s also were derided by many top Air Force leaders, and RAND ultimately failed to achieve a comprehensive science of war.

Systems analysis itself, however, was far from dead, because its component analyses had found receptive audiences within the Air Force and aircraft industry. After 1952, RAND concentrated on more narrowly defined problems, and a consistent argument emerged from the corporation's economists: Concentrate strictly on cost-effectiveness. For Air Force officers, the pared-down cost-benefit analyses provided "scientific" justification for their budget requests. For aircraft manufacturers, the "flexibility" of the technique permitted each firm to demonstrate the superiority of its product. And for RAND researchers, the cost-benefit analyses fed directly into the development of yet another pioneering methodology: the Planning, Programming, and Budgeting System (PPBS).

RAND designed the PPBS to help the Air Force manage the enormous costs of modern military technologies and weapons systems. This three-phased budget process consisted of *planning* and reviewing requirements, formulating and reviewing multiyear *programs*, and developing the annual *budget* estimates—hence the name Planning, Programming, and Budgeting System. Thus, by the late 1950s, despite the failure of early efforts to achieve a comprehensive science of war, RAND had succeeded in defining and codifying systems analysis, in the abbreviated form of cost-benefit analysis, as a "scientific" method of planning and decisionmaking. And it was the combination of systems analysis with program budgeting that led to the diffusion of RAND's military methods into the larger arena of American public policymaking. In 1961 the PPBS methodology became one of the cornerstones of the "McNamara Revolution" in the Department of Defense, and in 1965 President Johnson mandated its use across the federal bureaucratic structure.

Championed as scientific means of policymaking—in contrast to the sloppy, politics-driven methods of earlier years—systems analysis and program budgeting fundamentally altered the nature of public policymaking in the United States. These analytical and management methods had distinct consequences for policymaking wherever they were adopted: They created an environment of centralized, top-down decisionmaking; they replaced political bargaining with technocratic expertise as the primary means of policy formulation; and they gave rise to a vast market for policy-oriented social science research.

John F. Kennedy's election to the presidency in November 1960 and his selection of Robert McNamara as secretary of defense opened the door to great influence for RAND. McNamara saw centralized control in the hands of a very few expert managers to be the most effective way to pursue optimal efficiency. The core of the McNamara revolution was a complex administrative system that combined program-based management control with rational decisionmaking through systems analysis. Three of McNamara's most powerful subordinates were former RAND analysts, his staff was pervaded by RAND personnel, and the two methodologies critical to his revolution—program budgeting and systems analysis—were largely RAND products.

Military leaders, however, quickly recognized the PPBS for what it had become: a mechanism for achieving centralized control of the defense administration. Because the PPBS transcended service divisions, it pulled policymaking out of the individual services and relocated it in the civilian Office of the Secretary of Defense (OSD). The extensive role played by RAND methods and personnel in the McNamara revolution understandably dismayed leaders of the U.S. Air Force, RAND's original client. It was painfully obvious that,

Championed as scientific means of policymaking, systems analysis and program budgeting fundamentally altered the nature of public policymaking in the United States.

Researchers expected to find the Viet Cong populated by apathetic peasants who had been kidnapped and indoctrinated by communist agitators. Instead, the RAND staff found the Viet Cong to be zealous, committed, and sincere.

through RAND, the Air Force had forged the weapons of its own oppressors. Air Force leaders responded on September 22, 1961, by issuing the so-called Zuckert Directive, named for Secretary of the Air Force Eugene

Zuckert. The directive prohibited RAND from contracting with other government agencies without Air Force approval. The directive sent shock waves through RAND's senior research staff, for it threatened to nullify the watchword of RAND's organizational culture: independence.

The events of late 1961 placed RAND in a perilous situation between its traditional commitment to the Air Force and its budding relationship with OSD. As a special committee of RAND's board of trustees struggled to find a solution, they received succor from a not-unexpected source—OSD—with the belated completion of the Bell Committee report in April 1962. Congressional pressure for a review of government relations with nonprofit organizations like RAND had led President Kennedy to create a committee to study the issues and develop policies. The Bell Committee, named for Bureau of the Budget Director David Bell, issued findings uniformly favorable to RAND. The report specifically contradicted the Zuckert Directive and endorsed both RAND's independence and its freedom to contract with multiple clients.

Between 1959 and 1964, Air Force support declined from more than 90 percent of RAND's budget to about two-thirds. By 1965, work for the Department of Defense and NASA, neither of which had been RAND clients before 1958, represented one-fourth of the corporation's effort. RAND's board of trustees saw clearly that excellent opportunities for growth and influence lay outside the Air Force and with the civilian agencies of the defense establishment.

The Vietnam Conflict

It was the defense establishment itself, however, that became a major point of contention within RAND, as the corporation began to feel deeply the insidious effects of the Vietnam conflict. Just as Vietnam began to cut grievously into the American social fabric, intense personal and ideological differences threatened to shatter the collegial environment within RAND. One project—the Viet Cong Motivation and Morale Studies—nearly tore apart the research staff.

In 1964, researchers Joseph Zasloff and John Donnell set up operations in Saigon and conducted hundreds of interviews throughout South Vietnam with prisoners and Viet Cong defectors to discover what motivated them. A pattern soon emerged. The Viet Cong, especially long-term veterans, saw themselves as patriots fighting U.S. imperialists and their South Vietnamese puppets. The principal Viet Cong objectives were the redistribution of land and the expulsion of the foreign imperialists. For Zasloff, Donnell, and their Vietnamese assistants, this came as a shocking revelation. They had expected to find the Viet Cong populated by apathetic peasants who had been kidnapped and indoctrinated by communist agitators. Instead, the RAND staff found the Viet Cong to be zealous, committed, and sincere and their struggle to be fundamentally class-based.

By the time the RAND researchers briefed their findings to the top American leadership in South Vietnam and throughout the Pentagon, however, the corrupt and chaotic South Vietnamese regime appeared to be crumbling, and President Johnson and Secretary of Defense McNamara decided that large-scale U.S. intervention would be implemented to prevent its collapse. The president could not countenance the “loss” of South Vietnam with an election only months away. Despite their startling content, therefore, the Zasloff-Donnell briefings did not reach the pinnacle of American policymaking and had no impact upon the disastrous U.S. decision to escalate. After March 1965, the desire in both the White House and the Pentagon to *understand* the complex social and political forces at work in Vietnam faded and became replaced by the overarching imperative to *win*.

At RAND, the Viet Cong Motivation and Morale Studies led to the polarization among researchers into prowar and antiwar factions that reflected national divisions concerning American involvement in Vietnam. On one hand, the preponderance of the research staff were veteran “cold warriors” who believed in the “domino theory”—that a failure by the United States to resist communist aggression would lead to catastrophic consequences—and who thus supported American efforts to hold the line in Vietnam. “Dovish” staff members like Zasloff, on the other hand, worried about the moral implications raised by the Vietnam research. Throughout the 1950s, RAND’s research community had flourished in the secure belief that its work was essential to the defense of freedom against an implacable and godless foe. Alliance with a corrupt regime and the brutalization of unarmed peasants, however, severely eroded that sense of righteous purpose, and a steadily growing fraction of the RAND staff found the corporation’s work in Southeast Asia to be repugnant. More and more RAND staff members became disen-

chanted with the corporation’s virtually exclusive commitment to military research. As RAND moved further into the 1960s, it found its military focus and reputation to be an increasing liability in the recruitment of young researchers, and this growing unattractiveness coincided with dramatic increases in the salaries being offered by universities—RAND’s primary competitor in recruiting.



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U.S. soldiers struggle in South Vietnam during Operation Junction City, 1967. Disagreements produced by the Vietnam conflict contributed to the decision by RAND to diversify into social welfare research.

sive commitment to national security research and diversify into research on issues of domestic social welfare such as education, urban development, and public health. Ironically, RAND had been gaining exposure to social systems analysis through the support of the Department of Defense. By 1963, RAND was performing, as a component of its military-funded projects, considerable work on foreign socioeconomic problems—a circumstance driven by the broadening conceptualization of national security. The early 1960s

By 1966, the international war against communism merged with a domestic war against poverty.

witnessed the migration of primary national security concerns away from global nuclear warfare toward more complex and socially-driven issues such as regional conflicts, counterinsurgency, limited warfare, and social revolution. Correspondingly, RAND's national security research methods gradually incorporated more sophisticated socioeconomic analyses. As these studies demonstrated the usefulness of RAND's techniques in tackling social problems abroad, more and more RAND researchers argued that their techniques should be used to address social welfare problems on the home front.

Concurrently, by mid-1964, there were potentially rich sources of support for social welfare research under President Johnson's "Great Society" programs. Previously, money for nonmilitary social welfare research had been restricted to a few private foundations and the relatively penurious social agencies of the federal and state governments. The Great Society changed all that. The transfer of scientific analysis methodologies from the Air Force to the Pentagon and then into the social welfare programs of the Great Society would, by 1966, point to the new direction for which RAND was searching.

From the Pentagon to the Great Society
The origins and elaboration of the Great Society, and particularly the "war on poverty," cannot be properly understood outside their cold war context. In fact, the American social welfare programs initiated during these years were fundamentally shaped by the defense-sponsored methodological advances spawned at RAND. By 1966, in other words, the international war against communism merged with a domestic war against poverty.

The late 1950s and early 1960s saw a shift in the nature of U.S.-Soviet confrontation. American policymakers worried that widespread social ills such as disease, poverty, racism, and unequal wealth distribution throughout Africa, South Asia, and Latin America easily could be converted by clever communist

propagandists into powerful destabilizing forces. U.S. leaders also could see emerging patterns of social instability at home, and the Department of Defense was concerned that the same social ills that provided a breeding ground for rebellion in Southeast Asia might also be found in urban America. Connections between national security and social welfare provided some of the strongest arguments in favor of diversifying RAND's research agenda beyond overtly military matters. Adam Yarmolinsky, who went from being special assistant to the secretary of defense to being deputy director of the President's Task Force on Poverty in 1964, even described the "war on poverty" as "one of our most effective tools in the war against communism."

The Great Society almost veered in a completely different direction, however, when poverty warriors involved with the Community Action Programs threatened to mobilize residents and introduce real democracy to federal social welfare policymaking—an outcome anathema to the cold warriors of the Johnson administration. The empowerment of the poor threatened to destabilize existing social and institutional structures and thus ran contrary to what this dissertation argues was a primary objective of the Great Society: the stabilization of American society. By early 1965, top-level economists at the federal Bureau of the Budget were looking to reassert centralized control over the new social welfare programs, and their search quickly took them to the Pentagon.

The Planning, Programming, and Budgeting System rapidly gained currency as a possible solution. In June 1965, Charles Schultze became director of the Bureau of the Budget and began work to transfer the PPBS from the Pentagon to the social welfare agencies. Schultze assigned Henry Rowen, a RAND whiz kid, to lay the groundwork. Schultze and Rowen presented their design to Joseph Califano, the president's newly appointed special assistant for domestic programs, whose previous experience also had been primarily in defense. According to the design, each civilian department would draw up multiyear programs establishing goals and objectives and create a systems analysis office to evaluate the programs. The system would function similarly to the defense PPBS arrangement. At a cabinet meeting on August 25, 1965, President

Johnson directed the implementation of PPBS and the creation of systems analysis offices across the federal bureaucratic structure. Those agencies most closely associated with the Great Society programs—the Department of Health, Education and Welfare, the Office of Economic Opportunity, and the Bureau of the Budget—became headed by RAND expatriates recruited from either the Pentagon or Santa Monica.

RAND Refines Social Policy Analysis

Named president of RAND in 1966, Henry Rowen believed in the fundamental connection between American social stability and military strength. In the struggle between the communist Soviet Union and the capitalist United States, the society that most efficiently and rationally harnessed all its resources, social as well as military, would surely prevail. Therefore, Rowen and his assistants sought to create within RAND a federally sponsored institute for urban policy research. This meant, first and foremost, the application of systems analysis to social policy problems, although Rowen and staff agreed that systems analysis—in its existing, military-oriented form—would have to be substantially altered and improved if it were to deal meaningfully with the vast complexity of social problems like racism and hunger.

Rowen's aggressive moves were short-circuited, however, by Califano, who, in 1967, adopted many of Rowen's ideas and created the Urban Institute under the auspices of the Department of Housing and Urban Development. Despite this setback, Rowen and New York Mayor John Lindsay announced, on January 8, 1968, four contracts for studies of New York's Police Department, Fire Department, Housing and Development Administration, and Health Services Administration. Through 1971, the New York City–RAND Institute was the source of almost half of RAND's domestic social research efforts and the cornerstone of its diversification into social welfare research.

It was in its work with the Fire Department that RAND developed its most famous research product in the New York effort: slippery water. RAND persuaded New York fire chiefs to explore the usefulness of polymer additives in water, and the results were spectacular. By reducing the friction of water passing

through the fire hoses, polymer additives increased by 50 to 80 percent the amount of water discharged without any increase in pumping pressure. RAND research also played a central role in the city's sweeping rent control reforms of June 1970, in cleaning up Jamaica Bay, and in screening more than 87,000 children for lead poisoning, uncovering 1,600 cases in time for effective treatment.

Until the last contracts of the New York City–RAND Institute expired in 1975, the city gained substantial benefits, and RAND received invaluable experience in social welfare policy analysis—experience that proved to be the foundation for subsequent work in nonmilitary areas. From that foundation,



PHOTO BY LEIGH WIENER (used by permission of Devik Wiener)

From the offices of the New York City–RAND Institute, researchers persuaded New York fire chiefs to explore the usefulness of polymer additives in water, and the results were spectacular.

RAND's research programs in health care systems, environmental policy, communications and broadcasting, and education slowly got under way. RAND's eight-year experiment in New York City provided a critical source of stable social welfare research funding, a venue for training social policy analysts, and a springboard for successful diversification into social welfare research in the long run. ■

50 Years Of Looking Forward

WHAT MAKES RAND RESEARCH UNIQUELY FASCINATING IS ITS CUMULATIVE GROWTH OVER HALF A CENTURY combined with its ability to stay ahead of the times, sometimes leading in unforeseen directions. The following sketches of cumulative research illustrate both qualities—flexibility within continuity—and highlight key changes in policy and society resulting from the research. Other important research projects are listed below the timeline in chronological order. The years cited refer to publication dates of reports or to longer periods of ongoing research.

SPACE EXPLORATION (1946–present) From its very first days, RAND stakes out the forefront of space. On May 2, 1946, two years before incorporating as a non-profit organization and more than a decade before the orbiting of Sputnik, history’s first artificial space satellite, RAND releases its first publication, *Preliminary Design of an Experimental World-Circling Spaceship*, assessing the feasibility of space satellites. In the 1950s, RAND research leads to balloon reconnaissance systems, weather satellites, and the world’s first space reconnaissance satellite. The high-resolution photographic techniques developed by RAND to spy on the Soviet Union during the cold war come to be used in the 1990s to verify arms control treaties, and related breakthroughs in storing data on magnetic tape help stimulate the commercial videorecorder industry. In 1959, RAND publishes *Space Handbook: Astronautics and Its Applications*, a standard reference outlining the state of the art of space flight. In the 1960s, RAND suggests ways to reduce launching costs of Mercury and Apollo flights and develops computer specifications

for the Apollo spacecraft and lunar excursion model. Throughout the 1970s, 1980s, and 1990s, RAND plays a pivotal role in mapping the planets and their moons; researchers recommend spacecraft trajectories, equipment, and camera movements for nine interplanetary missions, including Galileo, which is now orbiting Jupiter. In the late 1990s, RAND research investigates power systems for space exploration, military uses of commercial space satellites, the Global Positioning System, and proposed transatmospheric vehicles, also known as reusable space planes.

GAME THEORY AND GAMING (1948–present) RAND publishes *Handbook on the Theory of Games* in 1949 and quickly becomes a leader in game theory—how opponents use limited information about one another to determine the best strategy. From the 1950s onward, RAND uses human gaming to gain insights about military action-reaction cycles and about crisis behavior of leaders. Beginning in 1982, the “automated war gaming” of the RAND Strategy Assessment Center

permits human players and computer models to substitute for each other in representing theater commanders and heads of state. In the 1990s, RAND develops drug policy games for urban officials; “peace games” to reduce gang violence; “The Day After” games, which allow leaders from the U.S. government, Europe, and the former Soviet Union to look back from hypothetical crises involving weapons of mass destruction and consider what could have been done to avert such confrontations; and “The Day After—in Cyberspace” games, in which U.S. government, military, and private industry officials counter information warfare attacks hypothesized to occur in the year 2000.

EARLY SYSTEMS ANALYSIS (1949–1954) A RAND hallmark, “systems analysis” quantifies the expected costs, benefits, and risks of alternative courses of action. Broad in scope, systems analysis combines the knowledge of experts in many fields to reach solutions that transcend any individual expert’s judgment. In military systems analysis, for example, the cost of producing one weapon must include all related costs incurred by the rest of the force as well as life-cycle costs of operating and maintaining the weapon. The first major application of systems analysis is the 1949 report *Strategic Bombing Systems Analysis*, which advocates using decoys to mask bombers from the enemy. A 1954 report, *Selection and Use of Strategic Air Bases*, shakes the foundation of nuclear deterrence policy by shifting the United States from a first-strike to a second-strike posture. The report advises the Air Force to relocate its bomber forces away from bases near the Soviet Union and toward home, where U.S. bombers could survive a first-strike attack and then carry out a retaliatory second strike. This radical shift entails abandoning overseas bases and relying instead

on long-range bombers and aerial refueling, another RAND innovation—and saves the Air Force more than a billion dollars in construction costs. In the 1960s, systems analysis will evolve into social policy analysis (see 1960s).

EARLY COMPUTING AND PROGRAMMING

(1949–1962) From 1949 to 1954, RAND builds the JOHNNIAC digital computer, one of the first “modern” U.S. computers, at a time when commerce still depends on keypunch machines for data processing. The computer is named for its designer, John von Neumann, a RAND consultant. The new computer technology, combined with the demands of analytic studies, prompts RAND to create new mathematical algorithms and their software programs: dynamic programming (1953), an approach to solving sequential decision problems, and its software; Information Processing Language (1957), which simulates human thinking and becomes the foundation for artificial intelligence; linear programming (1959) and its Simplex computation method; and SIMSCRIPT (1962), a language for simulation and modeling. Along with the stochastic programming, integer programming, and digital Monte Carlo methods also developed by RAND during the 1950s, these new tools compose the heart of operations research. Demand for random numbers to support modeling produces the 1955 book *A Million Random Digits with 100,000 Normal Deviates*, whose tables become a standard reference for engineers, statisticians, physicists, pollsters, market analysts, and lottery officials. In the 1960s, these computing advances will lead to the information revolution (see 1960s).

1940s

1946 1947 1948 1949

■ EXOTIC MATERIALS AND FUELS 1947–1949

■ AIR DEFENSE 1949–1953

Illustration from Preliminary Design of an Experimental World-Circling Spaceship, 1946.

PHOTOS FROM RAND ARCHIVES EXCEPT AS NOTED

SOVIET STUDIES (1950–present) RAND pioneers the field of Soviet Studies, beginning in 1950 with *The Operational Code of the Politburo*, which probes the political strategy of Bolshevism and aids the United Nations’ armistice-negotiating team in Korea. Subsequent studies analyze Soviet nuclear research (1959), Soviet cybernetics (computing) technology (1964), Soviet aviation (1970), the Soviet calculus of risks and uncertainties in using nuclear forces (1970s), the Soviet economic burden of maintaining its empire (1983), and alternative U.S. policies toward a changing Soviet Union (1986). Over the decades, RAND stimulates leading economists at Harvard University to carry on the work of Soviet Studies. In the late 1990s, RAND spearheads research on Russia’s demographic “crisis,” U.S. and Russian policies for the use of force, and the implications of migration within the former Soviet Union. RAND also supports the Russian-American

1950s

Business Leaders Forum, a program to promote cooperation among top American and Russian corporate executives.

COST ANALYSIS AND LOGISTICS (1952–present) Since 1952, RAND has advised the military how to improve efficiency and reduce costs in managing spare parts and other resources. In the 1960s, the METRIC mathematical model enables the Air Force to strengthen the forecasting of demand for spare parts in peacetime and thereby achieve higher performance at much lower cost. By 1983, the Dyna-METRIC model

estimates the need for spare parts during dynamic, wartime scenarios. Alternative logistics structures recommended during the late 1970s and 1980s result in centralized maintenance depots for tactical aircraft. In the 1990s, numerous studies on Air Force “lean logistics,” Army “velocity management,” and Marine Corps “precision logistics” help the services adopt commercial innovations to operate more efficiently, more rapidly, and more decisively.

NATO (1953–present) In the 1950s, prompted by the growing Soviet atomic capability, RAND studies U.S. Air Force vulnerability in an atomic war and examines alternative approaches to defending Europe. Resulting work on NATO force planning in 1964–1966 leads to a major change in NATO strategy away from automatic, massive nuclear retaliation and toward a more flexible response that relies on strong conventional forces in Central Europe. A 1971 report suggests reallocating NATO’s tactical air resources toward nonnuclear attacks of enemy air bases, and a 1973 study of vulnerable U.S. Army equipment in Central Europe prompts the secretary of defense to increase army stocks there. In 1983, RAND refutes the contention that Soviet bal-

Staff analyze maintenance data in RAND’s Logistics System Laboratory in the early 1950s—before the computer era.



1950	1951	1952	1953	1954
	<ul style="list-style-type: none"> ■ EXPERT JUDGMENT APPLIED TO OPERATIONS RESEARCH 	<ul style="list-style-type: none"> ■ MISSILES VS. AIRCRAFT FOR STRATEGIC BOMBARDMENT ■ SYSTEMS RESEARCH LABORATORY 1952–1955 		



In the early 1950s, RAND sets up a Systems Research Laboratory (left) to train the “systems” of men and machines at Air Defense Centers to prevent enemy aircraft from getting through. Simulated crises, “failures,” and debriefings place more and more stress on the system, which gradually “learns” how to handle situations far more demanding than those that actually could occur. Eventually, the entire Air Defense System implements the RAND training program, and its tremendous growth leads to the creation in 1957 of a separate corporation, the Systems Development Corporation, with its laboratory shown here in the early 1960s (below).



listic missiles would make NATO tactical air forces indefensible and ineffective. A 1987 study of conventional arms control determines that large and highly asymmetric reductions in Warsaw Pact forces are necessary to overcome an imbalance of forces in Central Europe. Research beginning in 1991 on possible NATO expansion plays a major role in the 1997 decision by NATO leaders to invite Poland, the Czech Republic, and Hungary to join the Alliance. In 1997 and 1998, RAND analyzes the issues and costs of NATO expansion and helps Hungary, Poland, and Romania assess future defense policies in light of expected expansion.

IMPROVED BUDGETING (1953–present) The 1953 study *Efficiency and Economy in Government Through New Budgeting and Accounting Procedures* proposes that the Air Force break down its costs according to missions performed by specific units operating specific equipment, thus permitting easier cost comparisons and better resource management. The 1960 study *Economics of Defense in the Nuclear Age* further helps to guide the efficient allocation of military resources. From these pioneering works emerges

RAND’s Planning, Programming, and Budgeting System (PPBS), a tool to help managers allocate defense resources among competing programs according to overall national objectives. PPBS becomes standard practice for the Department of Defense and the military services during the 1960s and, in later decades, for nondefense agencies, state and municipal governments, and private corporations.

1955	1956	1957	1958	1959
<ul style="list-style-type: none"> ■ AERIAL REFUELING ■ DESIGN OF MULTIPLE INDEPENDENTLY TARGETABLE REENTRY VEHICLES (MIRVS) 			<ul style="list-style-type: none"> ■ DELPHI METHOD (TO BRING EXPERTS TO CONSENSUS) ■ MILITARY R&D POLICIES 1958–Present 	<ul style="list-style-type: none"> ■ DETECTING UNDERGROUND NUCLEAR TESTS ■ STRATEGY IN THE MISSILE AGE ■ STRATEGIC OFFENSIVE FORCES STUDY 1959–1961 ■ EFFECTS OF ELECTROMAGNETIC PULSE 1959–1970

THE INFORMATION REVOLUTION (1960–present)

Building on its JOHNNIAC computer, RAND begins work in 1960 on the JOHNNIAC Open Shop System (JOSS), the first online, interactive computer system,



In the early 1960s, RAND helps Air Force officers (above) improve the scheduling of aircraft maintenance. By 1967, RAND statistical models predict the number and types of mechanics needed for unscheduled maintenance.

which provides the U.S. Air Force with a national network when other “networks” are still limited to a single building or geographical area. In 1961, researchers create the RAND Tablet, the first two-dimensional writing surface that allows humans to communicate instantly with computers through

characters printed on the tablet. In the mid-1960s, in response to an Air Force demand for communications able to survive a nuclear attack, RAND researchers invent “distributed communications”—now called packet switching—which evolves into one of the major technological innovations of our time: the Internet. Over the next 20 years, RAND leads national efforts to ensure computer security for the military—and computer privacy for civilians—with safeguards against eavesdropping, wiretapping, copying, or outright theft of files. A 1985 report, *Toward an Ethics and Etiquette for Electronic Mail*, proposes guidelines for social behavior appropriate for electronic mail. *Universal Access to E-Mail: Feasibility and Societal Implications*, a 1995 report, warns of an impending age of information “haves” and “have-nots,” recommends a U.S. policy of universal e-mail access, and addresses the technical and economic aspects of implementing such a policy.

CALIFORNIA WATER (1960–present) As early as 1960, in a landmark report entitled *Water Supply: Economics, Technology, and Policy*, RAND faults California for its highly inefficient allocation of water and recommends “water markets” to reallocate water to its best use. A series of RAND reports in the late 1970s

reinforces the recommendation with more than a score of suggested changes in state water law, state and local water agency practices, and methods of pricing and allocating water. A 1996 study of the economic effects of California drought management policies shows when and where those effects are most severe and how they are distributed across residential, commercial, industrial, agricultural, and government users. This knowledge can help water agencies decide how to allocate water and whether to invest in new water projects. A 1998 study of the effects of reduced water supplies to San Joaquin Valley agriculture during the 1986–1992 drought provides policymakers with better information on the costs and benefits of reallocating water from agriculture to the environment.

MILITARY MANPOWER (1967–present) RAND studies position it as the world leader in devising military personnel policies. In 1967, RAND statistical models predict the number and skill mix of aircraft mechanics required for unscheduled maintenance. Studies of Air Reserve Forces in the late 1960s give rise to a “total force” concept that considers active and reserve forces as complements, not competitors. In 1970, RAND recommends moving to an all-volunteer force: Any short-term loss in recruit quality would be offset by the increasing size of the recruit-aged population, a smaller military force after Vietnam, and possible increases in military pay. In the 1970s and 1980s, RAND’s studies of potential doctor shortages in the military lead to expanded roles for physicians’ assistants, enhanced medical-school scholarships, and a division of labor allowing surgeons to concentrate on the most difficult steps in surgery. Several RAND experiments from the late 1970s onward lead to new compensation policies—still used today—that help the military recruit and retain quality personnel. The experiments show that educational benefits need to be targeted to

1960	1961	1962	1963	1964
<ul style="list-style-type: none"> ■ SPACE DEFENSE ■ INTERCONTINENTAL BALLISTIC MISSILE (ICBM) MODERNIZATION AND BASING CONCEPTS 1960–1980 		<ul style="list-style-type: none"> ■ REMOTE AREA CONFLICT 	<ul style="list-style-type: none"> ■ SEA-BASED VS. LAND-BASED TACTICAL AIR ■ AIR-LAUNCHED VS. GROUND-LAUNCHED SATELLITE BOOSTERS 	

expand the pool of high-quality recruits and that bonuses are powerful tools for recruiting and retaining personnel without increasing retirement outlays. A 1989 report shows that Army recruitment advertising produces immediate and significant increases in the number of high-quality enlistments. A 1998 report outlines how the military could save money, raise productivity, and better manage careers—including any future drawdowns—by raising pay and converting to an alternative retirement system modeled after the Federal Employees Retirement System.

SOCIAL POLICY ANALYSIS (1968–present) From its foundation of systems analysis, RAND develops policy analysis, which often balances quantitative and qualitative factors and serves policymaking in many social policy areas. From 1968 to 1975, the New York City–RAND Institute offers solutions to nursing shortages, helps improve rent control, shows how to

relocate fire companies during fires and how to reallocate police personnel, and helps enhance water quality in Jamaica Bay. The 1986 report *Closing the Gap: Forty Years of Economic Progress for Blacks* finds that the wages of African American men in the United States increased 52 percent faster than those of white men between 1940 and 1980 and that the major causes were economic growth in society overall and vast improvements in the quantity and quality of education of African Americans. The study recommends that antipoverty efforts emphasize education and overall economic growth. Soon after the Los Angeles riots of 1992, a RAND report examining urban problems facing the city and nation suggests that, in the absence of federal attention to the inner city, local leaders must be willing to implement policies that may benefit only part of the target population.

1960s



It takes an entire crew of men to disassemble and move the components of the single JOHNNIAC computer (inset). In 1966, after more than a decade of service at RAND, the pioneering JOHNNIAC assumes its place of honor at the Los Angeles County Museum of Science and Technology (left).

1965	1966	1967	1968	1969
	<ul style="list-style-type: none"> ■ EVALUATIONS AND OPTIONS FOR VIETNAM 		<ul style="list-style-type: none"> ■ STRATEGIC FORCE-BUILDING AND CRISIS MANAGEMENT 	<ul style="list-style-type: none"> ■ FUTURE OF CABLE TELEVISION

1970s

HEALTH INSURANCE (1971–present) In 1971, RAND embarks on the 15-year Health Insurance Experiment, which places 2,700 families in health insurance plans ranging from free care to 95 percent payment, with some families enrolled in health maintenance organizations (HMOs). Families with free plans use up to 50 percent more health services than those in cost-sharing plans or HMOs, but the effect on the average person’s health is negligible; among adults, free care leads to better health only for those with poor vision or for low-income people with high blood pressure. A 1974 report concludes that national health insurance would provide more health services to more people and should improve quality of life—but would not appreciably extend life expectancy. A 1978 report estimates the effect of different deductibles on demand for care, and in 1988 RAND finds that demand for outpatient care declines for those paying higher rates, whereas demand for inpatient care holds steady. Corporations and unions use many of these conclusions to claim that cutting back medical fringe benefits would not undermine health. In 1996, RAND analyzes proposed medical savings accounts (MSAs), designed to reduce health care costs by allowing individuals with only a “catastrophic” insurance policy to set up a tax-exempt account to pay routine medical bills. The study finds that MSA legislation would not necessarily reduce health care costs, because many Americans with employer-provided insurance would not switch to MSAs. Research in the late 1990s examines the effect of the 1996 Health Insurance Portability and Accountability Act, which allows those formerly covered by group health insurance policies to purchase individual policies free of exclusions for preexisting conditions. RAND finds that the new legislation will not raise

individual premiums nearly as much as estimated by the Health Insurance Association of America.

HOUSING ASSISTANCE (1972–1982) RAND’s Housing Assistance Supply Experiment shows that cash housing allowances benefit the most needy families more—and cost less—than constructing housing projects. The experiment, conducted among 25,000 households in the two very different cities of Green Bay, Wis., and South Bend, Ind., also determines that cash allowances do not inflate the cost of housing; rather, they result in improved housing quality for recipients and put pressure on the overall market to raise housing quality. Perhaps the largest single social experiment ever conducted, the research contributes to changes in the U.S. housing code that make cash subsidies available to some low-income groups.

TERRORISM (1972–present) RAND pioneers research on terrorism with studies of the motivation, organization, and tactics of terrorists; U.S. policy, strategy, and tactics for dealing with terrorists and state sponsors of terrorism; U.S. capabilities to rescue U.S. nationals abroad; the potential of computers to help manage crises; and the potential for terrorist use of weapons of mass destruction. RAND’s database of terrorist incidents becomes the foundation for the government’s database and annual reports on terrorism, and RAND research on threats to U.S. nuclear programs helps the Department of Energy establish security criteria. A 1981 report concludes that, because the primary concern is international terrorism, the United States must seek international cooperation in identifying, isolating, and modifying the behavior of states that support or tolerate terrorists. RAND leads in the creation of an international network of scholars and government officials responsible for dealing with terrorism; later, RAND helps develop a cooperative

1970	1971	1972	1973	1974
<ul style="list-style-type: none"> ■ THE PRIVATE SECURITY INDUSTRY ■ AIR FORCE LONG-RANGE PLANNING STUDIES <i>1970–Present</i> 	<ul style="list-style-type: none"> ■ WATER QUALITY SIMULATION MODEL ■ STRATEGIC ANALYSIS: THE LONG-TERM COMPETITION ■ STRATEGIC AIRLIFT NEEDS AND ALTERNATIVES FOR THE 1980S <i>1971–1979</i> ■ SYSTEMS ACQUISITION POLICIES <i>1971–Present</i> 		<ul style="list-style-type: none"> ■ STAR: IMPACT OF ALTERNATIVE INTERCITY SHORT-HAUL TRANSPORTATION SYSTEMS 	<ul style="list-style-type: none"> ■ A PROPOSED STRATEGY FOR THE ACQUISITION OF AVIONICS EQUIPMENT ■ REMOTELY PILOTED VEHICLES ■ AIR FORCE HEALTH CARE SYSTEM <i>1974–Present</i>

effort between the United States and the Soviet Union. Studies in the late 1990s conclude that U.S. armed forces must look beyond state-sponsored terrorism and be able to deter and respond to networks of individuals as well.

EDUCATIONAL REFORM (1975–present) In 1975, RAND evaluates federal educational programs of the 1960s and finds that success depends not on technology or funding but on local adaptation and implementation. The study launches decades of research to monitor school reforms, focusing in the 1990s on new math and science tests, “whole-school designs,” and privately operated public schools. The latter study identifies the chief obstacle to school reform as top-down, rule-driven school systems and recommends charter schools as a way to reinvent public education. In the late 1970s, RAND studies school finance reforms—adopted by 25 states in an attempt to overcome funding disparities related to property taxes—and finds that states made negligible progress because many reforms were based on inaccurate assumptions and pursued conflicting objectives. Turning to higher education, a sobering 1997 study warns that the nation’s colleges and universities face a catastrophic shortfall in funding as a result of continuing enrollment increases, rising costs, and stagnant public funding. The study calls for increased public investment in higher education coupled with comprehensive institutional reform to control costs and improve productivity. A similar 1998 report focusing on California sounds a clarion call: A “tidal wave” of 700,000 additional students will hit the state’s higher education shores by 2015, and many students will be denied enrollment unless trends can be reversed. The report urges greater public support for higher education in California along with institutional reform to reallocate resources and streamline operations.

DUTCH INFRASTRUCTURE (1975–present) A five-year joint effort between RAND and the Dutch government in the late 1970s leads to the creation of the world’s largest permeable dam—a storm-surge barrier with large movable gates—which balances the environmental, economic, and safety concerns of the Netherlands. When lowered, the gates protect the Netherlands’ last and largest estuary; when raised, they protect people, homes, livestock, and the entire shoreline. Research in the early 1980s helps refine Dutch water policy by measuring the effects that prices, regulations, and new storage facilities have on agriculture, hydrology, irrigation, shipping, industry, drinking water companies, power plants, salt intrusion, groundwater supplies, and the environment. A 1993 RAND analysis points to affordable policies that would protect against floods while preserving, as much as possible, the landscape and natural and cultural values along the rivers. Also in 1993, after an El Al freight aircraft crashes into an apartment complex near Amsterdam, RAND analyzes the risks of expanding Schiphol airport and recommends safety management changes, safety incident tracking, and better public communication. A 1996 report—*Freight Options for Road, Water, and Rail for the Dutch (FORWARD)*—examines ways to mitigate the negative effects of

A storm surge crashes against the movable gates developed for the Netherlands by the Dutch government with RAND’s analytical assistance. When raised, the gates protect against flooding; when lowered, they protect the Oosterschelde estuary.



PHOTO COURTESY OF THE NETHERLANDS RIJKSWATERSTAAT

1975	1976	1977	1978	1979
<ul style="list-style-type: none"> ■ COMPUTER RESOURCE MANAGEMENT STUDY ■ SCHEDULING AIRCREWS AND AIRCRAFT 			<ul style="list-style-type: none"> ■ PREVENTIVE DENTAL CARE FOR CHILDREN 	<ul style="list-style-type: none"> ■ ASIAN SECURITY: POLICIES FOR A TIME OF TRANSITION ■ ESTIMATING COSTS OF SYNTHETIC FUELS: IMPLICATIONS FOR ENERGY PROCESS PLANTS

increased road freight traffic while retaining the economic benefits. The study identifies the most promising strategy as improving road freight efficiency—not shifting to other modes of transportation. In the late 1990s, similar studies of air and ground transportation help the Netherlands plan for expected growth.

FAMILY LIFE IN DEVELOPING COUNTRIES (1976–present) Beginning with the Malaysian Family Life Survey in 1976–1977, RAND designs, fields, and



PHOTO COURTESY OF JULIE DAVANZO

Beginning in the late 1970s, research with Malaysian villagers examines the interrelations between family patterns and economic development.

analyzes a series of household surveys in developing countries: in Malaysia in 1988–1989, Indonesia in 1993–1994 and 1997–1998, Guatemala in 1995, Bangladesh in 1996, and follow-up surveys now under way in Indonesia and Malaysia. Unique for developing countries, the rich databases—which are placed in the public domain—track demographic, social, health, and economic information at the individual, household, and community levels.

The surveys have supported more than 100 RAND studies on the effects of public policy and family decisionmaking on fertility and contraception, breastfeeding, infant mortality, child and adult health, health care utilization, education, labor supply and wages, income and wealth distribution, migration, and intergenerational relationships.

CRIME AND PUNISHMENT (1977–present) Multiple RAND studies in the late 1970s change the way people think about “career criminals.” Researchers confirm what police have long claimed: A small proportion of offenders commit a large percentage of crime. The research makes career criminals a national priority,

fostering new legislation and focusing resources. A 1986 study on recidivism, however, cautions against reserving scarce prison space for inmates deemed likely to return soon after release, because it is hard to predict which former inmates will commit crimes—and how soon after release—or how often they will do so. In 1994, RAND critiques California’s tough new “three-strikes-and-you’re-out” law for mandatory sentencing of repeat offenders. RAND predicts the new law, if fully implemented, will decrease serious crime by 21 percent, yet the huge cost of \$5.5 billion a year makes the law unlikely to be implemented. RAND proposes an alternative—guaranteed full terms for all *serious* offenders, even first-timers, with no imprisonment for many minor felons—which would produce the same reduction in serious crime at lower cost. In 1997, RAND levels a similar critique against mandatory minimum sentences in drug cases. Researchers find that a million dollars spent on mandatory minimum sentences would reduce cocaine consumption less than would a million dollars spent on the previous system of prosecution and sentencing—and that neither approach would reduce cocaine consumption or related crime as much as a million dollars spent on drug treatment programs for heavy users.

THE PRICE OF JUSTICE (1981–present) Numerous RAND studies evaluate the civil justice system. A 1981 report on California’s court-ordered arbitration program, established in 1979, leads to improvements that reduce court backlogs and costs without hurting either side. In the early 1980s, RAND gauges the mostly upward trends in malpractice claims, workers’ compensation benefits, asbestos litigation costs, and civil jury awards. A 1987 study on punitive damages discovers that judges generally reduce jury awards by about half. A 1988 study of air crash litigation informs aircraft

1980	1981	1982	1983	1984
<ul style="list-style-type: none"> ■ TSAR/T SARINA AIR BASE ATTACK SIMULATION MODELS 1980–1990 		<ul style="list-style-type: none"> ■ REVITALIZATION OF CLEVELAND’S ECONOMY ■ BALLISTIC MISSILE BASING ALTERNATIVES 1982–1985 		<ul style="list-style-type: none"> ■ STRATEGIC DEFENSE AND DETERRENCE

manufacturers that fully compensating survivors for monetary loss would be even more expensive than fighting their lawsuits. A 1991 report shows that no-fault auto insurance, as compared with traditional auto insurance, reduces transaction costs, matches compensation more closely with monetary loss, reduces the amounts paid for pain and suffering for less-serious injuries, and speeds up compensation. In 1996, RAND evaluates the impact of the Civil Justice Reform Act (CJRA) of 1990, finding that CJRA itself had little effect on reducing costs and delays, but that judges can make a difference: Early judicial management of cases, early setting of trial dates, and earlier cutoff dates for discovery can reduce delays considerably with no change in litigation costs, participant satisfaction, or perceived fairness.

1980s

DRUG PREVENTION AND TREATMENT (1983-present) Beginning in 1983, RAND develops and tests a drug prevention program called Project ALERT, which discourages tobacco and marijuana use among seventh and eighth graders by training them to resist peer pressure. Based on the success of this program, South Dakota schools implement ALERT Plus in 1997. A 1990 study of the economics of drug dealing in Washington, D.C., determines that preventing drug abuse depends primarily on reducing the street market demand that entices young men into the drug trade. A 1997 report estimating the cost-effectiveness of four cocaine-control programs—three supply-reduction programs of law enforcement and one demand-reduction program of treatment—finds that an additional dollar spent on treatment would be far more effective in reducing consumption than an additional dollar spent on enforcement, given current budget allocations.

IMMIGRATION (1985-present) A 1985 RAND report on the effects of Mexican immigration on California concludes that Mexican immigrants contribute more to public revenues than they consume in public services and that these immigrants follow the classic pattern of integration into U.S. society, with education playing a critical role. Twelve years later, a series of RAND

reports concludes that the costs to California of immigration from all countries—in terms of education, jobs, and government spending—are beginning to outweigh the benefits. The reports call for reducing illegal and legal immigration, emphasizing educational level and work skills in admissions decisions, and allocating federal payments to defray the heavy education and social costs borne by California.

AIDS COSTS AND CARE (1987-present) RAND funds its own research on AIDS in the mid-1980s before conducting government-sponsored studies from 1987 onward on the costs and complications of treating AIDS patients. The HIV Cost and Services Utilization Study, to be completed in 1999, will provide the first nationally representative data on the cost of treating people with HIV in the United States and will examine access to care, quality of care, quality of life for people with HIV and AIDS, unmet needs, social support, and a range of clinical issues. Another current RAND project examines and seeks to improve treatment for those with HIV who are also seriously mentally ill.

RAND researcher Stephen Carroll leads a 1980 discussion about potential topics of civil justice research.



1985	1986	1987	1988	1989
		<ul style="list-style-type: none"> ■ EFFECTIVE TEACHER SELECTION ■ LHX: ARMY'S LIGHT ATTACK HELICOPTER 1987-1990 ■ EVALUATION OF THE CIVILIAN HEALTH AND MEDICAL PROGRAM OF THE UNIFORMED SERVICES (CHAMPUS) REFORM INITIATIVE 1987-1995 	<ul style="list-style-type: none"> ■ LEADERSHIP CHANGE IN NORTH KOREAN POLITICS 	

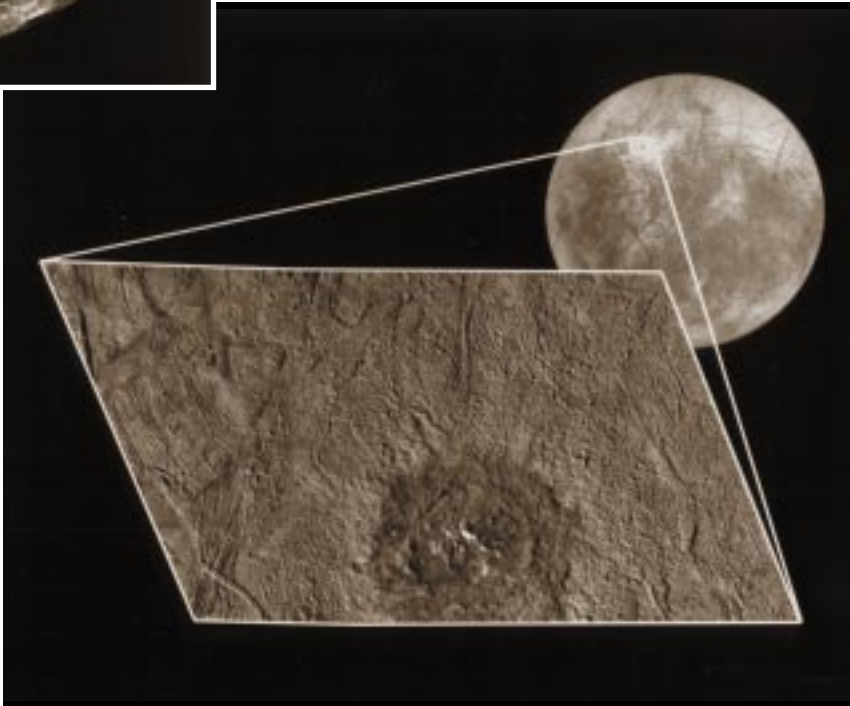
1990s



REVOLUTIONS IN MILITARY AFFAIRS (1989-present)

Whereas the term “revolution in military affairs” commonly refers to changes in warfare brought about by technological breakthroughs of the 1990s, other global and domestic trends of the post-cold war era spawn myriad additional revolutions in U.S. military missions, strategies, and standard operating procedures. RAND advice begins in 1989 with a “strategies-to-task” framework that allows planners to compare which forces link to national objectives. A 1993 report, *The New Calculus: Analyzing Airpower’s Changing Role*, argues that modern, land-based air forces are uniquely suited to meeting many post-cold war military needs; the report endorses overall U.S. force reductions yet underscores the need for selective modernization. Several studies conducted for the 1997 Quadrennial Defense Review lead to a Pentagon

In the late 1990s, RAND plays a pivotal role in mapping the moons of Jupiter. Recent images sent back from the Galileo spacecraft show huge cracks on the frozen, ice-encrusted surface of Europa (right) and plumes of smoke trailing from enormous volcanoes on Io (above), the only body in the solar system other than Earth with active volcanoes.



PHOTOS COURTESY OF MERTON DAVIES

1990	1991	1992	1993	1994
	<ul style="list-style-type: none"> EMERGING TECHNOLOGY AND ARMS CONTROL 	<ul style="list-style-type: none"> COST AND USE OF CAPITATED MEDICAL SERVICES SUPERFUND AND TRANSACTION COSTS 	<ul style="list-style-type: none"> LESSONS FROM THE GULF WAR 	<ul style="list-style-type: none"> DECLINE OF THE U.S. MACHINE TOOL INDUSTRY

blueprint for the 21st century that calls for a new round of base closures and troop reductions, fewer jet fighters, and a new emphasis on noncombat operations overseas. Several RAND reports sketch the requirements for these peacekeeping, humanitarian, and evacuation operations. The information revolution transforms the nature of conflict, according to a 1997 RAND book, *In Athena's Camp: Preparing for Conflict in the Information Age*, which predicts the passing of the era of massed field armies and the beginning of an age in which information and knowledge are the key elements of power. In response, RAND develops "The Day After—in Cyberspace," an exercise for senior defense and civilian officials and corporate executives to help identify threats, capabilities, policies, and budgets. Revolutions also hit closer to home: A 1990 RAND report finds strong similarities in the factors that influence men and women to enlist in the services; a 1993 RAND report finds no reason for the military to discriminate on the basis of sexual orientation; and a 1997 report finds that integrating women into military units has had little effect on readiness, cohesion, or morale.

APPROPRIATENESS AND QUALITY OF CARE (1989–present) In 1989, a RAND literature review discovers that as many as 25 percent of acute hospital services or medical procedures for the elderly are suspected to be inappropriate, and 40 to 50 percent of their outpatient medications are overused. The researchers report a substantial problem in matching acute services to the needs of elderly patients. Throughout the 1990s, scores of RAND

projects investigate potential methods to measure and improve the quality of care in various health care settings.

INVESTING IN CHILDREN (1996–present) A widely disseminated 1996 report, *Diverting Children from a Life of Crime*, measures, for the first time, the cost-effectiveness of intervention strategies for youth at risk of pursuing criminal careers. Three types of interven-



PHOTO BY ROBIN GRANT

Raynard King, codirector of the Drew/RAND Center on Health and Aging, addresses attendees at the "Spring into Health" conference in 1996. A joint effort by RAND and the Drew/King Medical Center in South Central Los Angeles, the Drew/RAND Center on Health and Aging seeks to develop a new model of interaction between research institutions and community groups.

tions—cash and other graduation incentives, parent training, and supervision of delinquent teens—appear more cost-effective in reducing crime than California's "three-strikes" law. A 1998 report, *Investing in Our Children*, examines an array of programs designed to promote healthy child development, particularly among disadvantaged children, in the first three years of life. The report concludes that these programs—home visits by nurses, parent training, and preschool—can provide significant benefits and that government funds invested early in the lives of some children might produce compensating decreases later on in government expenditures on welfare, criminal justice, and special-education programs. ■

1995	1996	1997	1998	1999
<ul style="list-style-type: none"> ■ UNEQUAL WEALTH AND INCENTIVES TO SAVE 	<ul style="list-style-type: none"> ■ FISCAL FEDERALISM AND THE SOCIAL SAFETY NET 	<ul style="list-style-type: none"> ■ MAKING SMALL LIGHT ARMY FORCES MORE CAPABLE ■ ADEQUACY AND EQUITY OF CALIFORNIA WORKERS' COMPENSATION ■ U.S. AIRCRAFT CARRIER INDUSTRIAL BASE 	<ul style="list-style-type: none"> ■ EFFECTIVE POWER GENERATION UNDER DEREGULATION ■ CHINESE DEFENSE MODERNIZATION ■ CONSEQUENCES OF PROPOSED CHANGES IN SOCIAL SECURITY ■ EFFECTS OF CLASS-SIZE REDUCTION IN CALIFORNIA SCHOOLS 	

Toward the Next 50 Years

Paul H. O'Neill is chairman and chief executive officer of Alcoa and chairman of the RAND board of trustees. James A. Thomson is president and chief executive officer of RAND.

RAND is attacking the problems of today and tomorrow from the same broad capability base and with the same values of quality and objectivity that established a legacy of achievement. In fact, many projects and plans of today flow directly from the research streams that produced major breakthroughs in earlier decades. A few then-and-now highlights should make the point.

The post-World War II period, like our own post-cold war era, was a time of transition. New technologies, Soviet power, the appearance of nuclear weapons—all demanded creative response. In our very first project, later described as the cornerstone of America's space program, a team of researchers demonstrated the feasibility and utility of placing satellites in earth orbit. To better understand a secretive adversary, another group helped launch the new discipline of Soviet area studies. Many of the nation's core strategies for defense and deterrence in the nuclear age were developed here. Staff scientists pioneered key features of the high-flying reconnaissance systems that gave the West essential windows into the closed world behind the Iron Curtain.

Today, our researchers are responding to the contemporary versions of these challenges: pursuing ways and means to ensure that the U.S. Air Force, our original sponsor, extends its command of air and space well into the 21st century; helping the U.S. Army shape

the ground forces of the future; formulating strategy for the much-discussed revolution in military affairs and for coping with the latest weapons of mass destruction; mapping the directions and implications of growing Chinese power; analyzing the logic and costs of NATO expansion and of a broader, less Euro-centric, transatlantic partnership; and engaging the new Russia through a dialogue among American and Russian business leaders.

In the 1950s and 1960s, RAND operated at the cutting edge of the information revolution. Staff members constructed one of the first online, time-shared computers. They also wrote the programs that became the basis for artificial intelligence systems. One of their most far-reaching innovations, the concept and technology of distributed communications, has evolved, spectacularly, into what we now know as the Internet and the World Wide Web.

Today, their successors are exploring the perimeters of information warfare, examining the vulnerability of the nation's information-based infrastructure, and weighing the costs and benefits of providing access to e-mail for all Americans.

Given our penchant for confronting the toughest issues and our emphasis on exacting analysis, RAND has always been fertile ground for the creation of new analytic tools. Linear programming, game theory, scenario writing, systems analysis, and policy analysis are techniques that were pioneered within our walls before migrating throughout the world.

The most recent addition to this tool kit is adaptive planning, a way of addressing policy problems—global warming is a good example—that are laden with uncertainties. A 1996 RAND paper embodying this adaptive planning approach provided

an important conceptual underpinning for the Pentagon's 1997 Quadrennial Defense Review.

Our health policy unit has been a particularly rich source of methodological innovation. The program took wing in the early 1970s with the RAND Health Insurance Experiment, the largest such sociological study ever undertaken. The mammoth, nationwide effort concluded some 15 years later with an invaluable database and a raft of findings showing the relationship between costs of coverage, health care utilization, and health outcomes. The experiment also spawned the first attempts to measure quality of care.

Today, RAND Health is refining and expanding those measures in partnership with government and, more recently, private industry. Pfizer Inc., to cite just one such partner, is supporting our efforts to develop tools for measuring and improving the quality of care provided to our most vulnerable elderly citizens. Recently, our health researchers completed a sweeping overview of the caliber of care prevailing across the country. More ambitiously still, they are now crafting strategies to reengineer the health care system in a fashion that puts quality of care on a par with cost control. With many Americans now enrolled in managed health care plans, this has become an urgent task.

Each of our research units has its own extensive agenda and interdisciplinary roster, but they frequently pool their expertise to mount integrated projects as well. RAND Health and the Institute for Civil Justice, for example, are pursuing joint investigations of arbitration in health care disputes and of litigation issues in managed care. RAND labor economists and criminologists have collaborated on an evaluation of the costs and benefits of programs for helping families with very young, at-risk children.

The late 1940s and the 1990s have been times of transition for research funding as well as for research challenges. Prior to World War II, government investment was minor. But that changed during and after the conflict. RAND itself was born out of the military leadership's concern for maintaining its wartime collaboration with America's scientific talent. The burgeoning federal role was justified on economic and

public health grounds as well as in national security terms. Research funding not only exploded in quantity but became qualitatively expansive as well, encouraging wide-ranging inquiry. For an institution like RAND, this translated into broad goals, long-term perspectives—and a string of immensely creative contributions to the public interest.

In recent years, the spirit of federal and, for that matter, industrial research support has changed radically. The emphasis today is on narrowly targeted goals and short-term perspectives. We are pleased to respond to these changing needs and do so with the same dedication to quality and objectivity as in the past. But the nation's need for broad, long-range thinking remains. To sustain our ability to pursue the wide-ranging inquiries that have served this nation so well for so long, we are building a robust relationship with the private sector. Some of RAND's leading analysts are now working with individual business firms, both to improve their decisionmaking and to collaborate in their public interest-related activities. The Pfizer partnership mentioned above and our current efforts to help Texas Utilities prepare for deregulation are good illustrations.

As research budgets shrink, margins grow tighter, and the federal government plays less and less of a public policy role, the appropriate response is to make our expertise available to a broader mix of clients. Increasingly, we expect to fulfill assignments for wide-ranging entities, including federal and state governments, municipalities, public-private partnerships, educational consortia, public utilities, foreign ministries, and individual businesses.

Quality endures; objectivity endures. These are the timeless RAND values that will be as applicable in the future as they have been in the past. Well into the 21st century, RAND will be helping policymakers arrive at the informed decisions that can do the most good for the greatest number of people. ■

Many projects and plans of today flow directly from the research streams that produced major breakthroughs in earlier decades.

RAND REVIEW

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