Our mission is to help improve policy and decisionmaking through research and analysis
On March 14, 1988, the United States Senate accomplished something that seems extraordinary in hindsight: It voted unanimously to ratify an international treaty to ban the use of chemicals that could harm the Earth’s ozone layer.

It was a triumph of bipartisanship, but it was also a triumph of research, of facts over falsehoods. For years, scientists and experts, including many at the RAND Corporation, had assembled and reviewed evidence that those chemicals were eating away at the ozone layer.

The issue was not without controversy. Scientists recognized that they could not prove that human activity was to blame. RAND helped break the stalemate by finding a new way to frame the issue—one based on probability, not certainty.

“Policymakers must act in the face of this uncertainty,” the researchers wrote in the preface to many of their dozen or so reports on the subject, “and RAND’s work is designed to help them act with the best information available.”

The idea that policymakers today could unite behind a common set of facts and act so decisively seems almost unimaginable. Too often, the policy dialogues that we need get lost in a barrage of cherry-picked truths and talking points.

Our phrase for this phenomenon is “truth decay.” It’s a fitting way to describe how ideological divisions are becoming increasingly corrosive and difficult to bridge. To paraphrase the late Senator Daniel Patrick Moynihan, people are entitled to their own opinions, but not to their own facts.

We can change this. We can demand more of our facts than that they merely fit our opinions.

RAND is driven by the idea that rigorous research and analysis can help people around the world lead lives that are safer and more secure, healthier and more prosperous. It's an idea backed by a set of principles for what good research requires—and what all of us should require, too.

Research and analysis should be based on reliable data and sound information. It should be transparent and fully explained. It should be accurate, clearly structured, and temperate in tone. Above all, it should be objective, independent, and balanced.

RAND exists to address issues at the top of the policy agenda, to help shape that agenda, and to cut through the fog of half-truths and deliver facts just as they are—not for any political gain, but for the public good. RAND has been doing this for almost 70 years. We remain committed to this enterprise.

In this annual report, we highlight a number of projects that are making a difference—ventures funded through philanthropy as well as projects commissioned by our growing base of clients and grantors who recognize the value of unbiased, evidence-based research and analysis.

As our colleagues showed 30 years ago, if you want to have a positive impact, you have to start with the facts.
Karen Elliott House chairs the RAND Board of Trustees. She is the former publisher of The Wall Street Journal and former senior vice president of Dow Jones and Company, Inc.

Michael D. Rich is RAND’s president and CEO. He began his career at RAND in 1975 as a summer intern and has served in a leadership role for more than three decades.
For decades, clients and grantors around the world have turned to RAND for empirical, nonpartisan, and independent research and analysis, bringing us their most vexing and complex public policy challenges.

These organizations include cabinet-level agencies, charitable trusts, city governments, and community nonprofits. These decisionmakers include program managers, CEOs, administrators, doctors, thought leaders, and educators. They have different concerns, different priorities, and different constraints.

But these diverse clients have one thing in common: They need analysis that relies on the best data and the strongest methods. And for that, in a sea of think tanks, universities, and consulting firms, they turn to RAND and its unique blend of scrupulous nonpartisanship and rigorous, fact-based analysis.

On the following pages, we share highlights from RAND’s client-funded research in 2016. These projects demonstrate an approach to problem-solving that is founded on rigor, stripped of speculation, and dedicated to promoting the public welfare.
The Costs of Corruption in Europe

Corruption has been called a “big black hole” at the heart of the European economy. The European Union (EU) has made fighting it in all its forms—from bribery to cronyism to political kickbacks—an international priority.

RAND researchers showed just how high the stakes are. They estimated that corruption costs the EU as much as €990 billion every year, or more than $1.1 trillion—a figure more than eight times higher than the initial estimate provided by the European Commission.

To calculate the cost, the researchers compiled government statistics, economic indicators, and corruption indexes for each of the EU’s 28 member nations. Their analysis takes into account the indirect effects of corruption, such as disincentives of companies to invest, as well as direct effects, such as money lost on tax revenues and public procurement.

The best performers in the EU form a group the researchers dubbed the “Magnificent Seven”: Finland, Denmark, Sweden, the Netherlands, Luxembourg, Germany, and Austria. The worst performers, they found, were Lithuania, Poland, the Czech Republic, Italy, Slovakia, Greece, Latvia, Croatia, Bulgaria, and Romania.

This research provided the European Parliament with the most current and realistic estimate available of corruption’s true cost to Europe as a whole. It also identified reforms that could cut those costs, including better screening mechanisms for member states, a Europe-wide e-procurement system, and a European public prosecutor’s office.

We found that corruption costs the EU considerably more than previously thought. But our recommendations highlight achievable targets designed to reduce corruption and limit economic losses.

In the wake of our report, many EU organizations and governments have publicly pledged to focus attention on halting corruption.

Learn more at www.rand.org/t/RR1483
Summer is a time when low-income students lose academic ground relative to their wealthier peers. But summer learning programs that offer academic and enrichment activities appear to boost aspects of student performance during the school year—if certain conditions are met.

The most important factor? Program attendance rates. Rising fourth- and fifth-graders with high attendance in summer learning programs performed better on math, reading, and social-emotional assessments after two consecutive summers, compared with students who were not invited to participate.

The academic advantage experienced by these “high-attenders” was equivalent to 20–25 percent of typical annual gains in mathematics and reading, RAND researchers found, and these benefits persisted throughout the fifth-grade school year. Though correlational, these results were controlled for prior achievement and demographics, suggesting that the benefits were likely due to the summer learning programs.

The researchers studied 5,637 children in five urban school districts, 3,192 of whom were accepted at random into summer learning programs in 2013 and 2014. The assessment—conducted under the auspices of The Wallace Foundation’s multiyear National Summer Learning Project—was the first of its kind to investigate the effectiveness of large-scale, voluntary, district-run summer learning programs serving low-income elementary students.

Promoting high attendance is critical to helping students experience lasting benefits from attending summer programs, but the researchers also encourage districts to run programs for at least five weeks, include and protect sufficient instructional time, invest in instructional quality, and factor in attendance rates when staffing the programs in order to lower per-student costs.

Learn more at www.rand.org/t/RR1557

High attendance in consecutive summer learning programs is critical, but 40 percent of students in our study fell short of that goal. Districts will have to work hard to increase attendance rates. Our recommendations include creating exciting programs, forging personal connections with families, and making summer learning mandatory for the lowest-performing students.

Catherine H. Augustine
Senior Policy Researcher
Defense Secretary Ashton Carter drew on months of RAND research when he announced in mid-2016 that transgender men and women could serve openly in the U.S. military.

The Department of Defense had asked RAND to estimate the costs and numbers of personnel involved as it reviewed its policies banning transgender service members. The result was the most rigorous analysis of transgender service to date, combining past research and surveys, medical cost estimates, and interviews with foreign militaries that had already opened their ranks to transgender people.

Researchers estimated that between 1,320 and 6,630 transgender people already serve in the active component—less than 1 percent of the total force. The annual costs of letting them serve openly and access transition-related medical care would be “overwhelmingly small” as a percentage of active component health care spending: less than $8.5 million, in a budget of more than $6 billion. Each year, fewer than 130 active-duty service members are likely to seek gender transition–related medical treatments that would affect their deployability.

Other countries have seen no significant effect on unit cohesion, operational effectiveness, or readiness since they opened their ranks to transgender people.

The study was the latest commissioned from RAND by the military as it reviews longstanding barriers to service. RAND research on opening the ranks to gay and lesbian service members led to the repeal of the military’s “Don’t Ask, Don’t Tell” policy in 2011. More recently, RAND research helped inform the Pentagon’s decision to integrate women into combat positions.

Learn more at www.rand.org/t/RR1530

Only a very small portion of service members in the active component—fewer than 130—are likely to seek gender transition-related medical treatments that would affect their deployability. For context, compare that with the more than 100,000 nondeployable soldiers in the Army alone in 2015, some 50,000 of them in the active component.

Agnes Gereben Schaefer
Senior Political Scientist
The Russian army would need no more than 60 hours to reach the capital cities of Estonia or Latvia, RAND war games have shown—a conclusion that is reshaping the posture of the North Atlantic Treaty Organization (NATO) in Europe.

Russia’s annexation of Crimea and aggression in Ukraine disrupted nearly a generation of relative peace in Europe. RAND experts staged a series of tabletop war games to test the strength of NATO’s defenses if Russia decided to invade two of its Baltic neighbors.

The outcome would be a disaster for NATO, researchers concluded. Russian forces eliminated or bypassed all resistance and were at the gates of the Baltic capitals between 36 and 60 hours after hostilities began.

That would leave NATO with just three bad options: launch a bloody counteroffensive to free the Baltics; escalate to the use of nuclear weapons, possibly leading to a full-blown nuclear exchange between the United States and Russia; or concede at least temporary defeat.

Instead, RAND recommended that NATO position three heavy armored brigades, reinforced in crisis by at least four rapidly deployable lighter brigades and supported by air power, in Eastern Europe as a deterrence force.

NATO’s secretary general circulated these findings to every member of the North Atlantic Council. Member nations have since committed to rotate thousands of troops into the region, including a U.S. armored brigade of more than 3,000 soldiers. Further strengthening that eastern flank could cost $2.7 billion a year, RAND estimated. The alternative? Potentially inviting a devastating war, rather than deterring it.

Learn more at www.rand.org/t/RR1253

NATO is outnumbered, outranged, and outgunned by Russia in Europe. But it is possible to begin restoring a more-robust deterrent posture. The possible consequences of failing to do so are so dire that prudent investments to stave them off are warranted—to assure allies living next to a belligerent Russia, and to provide an insurance policy against the risks of a potential catastrophe.

David A. Shlapak
Codirector, RAND Center for Gaming
The Economic Costs of Insufficient Sleep

A coffee-pounding, cell-phone–buzzing, stay-up-late-and-get-up-early culture costs the U.S. economy as much as $411 billion in lost productivity every year, RAND researchers found.

Their estimates provide the first cross-national look at the economic costs of insufficient sleep. And they underscore the importance of sleep-friendly work policies, such as fewer after-hours interruptions. Chronic sleep deprivation, the researchers found, costs employers around 1.2 million lost workdays a year.

The researchers calculated those costs for five of the world’s biggest economies, using workplace surveys, economic statistics, and prior research on health and productivity loss due to sleep deprivation. The United States paid the highest toll for insufficient sleep, between $280 billion and $411 billion. Japan, with its smaller economy, loses up to $138 billion, followed by Germany (up to $60 billion), the United Kingdom (up to $50 billion), and Canada (up to $21.4 billion).

People who get less than six hours of sleep, on average, face a 13-percent higher risk of mortality than someone getting the recommended seven to nine hours a night, the researchers found. Even someone getting between six and seven hours of sleep every night has a mortality risk about 7-percent higher.

Addressing those national sleep deficits does not require that we all unplug and turn in at 8 p.m., the research showed. If every worker who gets less than six hours of sleep managed to get six or seven hours instead, the American economy would see a boost of around $226 billion a year.

Learn more at www.rand.org/t/RR1791

Sleep and sleep loss are among the most intimate of personal behaviors, but sleep matters to all aspects of society, from an individual’s health to the success of the global economy. Improving sleep habits might do more than make people healthier and more productive—it could also help the world’s bottom line.

Wendy M. Troxel
Senior Behavioral and Social Scientist

Poor sleep costs the U.S. economy up to $411 billion a year
Estimating the Value of America’s Overseas Security Commitments

The national debate over the U.S. role in the world has called into question its overseas security commitments—its treaties and the troops it maintains in other countries. Are they worth the cost?

It has been widely held that overseas commitments help anchor trade around the world, to the great benefit of the U.S. economy. But a growing school of thought questions whether the United States can, or should, shoulder the costs, and calls for scaling back those commitments by as much as 80 percent.

RAND researchers used new data on U.S. treaties and troop commitments to test those two competing views. They tracked changes in the number and nature of overseas security commitments between 1955 and 2004, and matched them to subsequent economic gains and losses.

They found strong evidence that overseas commitments strengthen trade between the United States and other countries. Doubling the number of treaties, they calculated, could expand U.S. trade by 34 percent. Doubling troop numbers could increase trade by up to 15 percent.

Those security commitments also boost overall world trade, the researchers found: Countries enjoying U.S. commitments trade more with each other than they would otherwise.

Retrenching America’s overseas commitments by 80 percent, as some advocates have suggested, could save $126 billion a year in federal spending. But RAND’s analysis suggests that even a smaller 50-percent cut would cost the U.S. economy as much as $490 billion annually in lost gross domestic product (GDP). Its bottom-line conclusion: A drastic cutback of commitments would leave the United States poorer.

Learn more at www.rand.org/t/RR518

Given the challenges the nation is facing in ensuring economic opportunity and prosperity for all Americans, it’s not surprising that security commitments overseas are a topic of vigorous debate. Estimating the economic returns the United States receives from these overseas commitments is a necessary precursor to an informed discussion.

Retrenchment could cost the U.S. economy $490 billion a year in lost GDP

Daniel Egel
Economist
Modernizing Ukraine’s Ministry of Defence

The 2014 revolution in Ukraine created an opportunity for change in the country’s security sector—a system that has resisted reform for the past quarter century. Despite postrevolution improvements to logistics and other areas, however, the country’s security organizations weren’t able to respond effectively when conflict emerged in eastern Ukraine.

RAND researchers analyzing the country’s security sector found that substantial reforms are required to address gaps that preclude effectiveness, efficiency, transparency, and accountability. Their recommendations are designed to help Ukraine fill those gaps in ways that are well aligned with Euro-Atlantic standards and approaches.

For example, Ukraine should empower the minister of defence to serve as the senior civilian adviser to the president, prime minister, and parliament on security policies. The chain of command should run from the president to the minister of defence, and then to the chief of defence forces, the researchers contend.

The Ukraine National Security and Defence Council should also be expanded and empowered to better coordinate the activities of key ministries and agencies. This will allow the council to not only provide a forum for coordination but also ensure that the president’s decisions are executed on a day-to-day basis.

Although the international community can continue to provide assistance to Ukraine’s security sector, the researchers warn that pursuing the needed changes lies squarely in the hands of the country’s government. The effectiveness of reform depends both on putting appropriate institutions in place and making sustainable changes in bureaucratic culture, which may well prove even more challenging.

Learn more at www.rand.org/t/RR1475-1

Our research has helped focus Ukrainian government, media, and public attention on needed changes. In a May 2016 strategic defense bulletin, President Petro Poroshenko laid out a program of reform that draws heavily on our recommendations for bringing the country’s security establishment up to Euro-Atlantic standards.

Lynn E. Davis
Senior Fellow
RAND provides research services, systematic analysis, and innovative thinking to a global clientele.

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Organization for Economic Co-operation and Development (OECD)
UNICEF
World Bank

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Columbia University
Columbia University Medical Center
Dartmouth College
The Evergreen State College
Florida International University
The George Washington University
Harvard University
Indiana University
Louisiana State University
Pennsylvania State University
Singapore Management University
Temple University
Tufts University
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University of Arkansas
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University of Hawai‘i
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The University of North Carolina at Chapel Hill
University of Pittsburgh
University of Southern California
The University of Texas at Austin
The University of Texas at Tyler
Vanderbilt University

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Carnegie Corporation of New York
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CHDI Foundation
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The Rockefeller Foundation
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United Health Foundation
The Wallace Foundation
Walton Family Foundation
Wellcome Trust

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American Academy of Nursing
American Association of Neuromuscular and Electrodiagnostic Medicine
American Medical Association
American Orthotic and Prosthetic Association
College of Policing

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Beaver Valley Intermediate Unit
Brilliant Comers
California Mental Health Services Authority
California Travel and Tourism Commission
Cedars-Sinai Medical Center
Center for Court Innovation
Children’s Hospital Boston
Cincinnati Business Committee
Collaborative Spine Research Foundation
College for All Texans Foundation
Criteron Education, LLC
Decision Research
Economic Mobility Corporation
Expanded Schools
Great Lakes Higher Education Corporation and Affiliates
Gulf of Mexico Alliance
Hepatitis Foundation International
International Initiative for Impact Evaluation (3ie)
Kaiser Foundation Research Institute
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The Research Foundation for the State University of New York
The Scripps Research Institute
Seattle Children’s Research Institute
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For revenue by client sector, see p. 49.
Akin to a policy research and development lab, RAND Ventures is our way to support staff who aspire to pursue visionary ideas; address critical problems that are under-researched; shape emerging policy debates; and devise innovative approaches for solving acute, complex, or provocative policy challenges.

In short, RAND Ventures helps us think big.

Fueled by philanthropic gifts and RAND’s income from operations, RAND Ventures is a critical asset in our pursuit of data-driven research. It is essential to our ability to gaze over the horizon, beyond the constraints of many of today’s decisionmakers, to imagine, prepare for, and enable what’s next.

On the following pages, we share highlights from RAND Ventures in 2016. These projects introduced innovations by using existing methods in new contexts, generated important and timely insights, or spotlighted novel ways to frame some of the biggest challenges of our time.
More than 90 percent of motor vehicle crashes in the United States are caused by human error, such as drunk driving, speeding, and driving while fatigued. Technology heavyweights are betting that driverless cars will become the safer and more efficient ride of the future, greatly reducing the number of crashes—and associated deaths, injuries, and other losses—on our roadways.

Understandably, people want to know just how safe these autonomous vehicles (AVs) are, and especially whether they’re safer than human drivers. Test-driving seems like a logical way to assess the safety of AVs, until you begin to calculate the distance and time required.

That’s because traffic fatalities and injuries are actually quite rare compared with the number of miles Americans drive every year. So, to provide clear statistical evidence of AV safety, fully autonomous vehicles would have to be driven hundreds of millions—or even billions—of miles, RAND researchers found. Under even aggressive testing assumptions, it could take existing test fleets hundreds of years to cover that much ground.

Clearly, test-driving our way to safety is an impossible proposition if the aim is to demonstrate performance prior to authorizing consumer use of AVs.

But this doesn’t mean that driverless cars can never be deemed safe enough for the open road. Instead, regulators should pursue additional options for reducing risk, and policymakers should consider such tactics as limiting AVs to safer speeds and to well-mapped, well-marked routes in their efforts to balance the pursuit for certainty against the transformative benefits of AVs.

Learn more at www.rand.org/t/RR1478

It might prove impossible to fully assess the safety of autonomous vehicles without actually making them widely available. We must balance the desire for certainty about AV performance against the technology’s potential benefits, including reducing fatalities, increasing mobility, improving energy efficiency, and regaining the value of time spent traveling.

Nidhi Kalra
Codirector, RAND Center for Decision Making Under Uncertainty
Getting to Yes with China in Cyberspace

The Sino-American relationship has bristled with conflict, confrontation, and strategic mistrust since the founding of the People’s Republic of China in 1949. But the two countries are currently clashing over a very modern problem: the rules of cyberspace.

There’s very little overlap between U.S. and Chinese perspectives on cyber attacks and cyber espionage, and the two sides also see the question of international law and cyberspace differently.

The United States emphasizes the applicability of the Laws of Armed Conflict to the cyber domain. China, however, favors the creation of new norms focused on enshrining each state’s right to control the information that is accessible within its borders and claims that a focus on regulating cyber attacks will encourage states to regard them as a legitimate form of warfare.

The two countries began formal negotiations in 2013 to resolve these differences, only to see them abruptly suspended by China in 2014, when the United States indicted several Chinese military officers on charges related to cyber espionage.

Despite these challenges, meaningful negotiations over norms and rules in cyberspace are possible, according to RAND researchers.

To begin, the United States should more directly link cyber discussions to the broader health of the overall Sino-American relationship. Negotiations could move forward with a bilateral agreement that forbids attacks on each other’s critical infrastructure—a key area of shared concern—as well as any cyber espionage that could facilitate such attacks.

To ease Beijing’s concerns that China would be unable to catch U.S. violations, Washington could consider sharing insights into attack attributions. In exchange, Beijing could agree to common evidentiary standards and prosecuting violators. Any serious agreement must be backed by a process that both sides can trust.

Learn more at www.rand.org/t/RR1335

Our interviews suggest that both countries would consider renouncing cyber attacks—and even cyber espionage—on each other’s critical infrastructure. The sticking points are attribution, which is Beijing’s primary concern, and consequences, which are Washington’s. Each side must make concessions to reassure the other.

Scott W. Harold
Associate Director,
RAND Center for Asia Pacific Policy
The Colorado River supplies water to 30 million people in seven states, supports billions of dollars in economic activity each year, and irrigates 15 percent of all U.S. crops. Growing demand and a changing climate, however, have placed the Colorado River Basin under significant stress.

RAND researchers joined forces with the Lawrence Livermore National Laboratory to employ high-performance computer simulations to test water management strategies proposed by stakeholders over a vast number of plausible future scenarios. Their goal was to evaluate potential solutions in a scientifically rigorous and transparent manner, but without the delays associated with traditional deliberations and standard computers.

Combining RAND’s Robust Decision Making methodology with the laboratory’s supercomputers, workshop participants were able to perform and evaluate about 60,000 simulations in just 45 minutes—a dramatic acceleration compared with two years earlier, when similar analysis for the Bureau of Reclamation’s Colorado River Basin Study took several weeks of continuous computations.

Participants tested different water management portfolios, such as conservation, groundwater and seawater desalination, and water reuse, against thousands of scenarios, accounting for uncertainty about future climate change and development patterns. They identified several low-regret, high-priority options for reducing Colorado River Basin vulnerability in the coming years.

Researchers and stakeholders are optimistic about this combination of innovative analytics and advanced computing. Workshop participants agreed that the fusion holds tremendous promise for integrating engineers, planners, policymakers, and stakeholders; evaluating a broader spectrum of alternatives in more-transparent and more-expansive ways; and improving the decisionmaking process for a broad spectrum of national and global challenges.

Learn more at www.rand.org/t/CF339
The self-declared Islamic State has attracted worldwide attention—and thousands of foreign fighters—through its deft use of social media. But RAND researchers found that its opponents on Arabic-language Twitter actually outnumber its supporters by at least six to one.

Those opponents could be powerful partners in the fight against the Islamic State, especially in a region where the United States often is not seen as a credible voice. But researchers found that those opponents are fragmented along geographic and sectarian lines, and a message that resonates in one online community may fall flat in another.

The researchers analyzed more than 23 million tweets to better understand how the Islamic State and its opponents use social media. They then used sophisticated computer algorithms and data-mining techniques to identify major online communities and common themes.

They found that the group’s supporters, while outnumbered, are more prolific in their tweets and more disciplined in their messages: claiming to defend Islam, recruiting fighters, and criticizing the West.

Opponents often described the group as a terrorist threat, highlighting its violence and accusing it of subverting Islam. But those basic similarities masked important differences among them, the researchers found: Syrian mujahedeen do not tweet in the same circles as Egyptian Sunnis or Gulf State Shia.

The basic elements of an effective, grassroots anti-Islamic State campaign already exist, the researchers concluded. What’s needed now is social-media training and support.

Learn more at www.rand.org/RR1328

It is crucial that opposition to the Islamic State comes from credible voices within each community: A one-size-fits-all message from an outsider would not be effective. Our analysis will help identify the various themes to emphasize for each community, in partnership with those countering the Islamic State online and in the real world.

Elizabeth Bodine-Baron
Codirector, RAND Center for Applied Network Analysis and System Science

Researchers analyzed 23 million tweets to understand Islamic State social-media use.
A Better Approach to Public Pensions

Chicago’s public school district is responsible for annual multimillion-dollar payments toward legacy teacher pensions—payments that are crowding out its ability to pay for students’ education. Reform efforts raised the threat of a teacher strike in October 2016 and turned another harsh light on a nationwide problem of massive, unfunded public-pension liabilities.

RAND researchers used mathematical modeling to forecast how changes to teacher pensions or overall compensation might cut into teacher numbers. Their model aggregated thousands of individual decisions to stay or leave in any given year—decisions that reflect the effects of unanticipated shocks and of tradeoffs between continuing to teach in one district versus choosing another path.

The researchers used a RAND model initially developed to help the military maintain adequate force levels as it considered changes to its pay and retirement program.

In Chicago, the model showed that an across-the-board pay cut would likely drive more senior teachers away than changes to the pension formula, such as increasing the retirement age. A 3-percent reduction in salary, for example, would discourage teachers from staying in Chicago long term; under that scenario, the model predicts a 7-percent greater attrition rate through 30 years of teaching.

Those results suggest other questions that policymakers need to answer as they implement reforms. For example, will there be an adequate mix of teachers to cover required classes? And what would the loss of senior teachers mean in 20 years?

The lessons reach far beyond Chicago. The research validated RAND’s model—the Dynamic Retention Model—as a valuable tool to study public pensions and obligations, potentially anywhere.

Learn more at www.rand.org/t/RR1448

Cost-saving changes to teacher pensions can have different effects on teacher retention

“... This was the first study to model teacher retention in a large school district. Future work could apply our model to other school districts and states, allowing them to examine the costs and effects of different policies on employee retention.”

David Knapp
Associate Economist
The growing influence of Arab Gulf states in regional affairs, from the conflict in Syria to the military campaign in Yemen, has raised the stakes for their alliance, the Gulf Cooperation Council (GCC).

The six members of the council—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates—possess greater capabilities when operating together, and, if those capabilities are used in the service of promoting regional stability, the United States has a strong interest in GCC unity.

But researchers studying prospects for GCC cohesion over the next ten years warn that the fighting in Yemen and Syria could test the council, especially over what constitutes an acceptable outcome for those conflicts.

On the other hand, increased trade and infrastructure development within the region will likely strengthen economic ties between the GCC countries. The threat posed by the Islamic State could further strengthen their cooperation, particularly in the areas of intelligence sharing and coordination of internal security forces.

How well those nations work together is a key variable that could either advance or undermine regional stability, the researchers concluded. The United States should continue to work with member states both individually and as a group to encourage greater cooperation. It should also continue to press GCC states for human-rights improvements.

At the same time, Washington needs to reassure council members that it remains committed to the region’s security. This has become especially important in the wake of the U.S.-Iranian nuclear deal, which raised alarm among Gulf states about greater cooperation between the two nations.

Learn more at www.rand.org/t/RR1429

The Gulf Cooperation Council always has had high and low periods of cooperation and friction. This isn’t likely to change, but the consequences of intracouncil dynamics are greater now, given the growing activism of some member states.

Jeffrey Martini
Senior Middle East Analyst
The RAND Ventures program combines philanthropic gifts from individuals, foundations, and private-sector firms with earnings from RAND’s endowment and operations to help RAND support vital research pursuits and outreach activities that would otherwise go unfunded. Our donors share RAND’s commitment to quality, objectivity, and independence; entrust us with protecting these values in our work; and help RAND have an impact across the national and global policy landscape.

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At Pardee RAND, elite students from around the world learn the importance of methodological and analytic innovation, engage in a curriculum renowned for rigor and breadth, and are taught by faculty who are also RAND researchers. They conduct policy research with RAND mentors in on-the-job training, developing skills and sophistication that can’t be conveyed in a classroom.

But it isn’t just students who benefit from this collaboration with RAND. Students infuse RAND’s environment with important new ideas and perspectives, generating new ways of looking at difficult problems, new methods and approaches for dissecting and rebuilding systems and processes, and new ways of outlining options and solutions.

On the following pages, we share highlights from RAND research and analysis that benefited from the fresh perspectives, engagement, and sense of intellectual innovation of students in the Pardee RAND Graduate School.

To learn more about the Pardee RAND Graduate School, visit www.prgs.edu
As the world population surges toward 8 billion and natural resources become ever scarcer, a third basic need has joined food and water as a pillar of human existence: energy.

Without it, water pumps run dry, people spend hours securing fuel to cook with, and productivity is limited to daylight hours.

A better understanding of how and where shortages of food, energy, and water converge could strengthen international development efforts. That was the goal when a small team of Pardee RAND students—each of whom had seen, firsthand, the interplay of food, water, and energy—began pulling together numbers for a first-of-its-kind index of food, energy, and water supplies, country by country.

The students, working with RAND researchers, collected data on food prices and water availability, the share of people using modern cooking fuels, and even the average consumption of starchy foods, a marker for low-quality diets. They merged nearly a dozen data sets to show where food, energy, and water are not just available but also accessible to ordinary people.

The United States had the best overall score, followed by Luxembourg, Canada, Austria, and Iceland. The countries with the lowest scores were Burundi, Niger, Chad, Malawi, and Rwanda.

The index, depicted via an online map, offers a snapshot of world need and, with a mouse click, the details of any country’s food, energy, and water supplies. But it also represents a starting point to better understand and manage resource scarcity in the years to come, especially in the face of climate change.

Learn more at www.rand.org/t/TL165
Prioritizing Investments in Traffic Safety

Imagine being able to save 745 lives and prevent almost 200,000 injuries each year through a single national traffic safety intervention, all with a net annual savings of $5 billion. This might sound too good to be true, but it’s not, according to a first-of-its kind analytic tool developed by RAND.

The Motor Vehicle Prioritizing Interventions and Cost Calculator allows researchers and policymakers to compare the cost and effectiveness of various traffic safety interventions. The free tool, developed for the Centers for Disease Control and Prevention, helps federal and state lawmakers make cost-effective decisions to improve traffic safety and public health.

Using the tool, the research team calculated that spending just 10 percent more on traffic safety to implement universal motorcycle helmet laws would provide $122 in benefits to society for every $1 spent. This $5 billion return on investment reflects the extraordinary direct and indirect costs of injuries and lives lost in motor vehicle accidents.

Currently, the federal government provides approximately $579 million annually to states for traffic safety programs. However, crash-related costs reached at least $242 billion in 2010, according to the National Highway Traffic Safety Administration.

The researchers found that boosting traffic safety funding by 10 percent—and allocating the funds to states where they are most needed—would save 1,320 lives and prevent more than 225,000 injuries annually. Their analysis revealed that this approach—as opposed to increasing every state’s funding by 10 percent—would be more cost-effective.

Learn more at www.rand.org/t/RR1224

This project brought cost-effectiveness analysis out of the classroom and into the real world. Using parameters from previous RAND research, I was able to identify the most-effective traffic safety countermeasures and provide associated policy recommendations. Our findings could lead to substantial changes in traffic safety efforts nationwide.

Benjamin Batorsky recently received a Ph.D. in policy analysis at the Pardee RAND Graduate School. He is now a data scientist at the Boston Citywide Analytics Team.
Women in the U.S. Marine Corps Infantry

In 2013, the U.S. military announced the cancellation of a rule restricting women from being assigned to positions involving direct combat, long-range reconnaissance and special operations forces, and physically demanding tasks.

This change had the potential to open more than 230,000 positions in the U.S. armed forces to women who could meet occupation-specific, gender-neutral standards of performance—including positions within the Marine Corps infantry.

To help the Marine Corps understand the potential issues and costs related to this integration, the research team examined the gender integration experiences of foreign militaries and U.S. civilian police and fire departments. They also estimated the potential personnel costs associated with integrating women into the infantry and assessed likely effects on unit cohesion.

They found that integration would likely incur both one-time costs, such as adapting equipment or facilities, and recurring costs, such as higher attrition rates for female marines during training. However, they found that the overall costs of integration are likely to be modest, compared with overall recruiting and retention spending.

Their research also suggests that cohesion in gender-integrated groups tends to increase over time as groups work together, and that good leadership helps foster a shared sense of group identity.

As a former infantry rifleman and infantry officer in the U.S. Marine Corps, I know firsthand the importance of unit cohesion. Our research suggests that cohesion in gender-integrated groups is likely to increase over time when members work together and develop a shared sense of group identity.

Among other recommendations, the researchers note that, to maximize the chances of successful integration, the Marine Corps will need to base its decisions and implementation strategy on empirical data.

Learn more at www.rand.org/t/RR1103

Jonathan Wong recently received a Ph.D. in policy analysis at the Pardee RAND Graduate School. He is now a consultant at The Boston Consulting Group.
Terrorists and transnational crime syndicates alike might soon have the technological wherewithal to coin their own “virtual currency.” The concern is that it would be cheap, quick to produce, and almost impossible to trace.

But these nonstate groups still face daunting challenges to creating an online money system from scratch. The research team surveyed the state of the technology, the factors that might make criminal or insurgent groups take their finances online, and the implications should they succeed.

The high-profile success of Bitcoin, in particular, has shown that such virtual currencies can sustain billions of dollars in trade, all of it potentially anonymous. But the researchers looked at what it would take for a nonstate group to create its own virtual currency, not tap into an existing one like Bitcoin.

That would require a high degree of technological sophistication, as well as the computing infrastructure to support it. A virtual currency would also be vulnerable to cyber attack. And, as a method of day-to-day transactions, it would be worthless in places without reliable Internet or cell phone service.

But technology is advancing at such a pace that virtual currencies will become increasingly feasible, reliable, and acceptable, the researchers concluded. Because of that, the risk of criminal or terrorist groups launching their own deserves more scrutiny, they wrote. That’s especially true because the same advanced networking that allows the trade of virtual money could also be used to exchange plans and information, undetected.

Learn more at www.rand.org/t/RR1231

David Manheim is a doctoral candidate at the Pardee RAND Graduate School and an assistant policy analyst at RAND.

While collaborating with RAND researchers on this project, I was able to contribute insights from my experience assessing terrorism risk and from Pardee RAND coursework in cryptography and cybersecurity. Our team’s diverse expertise allowed us to investigate this important subject from both the technological and political-economic perspectives.
Identifying Future Disease Hot-Spots

The questions faced by world health authorities have become life-and-death urgent in this era of Ebola and Zika: What factors allow disease to cut such a deadly path through some countries but not others? And which of those countries are most at risk of becoming the next outbreak hot-spot?

Pardee RAND students, working with RAND researchers, set out to provide some answers. The team created a first-of-its-kind vulnerability index for every country in the world, designed to help government agencies and international organizations target funding and technical support to those countries most at risk.

They assembled more than three-dozen data sets, measuring medical expenditures and population density, government stability and economic strength, and even patterns of precipitation and the presence of paved roads. Their purpose was not to predict future outbreaks but rather to show which countries have critical weaknesses in their political, economic, or medical public health systems.

Their final index underscores the strong connections between political instability, conflict, poverty, and disease risk. They found that 24 of the 30 most-vulnerable countries form a belt from West Africa through the Sahel into the Horn of Africa.

The three countries hardest hit by Ebola—Liberia, Guinea, and Sierra Leone—had both earlier cases and higher levels of economic and political-international vulnerability, compared with four other African countries that successfully limited Ebola spread in 2014. Likewise, two of the countries struggling the most with Zika infections, Brazil and Colombia, stand out for their inadequate government services and poor sanitation.

Learn more at www.rand.org/t/RR1605
Innovation at Pardee RAND

Traditional ways of organizing scientific capability by disciplinary background or policy arena are no longer sufficient to generate the innovative analytic methods and tools needed to tackle the most complex and intractable problems the world faces today.

The Methods Centers at the Pardee RAND Graduate School are an investment in the type of methodological and analytic innovation the policy community needs. Drawing on the expertise of more than 1,000 world-class researchers, faculty, and students, the Methods Centers at Pardee RAND organize RAND’s diverse base of expertise around a set of interlocking and leading-edge analytic domains to create the next generation of research methods and tools.

The RAND Center for Applied Network Analysis and System Science applies rigorous network research methods to pressing policy challenges. This work provides important insights about the structural, contextual, and social factors that influence physical, human, and organizational systems.

The RAND Center for Causal Inference focuses on improving the use of state-of-the-art causal inference methods, which help researchers understand relationships between causes and effects. Understanding these relationships is critical in almost every policy domain, including health, labor, education, environmental studies, public safety, and national security.

The RAND Center for Decision Making Under Uncertainty assesses the depth and breadth of uncertainty and risk levers in policy domains and research pathways. It employs multiple methodologies, including forecasting and decision support, to analyze organizational decisions in broad settings where the uncertainty is high, the risk is complex, and the implications of such decisions are long term and future-oriented.

The RAND Center for Gaming promotes the use of games in research to improve decisionmaking across a wide range of policy areas, including urban planning, climate change, drug policy, disaster response, nuclear proliferation, and military operations.

The RAND Center for Qualitative and Mixed Methods develops and promotes tools for generating empirically based insights through exploratory data collection and analysis. Mixed methods are ideal for situations involving novel environments and foreign cultural contexts.

The RAND Center for Scalable Computing and Analysis engages in and supports the transformation of data science within RAND by fostering a community of expertise on best practices for the use of large-scale data.
New Courses

The Pardee RAND curriculum aims to arm students with the best analytical tools from many disciplines; help them practice applying those tools to real problems; and foster a creative, sometimes experimental approach that encourages new ways of thinking and doing.

In 2016, the school added the following new courses. They contribute to a curriculum that conveys essential research methods and perspectives and teaches students how to assess and improve systems rather than simply alleviate symptoms.

**Computational Methods for Operations Research and Data Science.** This course is preparing students for the school’s new methods and technology stream. Students learn how to numerically frame and solve operations research problems in linear and nonlinear optimization, network analysis, and system modeling to support policy analysis. Students are also introduced to open-source tools for data mining, manipulation, and visualizations.

**Law and Policy: The Implementation of Legislation Through Public Administrative Procedure.** This course explores how laws and regulations shape policy, focusing on four areas: health, foreign policy, communications and media, and financial services. Each week, students investigate a different aspect of agency policy development, first through readings and classroom discussion, and then through a lecture with an expert in that policy area.

**Understanding the Social Determinants of Health: Theories and Research.** This course familiarizes students with theory and models of the social disadvantage approach (e.g., socioeconomic status and the fundamental causes of disease) and health equity approach (e.g., inequities that stem from sociodemographic factors). Topics include immigration status and health, neighborhood conditions, structural violence and racism/discrimination, macro-level income inequality within and across countries, and working conditions.

**Comparative Historical Analysis and Case Study Methods.** This course covers such topics as ways to define and use case studies; case selection, representativeness, and generalizability; Mill’s methods of similarity and difference; Ragin’s qualitative comparative analysis; and methods for collecting and compiling case study data, including the use of primary and secondary sources.

**The U.S. Rebalance to Asia.** This course begins with a discussion of economic, demographic, and geopolitical trends in Asia and the region’s growing importance to U.S. diplomatic, economic, and security interests. Students explore China’s rise and its implications for the United States and countries in the region. The course also examines potential flashpoints; how the rebalance will likely progress going forward; and what it will mean for the future of the U.S. alliance system and the regional diplomatic, economic, and security order.
The Pardee RAND Graduate School recently completed a bold fundraising campaign to strengthen the foundation of the school and provide support for key areas, including scholarships, dissertation funding, academic programs, and student and faculty support. The five-year Be the Answer campaign surpassed its original $15 million goal, raising $27.39 million and an additional $5.6 million in legacy gift commitments.

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Highlights from Capitol Hill

Congressional Briefings

RAND experts visit Capitol Hill to inform policymakers about research and analysis that is relevant to current legislative debates. Video and audio recordings of Hill briefings on topics ranging from Baltic security to health care for veterans are available at www.rand.org/congress

Congressional Testimony

RAND experts are frequently invited to testify before Congress. Testimonies are available at www.rand.org/testimony. Highlights from 2016 include the following:

- **PLA Joint Training and Implications for Future Expeditionary Capabilities** | Mark Cozad | presented before the U.S.-China Economic and Security Review Commission | January 21, 2016
- **PLA Expeditionary Capabilities and Implications for United States Asia Policy** | Kristen Gunness | presented before the U.S.-China Economic and Security Review Commission | January 21, 2016
- **Department of Defense and Security Cooperation: Improving Prioritization, Authorities, and Evaluations** | Michael J. McNerney | presented before the Senate Armed Services Subcommittee on Emerging Threats | March 9, 2016
- **Implications of China’s Aerospace Industrial Policies** | Chad J. R. Ohlandt | presented before the U.S.-China Economic and Security Review Commission | April 27, 2016
- **Dementia Long-Term Care Policy Options for Family Caregivers and Medicare** | Regina A. Shih | submitted to the Senate Finance Committee, Subcommittee on Health Care | July 13, 2016
- **Fifteen Years After 9/11: A Preliminary Balance Sheet** | Brian Michael Jenkins | presented to the House Armed Services Committee | September 21, 2016
- **Shaping the Future of Autonomous Vehicles: How Policymakers Can Promote Safety, Mobility, and Efficiency in an Uncertain World** | Nidhi Kalra | presented before the Senate Appropriations Committee, Subcommittee on Transportation, Housing and Urban Development, and Related Agencies | November 16, 2016
Events

DEF CON 21 Hacking Conference “Black Badge” winner Lillian Ablon, information systems analyst, spoke about how our increasingly digital world presents new risks from cyber attackers.

His Excellency Yousef Al Otaiba, Ambassador of the United Arab Emirates to the United States, spoke to members of the RAND Policy Circle about his vision for a stable, tolerant, and prosperous Middle East.

Robert Bozick, associate director of RAND Labor and Population, joined Van Ton-Quinlivan of California Community Colleges, David York of Northrop Grumman, and other panelists to discuss how to nurture a workforce that is well prepared for the jobs of today and the future.

Brian Jackson, senior physical scientist, joined Matthew Johnson of the Los Angeles Police Commission, Kate Mather of the Los Angeles Times, and other panelists to discuss the role of technology and training in ensuring the fair and impartial policing of minority and ethnic groups.

Brian Michael Jenkins, senior adviser to the president of RAND, shared his thoughts about the future of the Islamic State with RANDNext members—an elite group of early- to mid-career professionals who gather at RAND for cross-industry networking and policy discussions on a diverse range of topics.

Artist Ramiro Puentes, subject of the film The Artist of Skid Row, displayed one of his paintings at a RAND Policy Forum on the growing homelessness crisis in Los Angeles.

Robert Bozick, associate director of RAND Labor and Population, joined Van Ton-Quinlivan of California Community Colleges, David York of Northrop Grumman, and other panelists to discuss how to nurture a workforce that is well prepared for the jobs of today and the future.
In a discussion with O’Brien, DJ Patil—deputy chief technology officer for data policy and chief data scientist in the White House Office of Science and Technology Policy—offered an example of how data science can help reduce the number of Americans who cycle through the nation’s 3,100 jails each year.

Politics Aside

RAND hosted its fifth Politics Aside forum on November 11–12, 2016, at its headquarters campus in Santa Monica, California. This signature postelection event engages policymakers, business leaders, philanthropists, and RAND experts in a series of nonpartisan discussions on critical issues of national and global importance. Friday evening’s festivities were hosted by journalist and RAND trustee Soledad O’Brien; Saturday’s all-day event was hosted by journalist and RAND trustee Malcolm Gladwell.

RAND is home to an extraordinary collection of thinkers, academics, and policy wonks. It’s the greatest intellectual playground in America, and I’d like to welcome you here for Politics Aside, [during which] we’ll look at the complexities of decisionmaking and the surprising places facts and objectivity can lead us.

— Malcolm Gladwell
A policy debate featuring different interpretations of the same facts, that’s healthy. It promotes compromise and consensus. But a policy debate featuring opinions about opinions? Without an agreed-upon common set of facts? That’s a recipe for gridlock.

— Michael D. Rich
RAND Chosen to Operate the Homeland Security Operational Analysis Center


The center will conduct analyses and make recommendations to strengthen the Department of Homeland Security across its missions to prevent terrorism and enhance security, secure and manage U.S. borders, enforce and administer immigration laws, safeguard and secure cyberspace, and strengthen national preparedness and resiliency.

The new center—a federally funded research and development center (FFRDC)—is funded under a five-year contract. It is expected to focus on seven areas: acquisition studies, homeland security threat and opportunity studies, organizational studies, regulatory doctrine and policy studies, operational studies, research and development studies, and innovation and technology acceleration.

The inaugural director of the Homeland Security Operational Analysis Center is Terrence K. Kelly, a RAND senior operations researcher. Henry H. Willis, a RAND senior policy researcher, will serve as associate director.

“The new center provides another opportunity for RAND to serve the public and apply its expertise on issues such as terrorism, border security, and other topics critical to protecting the U.S. homeland.”

—Michael D. Rich

Former RAND Trustee Minow Receives Presidential Medal of Freedom

Former RAND trustee Newton ("Newt") Minow was awarded the Presidential Medal of Freedom, the nation’s highest civilian honor. President Barack Obama presented Minow with the award at a ceremony at the White House on November 22, 2016, where he joined this year’s 20 other distinguished honorees, including Bill and Melinda Gates, Frank Gehry, Maya Lin, and Robert Redford.

Minow, an attorney with a long and distinguished career in public life, served as a RAND trustee from 1965 to 1997, including a term as chairman of the board. During his time as chairman, he encouraged RAND to establish one of the original eight graduate schools of public policy—now the Pardee RAND Graduate School.

After serving in the U.S. Army during World War II, Minow served as a Supreme Court clerk and counsel to the Governor of Illinois. In 1961, President John F. Kennedy selected Minow, then 34, to serve as Chairman of the Federal Communications Committee (FCC), where he helped shape the future of American television and was a vigorous advocate for broadcasting that promoted the public interest.

In the five decades since leaving the FCC, Minow has maintained a prominent private law practice while devoting himself to numerous public and charitable causes.
RAND Launches Arabic-Language Website

On July 19, 2016, RAND announced the launch of an Arabic-language website designed to bring its research and analysis to the Arabic-speaking world. Plans call for the website, www.rand.org/ar, to include more than 200 RAND reports translated into Arabic over the coming years. The website will feature reports determined to be of most interest to the Arabic-speaking world, as well as those focused on issues in the Middle East. Topics will include education policy, international affairs, health care, and regional governance.

The goal of the project is to share the findings of RAND research and analysis with key policymakers and the general public in the Middle East. RAND’s research and analysis will help leaders in the region make more-informed decisions around key areas that affect citizens.

“RAND has long made our reports and other research products available for free download on our website,” said Michael D. Rich. “With this project, we offer Arabic-speaking policymakers and citizens access to RAND’s objective analysis and evidence-based insights in their own language. We are pleased to be able to respond to the region’s interest in sound policy ideas and solutions across a range of critical issue areas.”

The translation project is an initiative of the RAND Center for Middle East Public Policy.

Sandra Berry Appointed to the DHHS Secretary’s Advisory Committee on Human Research Protections

Sandra Berry, chair of the RAND Human Subjects Protection Committee, was appointed to serve a three-year term as a voting member of the U.S. Department of Health and Human Services (DHHS) Secretary’s Advisory Committee on Human Research Protections.

The 11-member committee provides expert advice to the DHHS Secretary through the Assistant Secretary for Health on topics related to the protection of human research subjects, as well as recommendations to improve the quality of the system of human research protection programs.

The committee focuses on such issues as the treatment of special populations, including children, prisoners, and the decisionally impaired; pregnant women, embryos, and fetuses; international populations; the identifiability of research subjects; and investigator conflicts of interest.

The DHHS Secretary is responsible for regulatory oversight of the system for protecting human subjects in biomedical and behavioral research supported or conducted by DHHS. This responsibility extends to organizations that conduct such research, the Office of Human Research Protections, and other DHHS entities.

The committee holds at least two public meetings per year and includes nonvoting ex-officio members from the Centers for Disease Control and Prevention, the Food and Drug Administration, the National Institutes of Health, the Indian Health Service, and other DHHS organizations, as well as from a range of other U.S. government departments, including the U.S. Department of Defense, U.S. Department of Education, U.S. Department of Veterans Affairs, and the National Science Foundation.
Charles Wolf, Jr., a leading economist, the founding dean of what is now the Pardee RAND Graduate School, and one of the intellectual architects of modern policy analysis, passed away in October 2016 at the age of 92.

“A prolific researcher, Wolf wrote nearly 300 academic publications and more than a dozen books. His research focused largely on economic development, particularly in Asia; the economics of communist systems and their later transitions to market-oriented societies; foreign aid and security assistance; and burden-sharing among allies.

Wolf was also committed to RAND as a philanthropist, making major contributions to the graduate school’s endowment with his wife, Theresa. In the late 1990s, alumni of Pardee RAND and other donors honored Wolf by establishing the Charles Wolf, Jr., Endowed Lecture Series, which brings noted economists and speakers to the school to address important and timely policy issues. In 2014—the year Wolf turned 90—alumni and friends set up another tribute fund to support future students of the school.

Prior to joining RAND, Wolf served in Italy as a corporal in the Office of Strategic Services. He twice served as a Foreign Service Officer with the Department of State, and taught economics and Asian and Far East studies at Cornell University and the University of California, Berkeley.

In 2007, the government of Japan presented Wolf with the Order of the Rising Sun, Gold Rays with Neck Ribbon—one of the highest honors it awards an academic. It was given in recognition of the role Wolf and his research played in facilitating the maturation of Japan’s relationship with the United States.

Wolf remained professionally active until days before his death, a familiar figure at both RAND’s Santa Monica headquarters and Stanford University’s Hoover Institution, where he was a senior research fellow.
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**9 Locations**

**49 Countries**

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- Life sciences (7%)
- Other, less than one (1%)
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