

**It is
six
minutes
to
midnight
2010**



How close are we to catastrophic destruction? The Bulletin monitors “minutes to midnight” on the Doomsday Clock, and publishes information and analysis about trends and technologies that threaten the survival of humanity. First and foremost, these include nuclear weapons, but they also encompass climate-changing technologies and new developments in the life sciences that could inflict irrevocable harm.

1

Nuclear Weapons

The nuclear age dawned in the 1940s when scientists learned how to release the energy stored within the atom. Immediately, they thought of two potential uses – an unparalleled weapon and a new energy source. The United States built the first atomic bombs during World War II, which they used on Hiroshima and Nagasaki, Japan in August 1945. Within two decades, Britain, the Soviet Union, China, and France had also established nuclear weapon programs. Since then, Israel, India, Pakistan, and North Korea have built nuclear weapons as well.

For most of the Cold War, overt hostility between the United States and Soviet Union, coupled with their enormous nuclear arsenals, defined the nuclear threat. The U.S. arsenal peaked at about 30,000 warheads in the mid-1960s and the Soviet arsenal at 40,000 warheads in the 1980s, dwarfing all other nuclear weapon states. The scenario for nuclear holocaust was simple: Heightened tensions between the two jittery superpowers would lead to an all-out nuclear exchange. Today, the potential for an accidental or inadvertent nuclear exchange between the United States and Russia remains, with both countries anachronistically maintaining more than 1,000 warheads on high alert, ready to launch within tens of minutes, even though a deliberate attack by Russia or the United States on the other seems improbable.

Unfortunately, however, in a globalized world with porous national borders, rapid communications, and expanded commerce in dual-use technologies, nuclear know-how and materials travel more widely and easily than before—raising the possibility that terrorists could obtain such materials and construct a nuclear device of their own. The materials necessary to construct a bomb pervade the world.

As a result, according to the International Panel on Fissile Materials, substantial quantities of highly enriched uranium, one of the materials necessary for a bomb, remain in more than 40 non-weapon states. Save for Antarctica, every continent contains at least one country with civilian highly enriched uranium. Even with the improvement of nuclear reactor design and international controls provided by the International Atomic Energy Agency (IAEA), proliferation concerns persist, as the components and infrastructure for a civilian nuclear power program can also be used to construct nuclear weapons.

2

Climate & Energy

Fossil-fuel technologies such as coal-burning plants powered the industrial revolution, bringing unparalleled economic prosperity to many parts of the world. But in the 1950s, scientists began measuring year-to-year changes in the carbon-dioxide concentration in the atmosphere that they could relate to fossil-fuel combustion, and they began to see the implications for Earth's temperature and for climate change.

Today, the concentration of carbon dioxide is higher than at any time during the last 650,000 years. These gases warm Earth's continents and oceans by acting like a giant blanket that keeps the sun's heat from leaving the atmosphere, melting ice and triggering a number of ecological changes that cause an increase in global temperature. Even if carbon-dioxide emissions were to cease immediately, the extra gases already added to the atmosphere, which linger for centuries, would continue to raise sea levels and change other characteristics of the Earth for hundreds of years.

The most authoritative scientific group on the issue, the Intergovernmental Panel on Climate Change (IPCC), suggests that warming on the order of 2-10 degrees Fahrenheit over the next 100 years is a distinct possibility if the industrialized world doesn't curb its carbon dioxide emissions habit. Effects could include wide-ranging, dramatic changes. One drastic result: a 3- to 34-inch rise in sea levels, leading to more coastal erosion, increased flooding during storms, and, in some regions such as the Indus River Delta in Bangladesh and the Mississippi River Delta in the United States, permanent inundation. This sea-level rise will affect coastal cities (New York, Miami, Shanghai, London) the most, compelling major shifts in human settlement patterns.

Inland, the IPCC predicts that another century of temperature increases could place severe stress on forests, alpine regions, and other ecosystems, threaten human health as mosquitoes and other disease-carrying insects and rodents spread lethal viruses and bacteria over larger geographical regions, and harm agriculture by reducing rainfall in many food-producing areas while at the same time increasing flooding in others – any of which could contribute to mass migrations and wars over arable land, water, and other natural resources.

3

Biosecurity

Advances in genetics and biology over the last five decades have inspired a host of new possibilities – both positive and troubling.

With greater understanding of genetic material and of how physiological systems interact, biologists can fight disease better and improve overall human health. Scientists already have begun to develop bioengineered vaccines for common diseases such as dengue fever and certain forms of hepatitis. They are using these tools to develop other innovative medical solutions, including cells that have been bioengineered to serve as physiological “pacemakers.” The mapping of the complete human genome in 2001 allows for even greater understanding of human functioning. As a consequence of the Human Genome Project, scientists have already identified more than 1,800 genes associated with particular diseases.

But along with their potential benefits, these technological advances raise the possibility that individuals or non-state actors could create dangerous known or novel pathogens. Additionally, researchers with the best intentions could inadvertently create new pathogens that could harm humans or other species. For example, in 2001, researchers in Australia reported that they had accidentally created a new, virulent strain of the mousepox virus while attempting to genetically engineer a more effective rodent control method.

Unlike the biological weapons of the last century, these new tools could create a limitless variety of threats, from new types of “nonlethal” agents, to viruses that sterilize their hosts, to others that incapacitate whole systems within an organism. The wide availability of bioengineering knowledge and tools, along with the ease with which individuals can obtain specific fragments of genetic material (some can be ordered through the mail or over the internet), could allow these capabilities to find their way into unspecified hands or even those of backyard hobbyists. Such potential dangers are forcing scientists, institutions, and industry to develop self-governing mechanisms to prevent misuse. But developing a system to ensure the safe use of bioengineering, without impeding beneficial research and development, could pose the greatest international science and security challenge during the next 50 years.

As an independent 501 (c) (3) nonprofit communications organization, the Bulletin depends on the generous support of individuals and private foundations to produce freely available web resources www.thebulletin.org and our subscription-access digital journal with SAGE Publications at <http://bos.sagepub.com>.

Thanks to contributions from many of the outstanding supporters listed at right, the Bulletin launched in 2009 the annual Doomsday Clock Symposium, an international gathering of experts and leaders to review trends in nuclear security, climate change, and biotechnology. The success of the first two symposia, and the increasing visibility of our digital journal, drives policy experts, the media, and interested citizens to our web resources every day. The January 12, 2010 Clock announcement generated nearly 400 earned news stories worldwide and attracted more than 350,000 unique visitors to our website.

The clarity, timeliness, and authority of the Bulletin’s online content and our broadening audience are pivotal to the success of our new partnerships with SAGE Publications, Ltd. and with the University of Chicago Harris School of Public Policy.

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the Clock.

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“This is according to the Bulletin of Atomic Scientists. We estimate they [Russians] have a large inventory of operational nonstrategic warheads—5,390 is the number of tactical warheads, air defense tactical, et cetera. So they do still have more, and it still is a very legitimate concern to us.”

Senator John Kerry (D-MA) during hearings on the New START Treaty, December 2010

“Today's decision by the Bulletin of the Atomic Scientists to move the Doomsday Clock forward two minutes to five minutes before midnight highlights the continuing and immediate need to secure loose nuclear material.”

Senators Dick Lugar (R-IN) and Evan Bayh (D-IN), January 17, 2007

“The Doomsday Clock is maintained by the Bulletin of the Atomic Scientists, a group of international experts who are committed to our “security, science and survival.” My hope is that we can answer the Doomsday Clock's call—and take real action to protect future generations from the threat of global warming.”

Senator Frank R. Lautenberg (D-NJ) to the U.S. Senate Committee on Environment and Public Works, January 30, 2007

“For sixty years, the Doomsday Clock has been a lasting image of the nuclear age. It has served as a visceral warning symbol that we must take all necessary measures to not only halt the spread of new nuclear weapons powers through successful nonproliferation policies, but also that we must also roll back our own nuclear arsenals through arms control agreements.”

Rep. Edward J. Markey (D-NJ), Co-Chair of the House Bipartisan Task Force on Nonproliferation, January 17, 2007

“I rise today in strong support of H.R. 6 [the Energy Independence and Security Act of 2007], which works to stop global warming by creating a fund that will support research in renewable energy sources and encourage energy efficiency. Yesterday, the publishers of the Bulletin of Atomic Scientists said we are perilously close to destroying the stability of our planet by ignoring the threat of climate change. We can no longer afford to postpone action.”

Representative Stephanie T. Jones (D-OH), January 18, 2007

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“I continue to be unequivocally admiring of the rapid maturity of the Bulletin into a major credible voice at the intersection of science and the issues affecting the global “Commons.” I have been involved with the Bulletin since 1968; we were a voice of logic and empathy but not the stentorian voice that you have established.”

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Robert Alvarez, Institute for Policy Studies and former senior advisor at the Department of Energy

“Thanks for getting copy of the Bulletin to me in DC. I had a great opportunity to give them out. They are now in the office of the Secretary of State, Secretary of Energy, and the President's National Security Advisor. Great timing. I gave the remaining few out at a public talk at the Johns Hopkins School of Advanced International Studies. They almost had a fight for the few copies. I told them to check out the Bulletin online.”

Siegfried Hecker, former director, Los Alamos National Laboratory

“I am a recent ‘born again’ long-term subscriber to the Bulletin and am delighted at your new format. The piece by Matthew Wald, ‘Getting Power to the People’ is really good, and I am eager to forward same to a number of non-subscriber colleagues.”

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“The Bulletin is one of the best tools I have to teach my students about pressing contemporary issues and the complexities of the nuclear age. It is an invaluable and necessary resource.”

W. Patrick McCray, History Professor and member of the Center for Nanotechnology in Society, University of California at Santa Barbara

“There are very few other forums that combine the Bulletin's editorial fairness and meticulous attention to facts. If every member of Congress read each issue, I would be much more confident of its actions.”

Jonathan Penn, intellectual property attorney

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2007 National Magazine Award for General Excellence (under 100,000 circulation), from the American Society of Magazine Editors

2009 Lumity Technology Leadership Award first runner up for “innovative uses of technology in the nonprofit sector,” from Accenture

2007 Society of Publication Designers Merit Award for Best Use of Photography

2006 Houghton Mifflin's Best American Science and Nature Writing Selection for “Lights, Camera, Armageddon,” by Josh Schollmeyer (May-June 2005)

1997 Most Censored Story Award for “Costly Giveaways,” by Lora Lumpe, from Project Censored at California Sonoma State University (September 1996)

1992 New York University Center for War, Peace, and the News Media Olive Branch Award for a “series of articles on Iraq's nuclear weapons program,” by David Albright and Mark Hibbs

1991 Joaquin Costa Award for Journalism from Spain's Fundación Hogar del Empleado for Outstanding Contributions toward World Peace

1990 New York University Center for War, Peace, and the News Media Olive Branch Award for “My Life as a NATO Collaborator,” by Nathaniel Borenstein (April 1989)

1989 New York University Center for War, Peace, and the News Media Olive Branch Award for “Hanford's Bitter Legacy,” by Karen Dorn Steele (January–February 1988)

1988 New York University Center for War, Peace, and the News Media Olive Branch Award for “Slick'ems, Glick'ems, Christmas Trees, and Cookie Cutters: Nuclear Language, or How We Learned to Pat the Bomb,” by Carol Cohn (June 1987)

1987 National Magazine Award winner for Single-Topic Issue for Sept 1986 issue on “Chernobyl: The Emerging Story,” from American Society of Magazine Editors

1987 New York University Center for War, Peace, and the News Media Olive Branch Award for “Scared Stiff—or Scared Into Action,” by Peter Sandman, and Jo Ann Valenti (January 1986)

1986 Best Investigative Story Award for “U.S. Cover-up of Nazi Scientists,” by Linda Hunt, from Investigative Reporters and Editors, Inc. (April 1985)

1983 Forum Award for “providing a forum for discussion of critical Science-Societal issues in the global arms race,” from the Forum on Physics and Society of the American Physical Society

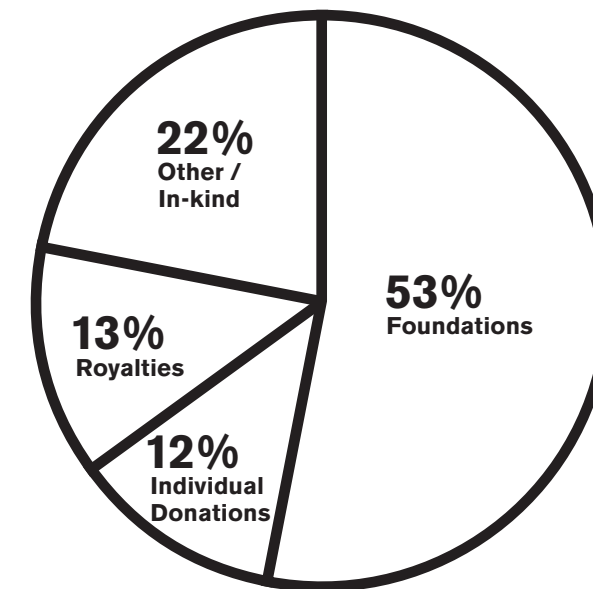
1975 Best Nuclear Reportage Award, from Friends of the *Earth Not Man Apart* newspaper (February 1976, BAS, p. 2)

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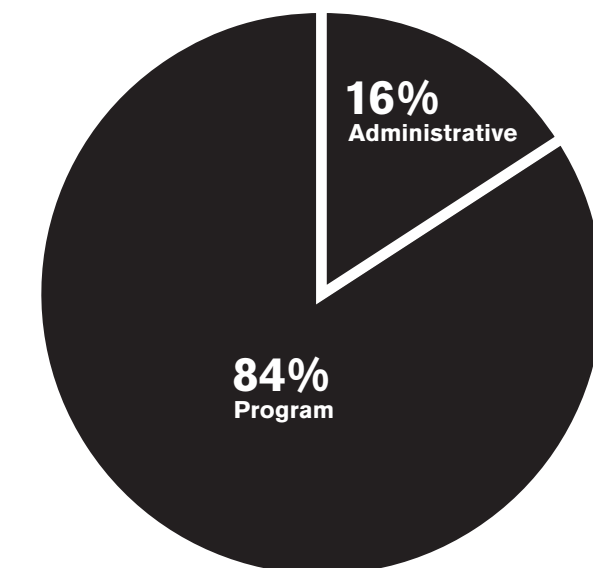
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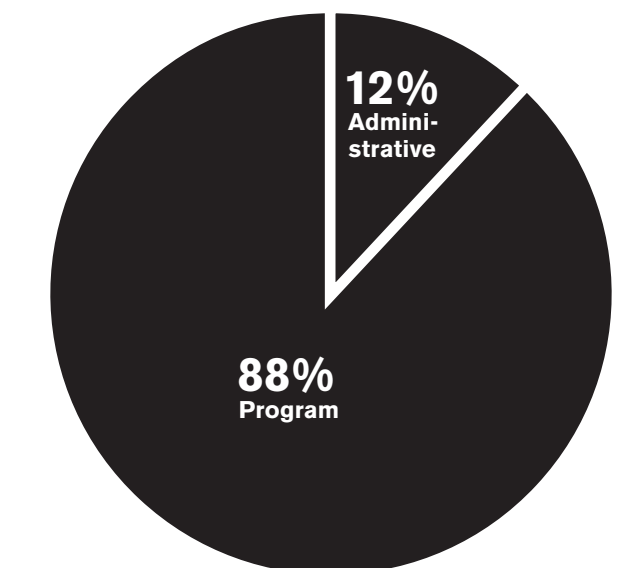
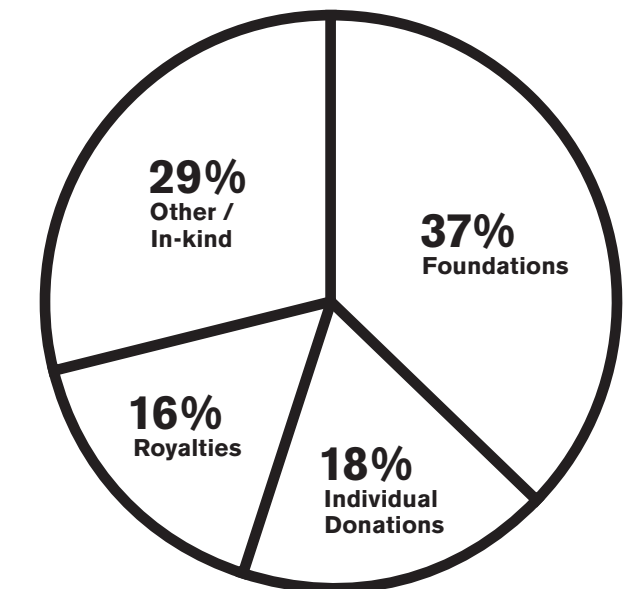
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Multi-media tutorials about Bulletin topics (Doomsday Clock, Nuclear Weapons, Nuclear Energy, Climate Change, and Biosecurity), residing permanently in Clock section of the website for background, presentations, and links to Bulletin and external resources.

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