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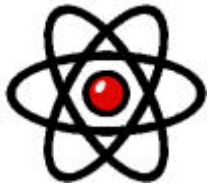

OTSA

PANEL REPORT FOR THE PRESIDENT: LONG RANGE ISSUES IN NATIONAL SECURITY

FALL 2002 CAPSTONE
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Executive Summary

In the years to come, major national and international developments will occur more rapidly and with little to no warning. These developments will affect the lives of Americans as well as their fellow global citizens. It is important that the United States government has the knowledge and capacity to respond to these developments and the widespread consequences resulting from their interconnected nature. Modern networked systems potentially can offer such a response or provide the connections that will bring about synchronous failure. Thus, it is critical for the U.S. government to adapt its current operational processes in order to best utilize these networked systems and to best prepare for the future. Per the request of the president, a panel of 21 government and several private sector experts analyzed the developments that will face the U.S. government in the future. In light of this analysis, the panel created an overall strategy for the government to implement in order to prepare for and to respond to the aforementioned developments. The four components of the strategy include: government's view of the future, the importance of rates of change, strategic policy implementation, and institutionalizing futuristic thinkers in government.

A View of the Future

In the future, the complexity of the world will increase in such a way that issues that were traditionally viewed as separate will become interrelated. The categories currently used to view the world, such as economics, security and defense, governance, and science and technology, will no longer be effective. The panel utilized these four subject areas as it began its initial work. However, as research and analysis progressed, the panel found these subject areas to be limited in scope and consequently

developed two spheres of activity to organize its work. These two spheres of activity are Humans and their Environment and Organized Human Behavior.

The first sphere, Humans and their Environment, includes the environment, energy, demographics, and technological innovations. For the purposes of the panel's work, demographics (the study of people, life, and communities) focuses on aging populations in developed countries and increasingly young populations in developing countries. The panel also studied the global standard of living, including environmental degradation and sources of energy. In the future, environmental degradation will decrease the quality of human life in the future, but renewable energy sources may prevent a future energy crisis and may slow environmental damage. Finally, the panel studied advancing technologies, specifically biotechnology and nanotechnology, which will affect the future of humans and the environment in which they live.

The panel's second sphere, Organized Human Behavior, encompasses all structures, organizations, and processes created by humans to guide their basic functions and interactions. This sphere includes the fields of economics, governance, and defense. Future technological advancements will affect how humans interact and how they organize their world. Technological innovations will allow financial markets to operate more efficiently. They will increase the speed of globalization and will create a conceptual economy founded on new economic principles. These same technological innovations will also enable adversaries to attack the United States using such methods as weapons of mass destruction and cyber- terrorism. The U.S. government will need to invest in such areas as biometrics, space-based weapons, and net-centric warfare in order to defend its soil and its citizens against such attacks. The increased speed and

complexity of information networks will require the government to increase its capacity to regulate the economy, to defend the nation, and to govern effectively. Consequently, governments of the world, including the U.S. government, will form "clubs" in order to address these issues on a regional or international level.

RATES OF CHANGE

Different issues develop at different speeds, and the amount of time that policymakers have to respond to these issues depends upon the issues' rates of change. For example, environmental degradation typically happens slowly over a long period of time. Thus, the change remains virtually unnoticed until an environmental catastrophe brings the issue to light. Policymakers will be ill prepared to respond if they do not know a particular phenomenon's speed, direction, and pattern of change. It is impossible for the government to predict the exact time and location of future developments. However, if the government understands the overall nature of such developments, policymakers will be aware of indicators that signal developments as they approach.

STRATEGIES FOR THE FUTURE

The interconnectedness of future trends is likely to produce numerous complicated and potentially destabilizing issues for governments all over the world. The U.S. government should employ two overall strategies in order to address the myriad of future developments. In regard to Humans and their Environment, the U.S. government should adopt a two-pronged approach to improve the natural environment in the long term. It is necessary to educate policymakers and citizens about the importance

of maintaining a healthy ecosystem. They must also understand the effect that technological innovations can have on humans and the environment. Policymakers should attach short-term incentives to policies that have long-term benefits for the environment.

In regard to Organized Human Behavior, the tension that currently exists between two fundamental American values, freedom and security, will increase in the future. The defense of the country against terrorism may require the monitoring of society that has the potential to violate democratic freedoms. The desire for efficient markets and free trade in an increasingly globalized world will decrease economic stability. If the United States decides to join supranational organizations to achieve security, it will sacrifice some of its autonomy. It is therefore essential for policymakers to try to mitigate the tension between security and freedom in their policies and practices.

Office of Technological and Strategic Assessment (OTSA)

The panel recommends creating a permanent Office of Technological and Strategic Assessment (OTSA). Following the previous panel's recommendation, the current panel designed OTSA as a government agency that would systematically explore the future and advise the president of its findings. The panel envisions OTSA as a hybrid of a pure network and a traditional hierarchy. OTSA's structure, membership guidelines, project selection, and project management should give it adequate flexibility to adapt to changes in the future but should also provide enough structure to allow it to work within the current bureaucratic and hierarchical government structure. It is the desire and recommendation of the current panel to institutionalize the process of future-trend

analysis in order to give such analysis a high priority within the executive branch and the U.S. government as a whole.

CONCLUSION

Four overall trends emerged throughout the report in addition to the four aforementioned components of strategic reform. First, the forces that shape the world are growing in complexity and, therefore, the government's current perception of the world should change. Second, the expansion of networks accelerates change and consequently reduces the action and reaction time available for governments. Third, power is being passed down to individuals and is simultaneously being concentrated up to the supranational organizations. Finally, technological developments promise to challenge basic assumptions about science, life, security, and death.

The following report stresses the role that networks and technology will play in the future. It is to be emphasized, however, that technological innovation and greater interconnectivity do not change the fundamental intentions of human beings. However, future innovation and interconnectivity will drastically alter the scope and magnitude of the impact that individuals can have on the world.

It is the recommendation of the panel that the U.S. government alter its view of the future. In doing so, it must adopt a greater appreciation for rates of change and must modify its current policymaking strategies as well as the structure of the government as a whole in order to develop the capacity to respond to future developments. The analysis of the future should be an institutionalized component of its operation. By implementing the recommended changes, the government will be able to respond to and cope with a

changing future in a shorter amount of time while still maintaining the fundamental underpinnings of American society.

INTRODUCTION

Since January 2001, three separate panels have addressed the president's concerns that the United States government is neither well positioned to contemplate nor effectively respond to the future. The third panel went further and recommended that the president establish an Office of Technological and Strategic Assessment (OTSA) in order to systematically analyze the distant future and the challenges it presents for current policymaking methods. Responding to the president's request to form a fourth panel, the national security advisor assembled a team of 21 government and several outside experts. The president instructed this fourth panel to function as a prototype of OTSA to analyze the future as well as to establish guidelines for the creation of OTSA. Although its work built on that of its predecessors, the last panel introduced four main elements that distinguish its analysis from that of previous years.

First, the panel reorganized the way in which people should think about the future. The three previous panels analyzed the future in four distinct areas: state stability and governance, economics, security and defense, and science and technology. However, the world is more complex, and studying each of these four categories in isolation becomes increasingly challenging and ineffective. Acknowledging the complexity of these relationships, the final panel divided its analysis into two main sections. The first section describes changes in the natural world, specifically those that revolve around humankind, including the environment, demographics, and the potential of technology to revolutionize people's lives from conception to the grave. The second section focuses on the manner in which humans organize themselves and addresses the interaction among economics, governance, and defense in the information age. Although one can find a multitude of equally valid ways to describe this fast-changing future, the panel's division

provides an organizing principle that is straightforward yet adequately sophisticated to enable an accurate and in-depth analysis of future trends and the driving forces behind them.

Second, this report introduces the concept of rates of change. Developed by Woodrow Wilson scholar David Rejeski, rates of change describe the speed at which future issues move toward the present.[1] A crucial element of preparing for the future is to understand the rate and type of change that is approaching. The first rate of change is a linear or slow-moving trend that appears on the horizon and continues to move at a constant rate until it has reached present day. The second rate of change can arrive exponentially, with an initial gradual approach followed by sudden acceleration through time. A third rate of change is a step pattern, remaining static for a period of time and then jumping to a higher level of awareness or influence before becoming static at that higher level. Finally, tipping points (or thresholds) arrive when something suddenly and drastically changes so that the effects of the change seemingly have no link to what occurred before. Categorizing potential problems according to this approach allows policymakers to better anticipate the future by giving them a framework for determining when a problem might become of fundamental importance for the immediate future.

Third, the panel developed a clear strategy for developing policy options. In the first section dealing with humans and their environment, the failure to implement long-term strategies and techniques to mitigate the effects of demographic dynamics and environmental degradation will result in a crisis that threatens governments and state stability. To avoid this collapse, the U.S. government should immediately take steps,

[1] David W. Rejeski, "S&T Challenges in the 21st Century: Strategy and Tempo," unpublished paper based on introductory remarks delivered at the 27th Annual AAAS Colloquium on Science and Technology Policy, April 11-12, 2002, Washington D.C.

such as educating the public and providing short-term incentives to modify people's behavior toward the environment for the longer term.

Policy recommendations for the second section—how humans organized themselves—seek to mitigate the tension between two basic values: freedom and security. As the world grows in complexity and technology becomes faster and more pervasive, American security—military, economic, political, and personal security—will be at risk. However, the most effective security measures will inevitably impose upon basic American principles, such as privacy, human rights, free speech, and participation in government. Public policymakers must ensure an appropriate balance between Americans' increased need for security and the maintenance of basic freedoms upon which the United States was built. The panel has outlined achievable policies for both sections; however, future incarnations of OTSA should work to develop new policies that (1) successfully create a self-sustaining world where humans, the environment, and technology all positively interact with each other to further American interests, and (2) work toward reconciling the tension between security and freedom.

Finally, as instructed by the president, the panel developed a detailed strategy for the creation of a viable OTSA. The previous panel recommended that OTSA be a networked, virtual government agency rather than the traditional "brick-and-mortar" institution. The current panel created an OTSA with adequate flexibility to adapt to future changes as well as with sufficient structure so that people familiar with bureaucracy and hierarchy can work with both the executive and legislative branches. These guidelines will allow OTSA study and analyze the issues that are presented in this

report, with greater insight into a complex future that leads to precise and actionable policies.

Humans and their Environment

In the future, humans and their environment will undergo drastic and irreversible changes. Both will be transformed in an increasingly complex manner because of rapidly advancing technologies. Advancements in medical and environmental technology will be accompanied by countless unintended consequences that can appear suddenly and without warning. The natural forces of environmental degradation and of human health and wellness will continue to shape the future of our natural world, but human innovation will continue to play a larger role as the United States seeks to alter the course of events in its favor.

Historically, environmental regulations and human development policies have been hard to implement, absent a natural disaster or humanitarian crisis. However, the nature of environmental and human change suggests that quick and preventive action is key to effectively coping with new threats to humanity's collective political, social, and economic future. In order to make forward-looking environmental and human-related policies feasible in the near term, it is essential that the government create policies that not only address future threats but also generate tangible benefits in the present. The following discussion outlines trends that may threaten humans and their environment and develops policies to shape these trends.

Environment and Energy Resources

Effective governance and state stability will be challenged as environmental degradation increasingly affects human health and wellness. Environmental resources are highly valued commodities because of their uniqueness and scarcity. Therefore, a drastic decrease in the quantity or quality of these resources would be very costly. Technological innovations promise future substitutes for these resources, but humans will continue to need basic elements such as water, land, and air for survival. Enormous changes in the environment will result from the complex interaction of systems of consumption, population growth, and development. Currently, indicators of a stressed ecosystem appear to be slow moving and predictable. Short-term demands and strong interest groups often influence policymakers' decisions on resource use while consideration of longer-term ecosystem disruptions or negative impacts becomes a lower priority. The negative effects of soil erosion, deforestation, water shortages, and climate change will pose a gradual threat over many years until suddenly they have become a pressing danger. As resources disappear at an increasing rate due to demographic and consumption trends, their scarcity will impact already saturated ecosystems and cause a breakdown of multiple systems in a complex failure.

In addition to these slowly moving trends, certain events can cause sudden change, resulting in a rapid downward spiral. Some potential accelerating forces of environmental degradation are:

- Conflicts that disperse refugees and force heavy concentrations of people in certain areas

- The use of chemical, biological, radiological, and nuclear weapons
- Rapid economic development
- Unplanned urbanization
- The overuse of water sources that leads to saline intrusion
- Seepage from waste sites into water and agricultural lands
- The overuse of pesticides
- Collective farming that can over burden land
- Natural and manmade disasters

Energy use is one of the principle factors of environmental degradation, and fossil fuels are one of the scarcest environmental resources. As more people experience the benefits of modern conveniences, energy consumption and demand for fossil fuels will rise. The energy situation will continue to deteriorate due to declining oil production, increased consumption, and an unreliable electric system. In the future, negative events resulting from high-energy consumption and continued over reliance on oil could include:[2]

- **Increased power outages and high energy prices for U.S. consumers**
- **An increase in respiratory and heart-related diseases and climate change linked to the gases released during the conversion of fossil fuel into energy**
- **War with oil-producing countries**

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[2] "Energy Efficiency & Renewable Energy," *Environmental and Energy Study Institute* Oct. 2000: 2.

- **A substantial increase in gasoline and electricity prices**
- **Depletion of a major oil reserve**

Renewable energy technology may provide a solution to the developing energy crisis and environmental damage. The future holds many opportunities for non-polluting energy sources. Solar photovoltaic costs have decreased from $1 per kilowatt-hour (kWh) in 1980 to 20 cents per kWh in 2000, and are expected to decrease to 10 cents per kWh by 2005.[3] Geothermal energy currently costs only 5 to 8 cents per kWh.[4] Fuel cell technology is extremely promising for use in transportation, because of its reliability, its adaptability to different applications, and its near-zero emissions.[5]

Movement towards renewable energy sources will likely proceed gradually as Americans continue to rely heavily on fossil fuels. Nevertheless, a revolutionary discovery could cause the development of renewable energy sources to take a step up to a quicker rate of change and rapidly expand the use of renewable energy sources. For example, fuel cells, currently in a developmental stage, offer the possibility of revolutionizing the transportation industry.

Despite the United States' current role as a leader in renewable energy research and development, other countries are aggressively following investment strategies, providing economic incentives, and building policy frameworks that encourage growth in this sector. The United States is starting to fall behind in the use of renewable energy, especially in comparison to some of European nations and Japan. Underlying causes involved in this phenomenon may be a tax and incentive structure that continues to favor fossil fuel energy and inhibits renewable energy's emergence in the market. If this trend

[3] Ibid., 2.
[4] Ibid.
[5] Ibid., 3.

continues, the United States may lose competitiveness in this growing sector, and begin to import technology originally created in the United States.[6] **Failure to keep up with the rest of the world in utilizing renewable energy could eventually lead to a major energy crisis and detrimental economic, environmental, security, and health-related outcomes.**

Demographics

Although demographic challenges have thus far been slowly emerging trends, they will become more important political and strategic variables in the years to come. In addition to the environment, the three main drivers of demographic change are population dynamics, migration, and infectious diseases.

In the future, the changing birth rates or "Demographic Clash" between the smaller, older, and wealthier developed world and the larger, younger, and poorer developing world will continue to diverge.[7] Global aging poses a significant threat to universal prosperity as the number of elderly people doubles and the number of workers decreases. Increased human life expectancy, coupled with an aging population in industrialized countries, will put enormous strains on their economies and environments and increase demand for energy.

Fortunately, the a severe aging crisis will not strike for approximately another twenty years, leaving sufficient time to plan for elderly healthcare and to implement extensive strategic migration mechanisms. Nevertheless, the prolongation of life is

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[6] Ibid.

[7] Borges, João Vieira, *A Demografia e a Estratégia: uma prospectiva para o século XXI, Revista Militar*, nº2-3/99, Lisboa, 1999. Paper presented to International Studies Association, Demographics and Strategy Conference. Hong Kong, 2001.

already a reality. The median age in the United States rose from 19 years in 1850 to 34 years in the 1990s, and is expected to rise 20 more years by 2050.[8] The number of people over 65 is predicted to more than double in the next 50 years, from 7 percent to more than 16 percent of the world's population in 2050.[9] **An aging labor force presents innumerable economic implications, such as depressed economic output, inflation, and less money available for investment.** These issues will require many difficult policy decisions on pension systems and social welfare programs.

At the same time, the median population age of less-developed countries (LDCs) is decreasing, which could present a significant opportunity or challenge for these countries and their economic institutions. Countries like Afghanistan, Pakistan, Egypt, Iraq, and Yemen are expected to experience population explosions through the year 2020.[10] Over the next twenty years the population of the world will continue to rise in absolute terms, although the rate of increase is dropping. A growing proportion of youth in many developing nations could impede development and contribute to political instability and crime in the absence of government reform and economic opportunity. "Mega cities," which do not have the capacity to effectively handle the projected increase in city dwellers, may turn into breeding grounds for diseases and fanaticism. Individuals will migrate from developing nations to the developed world in search of employment. Increased migration will lead to augmented nationalism and xenophobia in the developed world, and open borders will promote a proliferation of infectious diseases.

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[8] Francis Fukuyama, *Our Posthuman Future* (New York: Farrar, Straus and Giroux, 2002), p. 61.
[9] *Long-Term Global Demographic Trends: Reshaping the Geopolitical Landscape*, Director of Central Intelligence, July 2001.
[10] The United States Commission on National Security/21st Century, *New World Coming: American Security in the 21st Century*, 15 September 1999.

Eradication of some diseases and advancements in technology and healthcare should increase life expectancy, but the United States will still face daunting threats to national health. Internationally, the long-term effects of the current African AIDS epidemic partnered with a looming AIDS epidemic in China, India, and Russia will have a tremendous impact upon the international economic system. According to conservative projections, within the next twenty years, the total number of AIDS cases could lead Eurasia[11] into a period of economic stagnation. Like previous plagues and diseases that devastated entire populations and countries, AIDS has the potential to severely impact the international economy and wipe out large segments of the human race. Moreover, such massive demographic devastation would create total chaos in the international political system.

Technology

As the natural environment changes human life, innovative technologies promise to be equally disruptive forces. Biotechnology is a field of practical research that merges biological science, engineering, and biochemistry to enhance human health and welfare. **Neuropharmacology, stem-cell research, and human genetic engineering offer enormous benefits but can also have negative consequences for the human race.**

Neuropharmacology is a thriving industry, as drugs that aid intellectual, emotional, and physical capabilities appear on the market. [12] Mood-enhancing and behavior-controlling substances are widespread and effectively alter the human psyche. Stem-cell research is currently a burgeoning field in biotechnology, and the number of

[11] The panel defines Eurasia as the continent of Asia plus Russia.
[12] Francis Fukuyama, *Our Posthuman Future* (New York: Farrar, Straus and Giroux, 2002), p. 56.

researchers and programs developing therapies and cures with stem cells are increasing exponentially. Human genetic engineering is the least-developed technology at this point, as scientists do not have the ability to modify human nature in any significant way.[13] However, scientists forecast that by 2010, parents will be able to ensure that their babies will avoid alcoholism and obesity, and by 2050 newborns will be genetically modified to resist AIDS and other infectious diseases.[14] One day, parents might be able to choose genes for their children that enhance their intelligence, perfect their behavior, and alter their physical appearance.

Even further in the future than biotechnology but with greater implications for humans and their environment is nanotechnology. Nanotechnology will enable the construction of complex, practical devices at the molecular level, on the scale of one nanometer, or one billionth of a meter. **Potential benefits from nanotechnology include:**

- **Self-assembling consumer goods**
- **Carbon-based computers that operate billions of times faster than current models**
- **Safe and affordable space travel**
- **Biomedical nano-instruments capable of ending diseases, aging, and possibly death**
- **The elimination of pollution**
- **The reintroduction of extinct animals and plants**

[13] Ibid., p. 82.
[14] Sally Deneen, "Designer People," *E/The Environmental Magazine*, Vol. XII, No. 1, January-February 2001 < http://www.emagazine.com/january-february_2001/0101feat1.html>.

Developments in nanotechnology focus on three broad areas: computers, integrated microsystems, and molecular manufacturing. By 2015, computer power based on conventional chips will be billions of times greater than today's super-computers. The full impact from developments in quantum and bio-computing may not be felt until much later.[15] Microsystems research focuses on the integration of biological and chemical components into electronic systems allowing for "smart" technologies capable of sensing and detecting a wide range of substances, processing data, and making necessary systemic adjustments in one integrated chip.[16] Research into molecular manufacturing is focused both on top-down and bottom-up applications. A top-down approach means manipulating and integrating nanostructures into already established materials and systems. A bottom-up approach means developing molecular-sized robots, called nanobots that can self-replicate and construct molecular-sized products and systems. Nanostructures integrated into destructive byproducts could solve the problem of pollution, and they could manufacture scarce resources from the molecular level.

A potential innovative phase in the nanotechnology revolution will see the development of proto-type nanobots capable of manipulating individual atoms and molecules under their own power with the ability to self-replicate. Computer programs and mathematical models currently illustrate how simple rules can create complex, self-organizing systems. These systems mimic many of the patterns found in the natural world by emulating biological evolutionary processes that may have given rise to single and multi-cellular organisms billions of years ago. Therefore nanotechnologies following

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[15] Philip S. Anton, Richard Silberglitt, and James Schneider, *The Global Technology Revolution: Bio/Nano/Materials Trends and Their Synergies with Information Technology by 2015* (Santa Monica, CA: RAND National Defense Research Institute, 2001), 25-26, MR-1307-NIC.
[16] Ibid., 26-29.

these rules as outlined by advanced computer models would revolutionize biology by redoing or accelerating the evolutionary process.

Given the current and projected rate of change of this technology, human beings, institutions, and systems will have enhanced capabilities to control and manipulate the material and natural world on an unprecedented scale in human history. Smart technologies will be imbedded in a variety of materials, allowing for:

- Quicker and more accurate information gathering
- Dwellings that automatically adjust to exterior and interior changes in climate, human need, preference, or desire
- Biomedical devises that can pinpoint negative health impacts before they become life-threatening and accurately deliver medicines without damaging surrounding tissues and cells

The future development and use of both biotechnology and nanotechnology will irrevocably change the nature of human life and society by challenging the very social, economic, and political foundations upon which government and the international system depend. Domestically, biotechnology threatens existing social hierarchies based on genetic traits like intelligence, physical beauty, and athletic talent. Moreover, nanotechnology could reverse fundamental economic concepts of scarcity, unlimited wants, and negative externalities. Traditional notions of human equality and democracy and our perception of human personality and identity may become archaic. Internationally, these technologies could change the nature of global politics. **Absent a U.S. monopoly or global regulatory regime on the development of biotechnology and**

nanotechnology, these technologies can be used in malevolent ways with frightening implications for human and state security, privacy, and governance.

Policy Recommendations

The three areas of the environment, demographics, and technology are inextricably linked with each other. A damaged ecosystem will affect a population's birth and death rates and force people to migrate to more stable environments. Population growth in cities and immigration to developed countries can threaten the fragile stability of the ecosystem in those areas. Biotechnology and nanotechnology have the potential to solve these difficulties by eliminating pollution, creating an infinite source of energy, curing diseases, and providing an unlimited amount of food, water, shelter, and other basic necessities. However, technology will likely have unintended and harmful consequences as well. Although both the potential threats and promises of these areas seem far off, their interconnectedness implies that if one part experiences a rapid development—such as a revolutionary discovery in nanotechnology—the rates of change in the other areas will follow suit.

To prepare for the threats and promises in the natural and scientific world, policymakers should follow two overarching strategies. First, the government must create policies that educate the general public and policymakers about the health of the human environment and on the societal impacts of science and technology. **Without a comprehensive education mechanism, people's behavior, interaction with the environment, and views of science and technology**

are not likely to change. Second, the government must provide short-term economic incentives for policies that provide long-term benefits for the human environment. **The government should also institute safeguard measures and implement precautionary actions to ensure the country's protection against the malevolent uses of a new technology.**

For an education and public awareness campaign, the panel recommends:

- The EPA's Policy Planning Unit should expand to focus on medium- and long-term scenarios. One example is to develop a National Water Board (in association with the American Water Works Association, the Association of Metropolitan Water Agencies, and the Water Environment Foundation) to consider the implications of water shortages on a national as well as a regional basis.
- Increase funding to UNESCO to promote universal standards in education so that all children can be guaranteed the opportunity of a high school education.
- Increase donations to the World Health Organization to improve and expand global capacity to track the spread of disease.
- Have OTSA address economic, social, political, legal, ethical, and security implications on both a national and global level of related technological development. OTSA could work with an International Science and Technology Organization to disseminate information about technology's risk and

opportunity.[17] These studies will help prepare policymakers to make crucial decisions as these new technologies arise.

For a short-term incentive strategy, the panel recommends:

- Developing market-based pollution systems modeled on the Clean Air Act's pollution trading system, eventually scaling up to a viable international pollution trading market for air, water, and land pollution.
- Promote research and development in biodegradable consumer goods with the goal of reducing the amount of non-biodegradable waste in landfills by 75%.
- Increasing funding for programs (i.e. the Energy Star Program, Wind Powering America, Million Solar Roofs) that provide incentives and goals for state regulators, manufacturers, builders, and consumers through tax credit incentives, labeling, and corporate social responsibility recognition.[18] Promote existing "smart growth programs" which encourage better-coordinated land-use planning, transportation, and energy policies.
- Facilitating the change of the International Labor Organization into an international employment agency to strategically locate needed labor around the world. In addition, create an economic refugee status in order to allow workers to escape the depression and lack of opportunity in their own country and fill voids left by an aging population in developed countries. Redistributing the labor force will have short-term economic benefits in many parts of the world.

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[17] Jerome C. Glenn and Theodore J. Gordon, eds., *2002 State of the Future* (American Council for The United Nations University, The Millennium Project, 2002), 72.
[18] "The Energy Star Programs: Saving Money and the Environment," *Environmental and Energy Study Institute* Nov. 1999: 1.

- Provide funding for universities and private companies to research and develop biotechnology and nanotechnology solutions to problems like disease, pollution, and food shortages.
- Institute a tiered system for retirees, adjusting the retirement age to account for a longer living population. This policy would be extremely difficult to implement, but if it accompanied an education strategy that demonstrated the necessity of it and if it provided economic incentives to the elderly, they would be more likely to agree to retire later in life.

II. Organized Human Behavior

As changes in humans and their environment promise to challenge government regulation, the scope of available information promises to challenge how humans organize their behavior. Traditionally, the autonomous disciplines of economics, governance, and defense could each be dealt with in virtual isolation. As unfettered information races across the globe, the interplay between markets, national regulations and defense measures impact the other. Policymakers must account for the interplay that challenges traditional conceptions of human organization by reconciling the need for security and freedom; efficiency and regulation; and autonomy and cooperation.

Information technology increases the speed of life and particularly threatens how humans organize behavior. Market efficiency has outpaced national regulation, but the effect of economic efficiency threatens national and personal economic security and vulnerability. Governments are unable to keep pace with the speed of information dissemination or provide for some of the basic needs of citizens threatened by

transnational forces, but at the same time they are tasked with defending democracy and personal freedom. The defense industry is challenged with new threats. Protecting against these threats, however, may mean a reconfiguration of what is considered personal information and the concept of national security. In order to defend against these threats, governments must balance between security and freedom. Will the trend to scale regulation up to the international level in the pursuit of efficiency and security erode national and individual autonomy? Will a new conceptualization of economic fundamentals lead to prosperity but harm equality? The panel explored the reorganization of human behavior and possible government responses to these dichotomous trends of security and freedom.

ECONOMICS

Macroeconomic trends reflect the role technology and networks play in creating tension between freedom and security. In the future, increasing efficiency will decrease stability of he U.S. financial system, and humans will have trouble keeping pace with the super-efficient economy. Similarly, the United States will have to make a choice about sharing its economic gains with other countries. However, undeveloped countries with no hope of having a truly developed economy will pose a threat to the security and stability of the United States and the rest of the developed world.

Financial markets in the future will attain a volume and operating speed that facilitates countless transactions. The operating speed of these markets holds the potential for unparalleled efficiency, as consumers reap the benefits of unprecedented free trade, and firms access previously untapped markets. However, this potential for leaps in efficiency is tempered by likely instability. People will need to react more

quickly to accelerating financial events, but human reaction time could become too slow as technology's speed accelerates beyond the human capacity to control it. As the Asian financial crisis of 1997 demonstrated, free markets can crash within a matter of hours and quickly affect the global economy before anyone can react. Policymakers will have to choose between efficient or stable financial markets.

In the international financial system, technological innovations continually aid international financial integration by allowing for real-time financial transactions. **More efficient financial markets are likely to facilitate growth, but global integration will leave the United States increasingly vulnerable to fluctuations in the international financial markets.** Threats include domestic corporate scandals, fraudulent accounting practices, the risk of contagion in the international financial markets, and cyber terrorism.

The amount of capital flowing from richer to poorer countries could continue to decrease. If this occurs, countries that default on their loans may cause a domino effect, and initiate a ripple of defaults throughout the system. Although the Argentine case was confined, the Asian crisis spread through several countries. Similar crises will reoccur until a proper framework is established to mitigate their effects.

In international trade the types and numbers of actors will increase, and these actors will impact how countries do business with each other under the constraints of the rules and norms of the international economy. **States will still provide the basic framework for the free market, but they will become increasingly engaged in more complex interactions with regional and international institutions like the World Trade Organization (WTO), non-governmental organizations (NGOs), and private sector actors such as multi-national corporations (MNCs).** As the WTO widens its

membership and further reduces trade barriers, the United States can expect to face increasing constraints on its autonomy to protect citizens. NGOs will pressure the International Monetary Fund (IMF), the World Bank, governments, and the public to act decisively on issues such as labor and environmental degradation. MNCs will become more independent international actors and continue to demand exemptions from state regulations while also clamoring for protection in new markets. These diverging trends have found a place in discourse and protest, but little in government regulation.

In its current form, the international political economy is unlikely to facilitate the development of a purely free trade regime for fear of immeasurable social costs and instability. However, the Internet will continue to allow firms to eliminate middlemen and attract consumers in nations with high Internet connectivity. **The interconnectedness and speed of transactions in the business world will necessitate reform of the international political economy from a domestic-based structure to an international trade regime based on numerous, atomistic actors and lower transaction costs.**

An example of the social implications of this international trade regime is the distribution between developing nations and the developed world. The forces of globalization will continue to be a main factor at the center of the United States' policy toward LDCs. International competition—where developed nations with mobility and skills to prosper in global markets have an advantage—is going to increase. Income inequalities and uneven distribution of technologies will likely continue, leading to increasingly virulent calls for greater equality by poorer individuals and nations. Globalization will also impact American governance. WTO and North American Free

Trade Agreement policies, for example, will continue to conflict with national laws. Failing to coordinate legislation between the United States and multilateral actors could lead to bitterness and animosity among these nations. **However, globalization will ultimately assist in continuing to expand economic growth and strengthen the democratic process through global interconnection of many nations.**

In addition to the global economic system, a gradual erosion of the foundations of traditional economic principles will force policymakers and academics to account for and develop a new framework through which business and commercial activities can be conceptualized. Advances in information communication technology (ICT) could potentially hold the key to ending resource scarcity, on which modern economics is based. The challenge is finding new mechanisms to influence a conceptual economy.

Assuming the pace of ICT advancement remains constant or even accelerates, the core concepts of modern economics, resource scarcity and price, will probably diminish in importance. Conceptual goods[19] produced in the ICT sector require fewer traditional inputs such as land or labor. In developed economies, the scarcest resource is time, a factor excluded from traditional economic thought. The ICT sector can also reduce resource scarcity by decreasing the amount of resources required to produce a given good.[20] Finished conceptual goods would not be finite, making prices unnecessary.

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[19] Conceptual goods are defined here as those goods whose price is solely determined by the value of labor—and not that of capital and natural resources—required to produce that good. Examples of such goods that improved social welfare beyond the ability of the original inventor's profit include the discovery that surgeons could prevent infection by hand washing, and Henry Ford's invention of the assembly line production process.

[20] According to the World Development Indicators, the United States produced nearly half as much CO^2 per dollar of GDP in 1998 as in 1960, indicating that fewer natural resources were consumed per output.

Eliminating resource scarcity and price would restructure economies, markets, and resource use patterns for these goods.

The conceptual economy will develop slowly, but it still could create great gains in a short period of time. In the absence of an earth-shattering ICT discovery, the conceptual economy will be difficult to detect from a snapshot of the economy. A conceptual economy, however, will not eliminate the conflicts over economic management because those who believe the conceptual economy is approaching will face resistance from those who cling to the more familiar economic principles. Such conflict is already visible in the discourse over productivity gains in the U.S. economy. Some attribute such gains to the use of ICT, while others only see a bubble. Because the development of the conceptual economy is dependent upon the pace of ICT development, the conceptual economy could grow very quickly if sudden technological changes result in a rapid flood of new capabilities.

The growth of the conceptual economy will present unique challenges to firms. Corporate organizations will face pressure to lower prices on conceptual products. If the value of their product depends on widespread usage, they will have an incentive to lower the cost of that product as much as possible. If that product is not a physical good with manufacturing costs, but a concept or digital application, it can be mass distributed for free. How governments are able regulate this evolution needs to be addressed by questioning the assumptions of market structures.

Governance

The speed at which the United States must react to change will increase the tension between freedom and security in all areas of government decision-making. Just like the area of economics, human governance must adapt to meet the increasing rate of change of future threats while maintaining the proper balance between freedom and security. Governments will repeatedly have to choose between:

- Freedoms associated with sovereignty versus the stability that comes with supranational organizations
- New capabilities offered by the information age versus the security of a less networked society
- The flexibility to respond rapidly to changes on the horizon versus the responsibility to reinforce traditional, but slower, democratic processes.

This dilemma between freedom and security will affect everybody from the individual to nation states to international organizations.

Reaction to a scaling up of authority will take place in fits and starts as the trends compete. In order to control their fates, nations will form "clubs,"[21] unions of states or organizations assembled according to region or specific topics. These clubs can take a variety of paths as they evolve in the future. Clubs may adopt accountable, representative, and transparent democratic processes and develop fast and effective ways to meet transnational challenges, or they may hinder the effectiveness of individual nations' actions with time-consuming bureaucracy and least common denominator decision-making.

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[20]Arjun Appadurai, "Broken Promises," *Foreign Policy*, September-October 2002: 43.

Regional institutions' ability to make smaller voices heard in opposition to certain U.S. policies will inspire other countries to form similar regional clubs in response to resentment of U.S. intervention in their "neighborhoods" and to regain a sense of power. Economic club trends move steadily toward both regional clubs (like the European Union) and global ones (IMF/WTO), punctuated by "spikes" as unfavorable IMF/WTO rulings and policies cause movement away from global clubs and towards locally sensitive regional clubs. Regional trading blocs and countries abandoning global organizations challenge the U.S. goal of creating open markets and fostering free trade.

Just as the United States and western European countries joined NATO in the face of the Soviet threat, nations will form clubs to deal with transnational threats such as environmental degradation, terrorism, and organized crime. Although these problems cross regional boundaries, countries will seek first to deal with them on a more malleable, regional basis. These clubs could potentially address transnational threats in a manner amenable to U.S. interests or deeply antithetical to them. The change posed by each of these two scenarios will be either a "slow opportunity" or a "slow threat" to U.S. interests. Club formation in response to U.S. hegemony is an opportunity if countries decide that joining pro-American institutions is their only path to success and security. However, clubs could pose a major threat if powerful and hostile global clubs are formed in reaction to American policies or actions.

While the United States grapples with how to best handle the proliferation of clubs, the information age will also produce a number of threats to governance on the domestic and international level. The speed and complexity of information networks, accompanied by society's growing dependence on network-generated goods and services,

will increase both the prosperity and vulnerability of governments and businesses. The government will have less time to act and react to the volume of information flowing throughout the world. Individuals will profit from access to global services but also experience threats to their right to privacy both from government and private sources. In the future, governments and businesses will share information databases and have the ability to track conversations, medical records, and purchases made by citizens all over the country. Without proper legal protection, individual privacy rights could be endangered.

While the United States will likely continue to dominate worldwide sources of media and attempt to expand its influence in emerging communications systems, people around the world will be able to choose from a multitude of media and information sources. **The United States' ability to harness the advantages of information sharing, rather than resisting the inevitable changes, may ultimately prove the difference between thriving or failing as a governed society.**

In adapting to the speed and complexity of the changing future, the U.S. government must be careful not to compromise the fundamental tenets of democracy. Technology is inherently neutral, and technological developments do not by themselves either strengthen or weaken American democracy. More important is a discussion of how people, especially governmental leaders, use or misuses this technology. Some individuals might seek to exploit technology for personal political reasons and threaten democratic principles like privacy, accountability, and representation. While this threat should not be minimized, the United States has seen numerous technological changes over the past two centuries, and the system of

government established by the Constitution with its checks and balances has continued to safeguard American liberties. The United States' battle-tested institutions (the three branches of government), supported by the watchdog media and a vigilant citizenry, should succeed in defending democracy and the fundamental rights and values of Americans.

Two major trends related to democracy appear on the global scene. First, democracy will likely continue to proliferate around the world at an increasingly faster rate as the United States and other developed countries support democratic growth and serve as a "city upon a hill" for other nations to follow. Second, citizen participation in these developed democracies, especially in the United States, seems to be on a gradual but constant decline as voter participation decreases with every election. Without a participatory citizenry, the system of democracy breaks down and allows government representatives to act with less accountability. Such a situation opens the door for an individual to exploit the broken system and use technology to increase his or her own power, seriously infringe upon American rights, and effectively shred the Constitution. Suddenly, the United States—this city upon a hill—no longer shines as brightly for the newborn democracies around the world. Democracy is not a given but an ongoing experiment that requires constant attention.

Defense

Economic, environmental, and non-traditional military concerns are now threatening national security and international stability. **In order to protect the United States, the government must study all types of potential threats and take a**

comprehensive approach to national security planning. The freedom and openness brought on by technological innovation and increased communication also increases the United States' vulnerability to new and different types of threats. The government must confront these new concerns but cannot ignore the constant threat of more traditional military conflicts. The information age is transforming traditional military threats making them more difficult to defeat, but technology is also increasing the United States' capacity to combat multiple threats on many different planes. The future of U.S. military affairs will be characterized by a struggle to defend against new and increasingly sophisticated attacks, while maintaining a proper balance between freedom and security.

New communications technologies make the threat of terrorism even more dangerous. The United States has lost its competitive advantage in fighting terrorism because terrorist organizations are constantly evolving in ways the government is not. **In the future, non-state actors and terrorist groups will employ new strategies in their attacks on the United States, such as the use of nuclear, chemical, and biological weapons.** The U.S. preparation will also be challenged by more effective delivery methods for these types of weapons. As these attacks become more devastating, the psychological effects on the public will become more and more pronounced.

Just as the financial system will face the threat of cyber attacks, the military will also have to combat cyber terrorism. Computer and networking equipment will become less expensive and more accessible, and expanded communications satellite infrastructure will allow Internet access to reach even the most remote areas of the world. Terrorists, lacking more symmetrical attack capabilities, will move to strike American

technological vulnerabilities. These vulnerabilities will only increase as the United States becomes more reliant on computers and networks to manage the national infrastructure.

Potential cyber attacks will continue to be extremely difficult to pinpoint and prevent because of the continuously changing nature of information technology. U.S. policymakers must become sensitive to new changes in the information technology (IT) sector and lead the effort to shape IT development rather than simply adapting to previous technological advances.

The threat of terrorism and potential attacks on the U.S. mainland will require federal, state, and local government institutions to coordinate their actions, reinvent their mindsets, and modify their structures in order to respond to these external threats. The recent creation of the Department of Homeland Security demonstrates this new mindset and will help coordinate federal, state, and local governments. Because many terrorists operate covertly in an open society, the government will also need to expand its intelligence and investigative capabilities in order to prevent future attacks. Disputes will arise between those who will be willing to sacrifice liberties in favor of security and those who will want to protect their liberties despite the potential danger.

Another threat to national security is the proliferation and potential use of weapons of mass destruction (WMDs), which will become increasingly available to terrorist organizations. Political instability could compromise a nation's control of weapons materials, increasing the potential for theft and illicit sales of components. In the future, terrorists will prefer less sophisticated, yet more covert delivery methods, such as human transportation of suitcase-sized weapons. Hostile states may also commission non-state actors to execute WMD attacks in order to minimize the political repercussions

for their governments. The increase in the number of states with active WMD programs increases the likelihood of an attack on the United States.

Countries all over the world will also look to space as the ultimate military high ground for combating a WMD attack and monitoring all military activity. With the dual capability of attacking space and ground-based targets, space-based lasers will be one of the most deadly space weapons for preventing WMD attack and a variety of other threats. Ultimately, controlling space means having the ability to monitor and react to military threats at all levels simultaneously.

Space assets must be protected from the potential use of anti-satellite weapons and electromagnetic radiation produced by the detonation of a thermonuclear device in the high atmosphere. If an adversary rendered useless the space-based communications infrastructure, the United States would lose its advantage on the battlefield. The United States will need to decide between dominating space by controlling space activity and monitoring military movement from space, and establishing an international regime (or a "club") for governing the use of space weapons and the protection of space assets. At a minimum, the United States must prevent another country from controlling space on its own.

In the future, warfare will occur in cyberspace, outer space, and everywhere in between. Advancements in technological capabilities will influence the way that the government deals with the scope and speed of these threats. However, the government must not allow technological capabilities to dictate defensive strategy. Both state and non-state actors will employ a variety of innovative tactics and technologies to inflict maximum

damage to U.S. interests both at home and abroad. Also, government efforts to combat these emerging threats will draw criticism, as technological capabilities challenge current conceptions of privacy and other civil liberties. Although conventional war continues to threaten American security, most non-state actors and powerful nations are strategizing about other forms of attack, like biological and chemical warfare, that are more difficult to prevent and combat. If the United States does not change its national security priorities, these threats will become more serious.

One change resulting in a rapid flood of new military capability is the creation and development of robots to perform human tasks and pilot aircraft such as the unmanned aerial vehicle. While these new technological inventions provide the military with large gains in efficiency, they will also change the role for humans in warfare, as robotic weapons, and perhaps robotic soldiers, become more viable.

Net-centric warfare will become a major phenomenon in the future as the number of network-based conflicts and crimes increase. Net-centric warfare will significantly improve battlefield management capabilities. Soldiers will have the ability to communicate, in real time, with all levels of the command and control structure. Command centers will also have real time access to video images transmitted from ground and air assets. These improved capabilities will lead to greater efficiency in conducting combat operations, as well as preventing unnecessary civilian casualties,

while inflicting maximum damage to the enemy. As IT innovation continues, the potential for exploiting the possibilities of net-centric warfare will improve dramatically.

Policy Recommendations

As this section has demonstrated, technology is rapidly affecting trends in the areas of economics, governance, and defense. These trends could cultivate enormous gains like a conceptual economy where goods are no longer scarce, or they could lead to enormous disasters like biological and space warfare. Changes in one of these areas will affect the others. For example, a cyber attack against American financial markets will be of great concern to the defense community. A war involving WMDs will likely lead many people to question their system of governance. Supranational clubs are fundamentally a governance question, but these clubs are most often formed for economic or military reasons. Finally, technological developments could serve both to usher in the conceptual economy and revolutionize warfare.

This section also emphasized the tensions between freedom and security, efficiency and stability, and equality and power in all these forms of human organization. Policymakers should strive to mitigate this innate conflict, and OTSA should continue to examine these problems to seek the middle ground within the ideals of security and freedom. In order to move the United States toward this optimal position, the panel suggests the following policy recommendations:

In the area of economics:

- Reduce trade barriers to developing countries for goods in which they hold a comparative advantage, and encourage the European Union to amend its Common Agricultural Policy. Developing countries often hold comparative advantages in the agriculture and textile industries, but developed nations' barriers to these goods are often the highest. Reduction of these trade barriers will facilitate freer trade, which will benefit consumers and producers, increase market efficiency, and improve the economies of developing countries. In the long term, developing countries with viable economies pose far less of a security risk to the United States.
- Task economic experts within OTSA to study the positive and negative implications of a conceptual economy. By analyzing a conceptual economy now, the government will be better prepared to deal with it when it comes. At the same time, the government should help fund research and development in technologies that promise to reduce or even eliminate the current problem of scarcity.
- Establish a WTO convention on intellectual property rights to govern the exchange of ideas in the conceptual economy. If policymakers decide that protecting those rights is desirable, amend the Agreement on Trade-Related Aspects of Intellectual Property to take into account the increasing threat that the Internet poses to those rights. This would provide some stability to an otherwise fluid and free system.

- Ensure that sufficient funds are available for liquidity in times of market stress by creating common integrated communication networks among participants in the financial system and instituting real time backups of financial data and software.[22]

In the area of governance:

- Create a task force made up of the executive and legislative branches and private citizens to develop a virtual bill of rights that detail what individual information should remain personal and what information is necessary to defend the homeland. Determine what information can be legally used and what would be considered misuse.
- Establish an OTSA working group to advise on the benefits and drawbacks (increased influence versus the loss of sovereignty) of joining certain clubs and to create a strategic plan for eventual membership.
- Encourage greater participation at the state and local level and greater transparency and input into decision-making on the national and supranational levels; and strengthen the connection between local, state, and federal governments to make governance more relevant to people's lives. This may include delegation of more duties to the state or local level. Make government matter to people again!
- Encourage citizens to work to influence their government by using the Internet to research issues and contact members of Congress.

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[22] *Panel Report for the President and Congress: Comprehensive Strategic Reform*, Washington, DC: Center for the Study of the Presidency, September 2001, p 33.

- Provide incentives for the youth to vote. This could mean making first time registration easier, perhaps by allowing people to register through their work or university system. Implement online voting for the tech-savvy youth population.

In the area of defense:

- Continue to invest in weapons and intelligence technology and employ C4I[23] capabilities that enable real-time action and decision-making by U.S. forces and work toward developing a joint military strategy incorporating all branches of the Armed Forces.
- Increase funding to universities, research organizations, and the private sector for the development of automated technologies that reduce combat casualties.
- Direct and appropriately fund intelligence agencies, including Defense Human Intelligence Service, to gain access and provide insight into organizations, especially terrorist groups, attempting to develop/purchase WMD capability.
- Develop a civil defense plan with the proper health and security agencies in the event of a WMD attack. This defense plan should also be coordinated on an international level so that all countries are working toward the same goal of preventing and defending against the use of WMDs.
- Direct OTSA to study the long-term implications of a militarized space to help decide whether the United States would be more secure by seeking to control space or by establishing an international regime for governing the use of space.

[23] Command, Control, Communications, Computers and Intelligence

III. Office of Technological and Strategic Assessment (OTSA)

Mission

The fundamental mission of the OTSA is to enhance the president's ability to govern effectively by providing nonpartisan, apolitical research and analysis of long-range national security issues that have yet to appear on the agendas of other security policy entities. In particular, OTSA will supplement the efforts of the National Security Council (NSC) to keep the president apprised of security issues by focusing exclusively on the long term, allowing the NSC to focus on the short and medium terms. OTSA's starting point should be the problems and policy recommendations as detailed in the first two sections of this report.

OTSA's secondary mission is perhaps even more ambitious: to provide a long-term model for government reform. While OTSA will likely present some explicit recommendations regarding government restructuring as they relate to specific long-range national security issues, OTSA's own day-to-day example will provide a subtle impetus for evolution as well. As this section will discuss, OTSA is designed to be more network-based and decentralized than other government agencies. Certain administrative structures will be necessary to allow OTSA to interact effectively with the rest of the government, which is rigidly hierarchical. However, the structures employed in this "controlled decentralized network" will lack the stifling emphasis on authority that characterizes the hierarchical structures so commonplace in government today.

Adopting more network-oriented processes provides several advantages over purely hierarchical systems. Hierarchical systems are rigid, with a strict chain of command and varying degrees of authority within the chain. Information can travel up

and down the chain, but is filtered as it proceeds through each level. Information tends to flow down faster than it flows up, and information traveling up the chain often never reaches the top. These tendencies lead to an arduous, lengthy, and relatively unimaginative decision-making process. Networks, on the other hand, facilitate information sharing and allow greater flexibility and creativity. Authority in a pure network is shared, and all members have a personal stake in the outcome. A network often has some sort of core that loosely defines the tasks at hand, overseeing the administration of the network without exerting authority over substantive outcomes. Because the network lacks the static authority structures of hierarchies, members can collaborate freely with each other and the core as they see fit. Information flows neither up nor down; it flows throughout, reaching every interested party in the network. Networks give creative or unconventional ideas more salience, whereas unusual ideas in hierarchies are often silenced or homogenized before they ever reach the top.

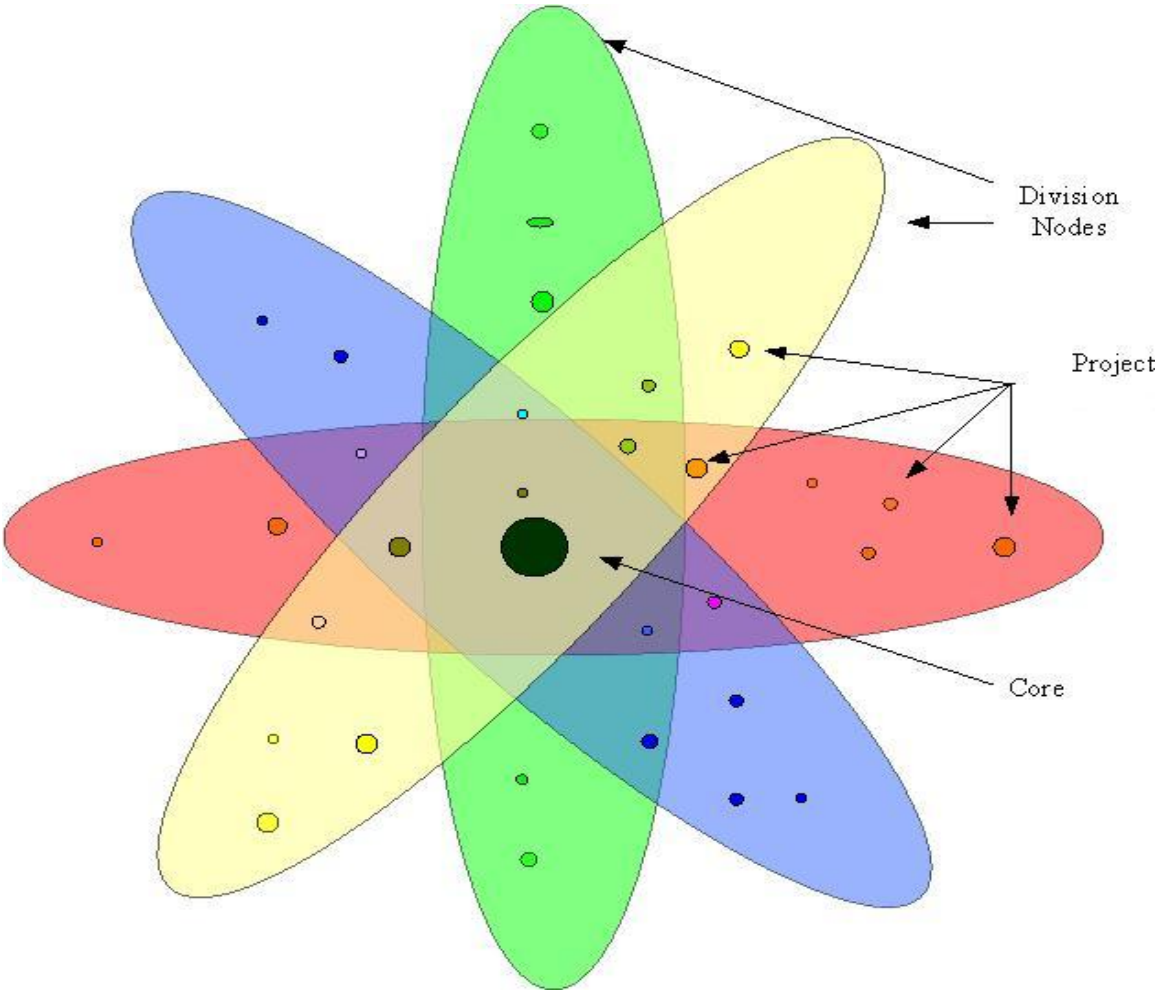
Although networks would add much-needed flexibility and creativity to the government decision-making process, it remains to be seen whether a government based entirely on hierarchy can successfully move towards a more network-oriented structure. However, in an age of network-oriented adversaries, a more networked government would be more ideal to respond to emerging threats, since decisions could be made more quickly and with better information. A networked government would also be less vulnerable to crippling attacks. If one part of the network were targeted, others would

still function with minimal disruption, whereas in hierarchies, attacking one part of the "chain" disables the entire organization.[24]

Structure

OTSA is designed to foster collaboration among the top experts in four areas of particular strategic significance: science and technology, security and defense, economics, and governance. (However, OTSA may face the same challenges that this panel did when divided into four distinct groups. Therefore, OTSA should have the flexibility to rearrange itself so that it can best address long-term national security threats.) **Experts from government, academia, and private industry utilize OTSA's controlled decentralized network (CDN) to work together in what is a hybrid between a pure network form and the traditional bureaucratic agency.** The following diagram illustrates OTSA's basic structure:

[24] Arquilla, John and David Ronfeldt. *The Advent of Netwar* (Rand, 1996).



The Division Nodes (DNs) are based on the four above-mentioned categories: science and technology, security and defense, economics, and governance. Each DN has a Division Node Administrator (DNA), who will track and manage their OTSA members and have a substantive knowledge of the subject area. On a theoretical level, all DNs intersect with each other and the Core; an OTSA project could conceivably relate to two, three, or even all four of the DNs. Within Division Nodes, the small circles represent

individual projects, in which OTSA members with relevant expertise collaborate on a specific research topic.

The core is the administrative center of the network. The core comprises the OTSA Director, the four DNAs, an external relations liaison, and the minimal support staff is necessary to perform administrative functions. The external relations liaison will field inquiries and requests from other executive branch agencies, Congress, and the media. The support staff will include technical personnel, who will be responsible for OTSA's IT needs, including maintenance of the membership database, management of the OTSA website, technological training/assistance for OTSA members if necessary, and general network maintenance and troubleshooting. Other core support staff will include a small layout and design team for the publication of documents, and a handful of clerical personnel. The Core is the only brick-and-mortar component of OTSA; it provides needed stability, continuity, and structure for the network, with minimal hierarchy and at very low cost.

Members

Members of OTSA (excluding the Core) will be designated as either "latent" or "active," depending on their current level of involvement in OTSA. By default, all OTSA members are latent, which means that they are available to work on a project but are not currently doing so at present. Latent members are not monetarily compensated, and are presumably working at the agency, organization, or firm. Active members are currently working on an OTSA project and receive a salary from OTSA commensurate

with experience for the duration of their active status. Active members would, in effect, take a leave of absence from their workplace while working for OTSA.

Current OTSA members or DNAs recruit new members as necessary. Interested parties who have not been invited may apply for membership. The need to work with classified information could certainly arise, so all members must eligible for a security clearance; this will obviously be more urgent in some DNs than in others. Many of the members whose expertise requires a clearance will already have acquired it through their workplaces, and these workplaces will most likely have means and procedures for accessing classified information through existing government networks. In other words, the need to protect sensitive documents will not be an insurmountable obstacle for OTSA members.

The OTSA Director is chosen by the National Security Advisor with the consent of the president. Good working relationships among these three individuals—especially between the Advisor and the OTSA Director—are profoundly important. The Director then chooses the DNAs. The rest of the core will be hired through the standard civil service procedure.

Project Selection

Even in a "virtual" organization with relatively low overhead, finite resources are an unfortunate reality. Prioritization and selection of projects, therefore, is a key concern. Given OTSA's stated mission, research requests from the president and/or the National Security Advisor will hold top priority in the selection process. This "top-down" approach, however, should be employed only rarely, as part of OTSA's purpose is to

examine issues not yet on the security agenda. Ideally, most projects will originate from OTSA members' proposals. These proposals can be evaluated and voted upon by all interested OTSA members (latent and active) quite easily via an OTSA intranet. Proposals will not be forced to endure an extensive filtering or homogenization process, as new and unusual ideas will be seen by the entire OTSA membership. Proposals that are not selected will provide fodder for other ideas and could become potential areas of collaboration.

Project Management

Once a project is selected, an ad hoc group is formed of the OTSA members with the most relevant areas of expertise. These members might all be affiliated with the same DN, but that is not necessary, expected, or even desired. The project group exists for the duration of the project and no longer. **Rather than establishing rigid guidelines for the internal positions and responsibilities of each group, such roles are determined by the group members at the outset of a project.**

The challenge of a decentralized structure is the apparent lack of management or power structure. In the case of OTSA, however, several factors will neutralize this issue. Projects will not continue indefinitely, as one of the administrative functions of the DNAs is the establishment and enforcement of final project deadlines. Fluid structures increase creativity through competition among peers; OTSA members, who are likely to be a particularly motivated group to begin with, will strive to differentiate themselves by rising above the expected level of achievement, thus gaining the recognition of their

peers.[25] Even though this motivation is partially ego-driven, it also guarantees high quality and participation.

Naturally, this system can only succeed when members share a common vision and goals.[26] If members are thus aligned, then they are more likely to work together effectively. Accountability is also essential for project management within a decentralized network structure. Members of each project will therefore develop accountability agreements which outline at the beginning of the project the goals, expectations, and responsibilities within the group. This aligns the intellectual and creative energy of the entire group, and lays the groundwork for effective and efficient cooperation. Project assessments at the end of each project will allow group members to assess their own performance as well as that of their peers. The combination of these tools will produce the necessary amount of structure without imposing crippling authoritative requirements. One of the oft-overlooked assumptions underlying network theory is that people *are* able to function effectively in the absence of hierarchical authority; OTSA's design is based on this belief.

Networking Methods

Although the members decide the details of group interaction for a project, certain communications strategies will prove particularly useful. Advanced technology will not completely alter the standard processes of joint small-group project work. For example, it will be extremely helpful to have face-to-face meetings in both the initial and final

[25] George N. Dafermos, "Management and Virtual Decentralised Networks: The Linux Project," *First Monday*, volume 6, number 11 (November 2001), http://firstmonday.org/issues/issue6_11/dafermos/index.html.
[26] Ibid.

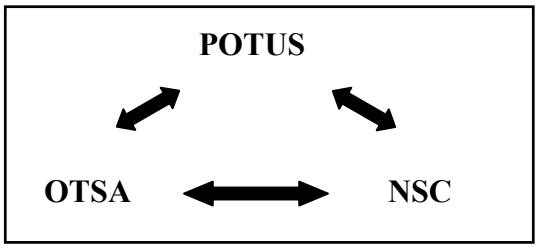
phases of the project in order to enhance group cohesion. Subsequent electronic communication will be more productive and sustainable if the group members are familiar with each other. In the final stages of a project, consensus can be more efficiently reached in a face-to-face meeting.

While personal meetings are desirable, communication technology will help to manage long-distance working processes. Especially in small creative group interactions, informal exchange is essential for project success. At present, this can be achieved by videoconferencing and instant messenger (IM) technologies. In the near future, the video capabilities of IM will greatly increase, making more meaningful interaction possible. In the next 5-8 years, it is likely that advances in virtual reality technology will allow group meetings to take place in cyberspace, which would enable group members to interact in a more natural and intuitive manner. Whether these cyberspace meetings would be productive and cost-efficient remains to be seen.

OTSA and the Government

OTSA was created at the behest of the president, and the analysis it produces will serve the White House first and foremost. Since the president does not need to be immediately briefed on every long-term national security issue, the National Security Advisor will usually act as the conduit between OTSA and the president. **OTSA's relationship with the NSC will be symbiotic in nature, as OTSA will take on the task of identifying future security concerns, allowing the NSC to focus on crisis management.** OTSA's "jurisdiction" comprises the long-term, while the NSC's portfolio involves the short and medium terms. Ideally, information sharing and agenda

setting will occur in all directions between the president (POTUS), NSC, and OTSA. The following diagram illustrates this concept:



OTSA will also collaborate with the National Economic Council and the Office of Science and Technology Policy as appropriate. These entities mainly deal with current issues and do not have the time or resources to look into long-term issues. They also often lack the president's attention. Cooperation with OTSA on some long-term projects might somewhat ameliorate that situation, allowing these offices to perform their duties more effectively.

Cultivating positive relations with other executive branch agencies and Congress is extremely important if OTSA is to achieve the stature and influence to which it aspires. The external relations liaison in the Core is responsible for fostering positive relations with other government entities. This person will make arrangements for OTSA experts to give Congressional testimony or agency briefings when requested, and will field informal requests or suggestions regarding future research topics. OTSA's primary responsibility will remain with the White House, though, so these requests would be fulfilled only as time and resources permit.

OTSA can also forge bonds with the rest of the executive branch through the experts from these other agencies that become OTSA members. OTSA's prestige and unique opportunities should attract talented individuals from other agencies to participate, and the participant's home department will be glad that it had input into the project through its representative.

The Future of OTSA

In order to establish some level of permanence, OTSA must strive to establish itself as an indispensable resource for insightful, thorough, and fair identification and assessment of developing national security issues. **OTSA's unique contribution lies in its truly long-term focus, especially considering that most government policy analysts barely have the time or resources to see beyond the next ten months, let alone the next ten years.** The "turf" of the distant future is largely unclaimed by other agencies, allowing OTSA to operate with far fewer turf battles than, for example, the Department of Homeland Security.

Since the current president requested OTSA's creation, the panel hopes that OTSA will have White House support for the immediate future. If OTSA is even remotely successful, it will quickly become indispensable to the most important decision makers in government. Establishing solid relationships with others in government will substantially supplement this support; hence the inclusion of an external relations liaison in the Core. OTSA must be perceived as a useful complement rather than a rival. By providing maximum utility with minimum threat, OTSA will lay the groundwork for long-term operational effectiveness.

Appendix A – The Experiment

This project forced the panel to think on several different, but interrelated, levels. First, the four substance groups (economics, science and technology, governance, and military) dealt primarily with long-term national security threats and major changes. Second, the networks and processes group focused primarily on developing a system for OTSA as was outlined in the final section. Finally, all five groups were instructed to work as if they were a networked OTSA using the Prometheus platform, which allowed for online discussions, chats, uploading files on the Internet, and other networked elements. This appendix will explore the effectiveness of this OTSA prototype; however, applying lessons from this experiment to the real OTSA may be difficult because of significant differences between the model and the new government agency.

The experimental panel never really functioned as a networked organization according to the OTSA guidelines. Prometheus never became the primary means of communication, and groups resorted to more familiar forms of communication, such as e-mail and face-to-face meetings, in order to share ideas and divide responsibilities. Nevertheless, some interesting discussions did begin on Prometheus and prompted creative thinking. Most groups also found the chat function on Prometheus to be slow and unwieldy.

Several factors seemed to limit the capacity of the panel to work as a network:

1) At the very beginning, the panel was given strict hierarchical structures. Everyone divided into clearly defined groups, chose a group leader, and selected a Deputy Advisor for the panel. The panel was instructed that communication to outside experts should pass through the group leader. These hierarchical structures inhibited the

creation of a true network. Initially, the panel believed that ideas for subjects could come from the bottom-up and that the hierarchy could be eliminated. However, the work of this experimental panel shows that most people need clear instruction from the top and hesitate to take their own initiative for changing something or developing new ideas.

2) Lacking the knowledge and experience of functioning in a network, the panel retreated to familiar and hierarchical modes of working within groups. Many of the new ideas the panel tried (like policy node discussions, changing the structure of the paper, or PowerPoint coordination) only occurred because the Deputy Advisor pushed the entire class. Without this leadership, the entire panel would have stalled. Within the groups, each person had his or her own subject area, and cross-fertilization among the groups occurred primarily at the level of the group leader.

3) There was little incentive for members of the panel to commit themselves fully to the experiment and function as a network. With the knowledge that this project was simply a one-credit pass or fail course, many individuals realized that they simply needed to write the three papers by the expected deadlines and work within the group to form some common ideas. These tasks could be completed by outside research and individual writing with some discussion within the group. Nothing motivated them to work as a network, to discuss various ideas on Prometheus, or to share ideas across group lines. With schedules filled with other items and time always disappearing, many members chose to do what was necessary but no more.

Although some of these lessons can be applied to an OTSA within the government, the panel believes that the OTSA members will be much more motivated, both intrinsically and extrinsically, to function as a network and make OTSA work in the

absence of leadership from the top. They will also be experts in their the projects, so the lack of commitment to a project that the class experienced will likely not occur. However, we have addressed some of these potential problems as we developed guidelines for OTSA. Therefore, the panel has tried to create OTSA with a minimal amount of structure and given it great flexibility in the project research and writing. Outlining expectations at the beginning of the course and having peer assessments will help provide some structure to the network but allow the members to evolve as they see fit.

Ultimately the success of OTSA depends on the people in it. Young or old, tech-savvy or computer-illiterate, the transition to fully networked interaction does not come automatically, especially in a workplace setting. It is absurd to expect the "ideal OTSA" to appear, Athena-like, fully formed and fully functional from the very beginning. The panel's suggestions for OTSA encourage a networked environment, and the controlled decentralized network will serve as an effective first step towards the ideal as its members work within the network and see its benefits.

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