WAITING FOR SPUTNIK
BASIC RESEARCH AND STRATEGIC COMPETITION

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Executive Summary

Since the 1940s, spending on scientific research has been crucial for U.S. national security. Our investment in science and technology underpins America's current military and economic strength. The problem is that funding levels that were adequate in the past are now insufficient. The reasons for this are straightforward. A series of interconnected changes are reshaping the international environment in ways that challenge U.S leadership:

-- **Globalization** has diffused technology and research capabilities around the world and helped to create the wealth that lets many countries pursue technological leadership.

-- The **transition to a global information economy** will make the countries that are better at creating new knowledge the economic powers of the next century.

-- Few companies can invest in basic research in a fast-moving **competitive global business environment** that demands results in the next quarter, not the next decade. Some analysts believe that DOD has made a similar shift away from basic research.

-- **Asia's economic ascent** made that region a leader in global manufacturing. Now Asian nations hope to repeat this success in scientific research. China, India and other Asian nations are increasing their research capabilities at a faster rate than the U.S.

-- **Sophisticated commercial technologies** that perform like military equipment diminish the U.S. military advantage and put a premium on accelerating research.

The U.S. is underinvesting for this new strategic environment. It spends more than other nations on research and development, but the figures hide a damaging deficiency in key areas -- basic research in physics, mathematics, computer sciences, and engineering conducted at universities and other institutions. These scientific and engineering disciplines are the basis for military transformation, provide the workforce for sensitive projects, enable other kinds of science, and are the ultimate source of economic growth. Measured by share of GDP, their funding has decreased steadily since 1975.

Some of the consequences of underinvestment are already apparent – such as a shortage of U.S. citizen scientists to work in sensitive national security programs. Other effects – the shortfall in the research that feeds economic and military innovation – will not appear for another five to ten years. The U.S. still leads, but its advantage is shrinking as our spending slows while strategic competitors accelerate their efforts.

Basic research is not a conventional national security problem, but decisions on research funding

have major implications for the national interest. Technological superiority provides the U.S. with unprecedented security and influence. It is the result of a dynamic process of innovation that links the discovery of scientific knowledge to economic and military advances. The connection between basic scientific research and national strength lies in the ability of a nation to innovate, and turn research into new products and services. The U.S. has an unparalleled ability to innovate that is the envy of other nations, but they have looked upon our success and now seek to duplicate it.

The effect of underfunding on national security is acute and damaging, but a sense of urgency is undercut by the long lag between the production of new knowledge from basic research and the transformation of this new knowledge into products and services. Research into quantum physics in the 1920s laid the foundation for a microelectronics industry that did not appear until the 1950s. Physicists began to discuss nanotechnology in the late 1950s, but products are only now appearing on the market. The research behind the Internet began in the late 1960s, years before it unleashed sustained economic growth. The long interval between basic research and benefits can create pressure to defer funding in times of budgetary constraint. Unfortunately, the U.S. has been deferring investment in key research areas for decades. The conclusion of this report is that the United States has underestimated the consequences of underfunding basic research for the new strategic environment.

Basic research depends on federal funding. Today's competitive environment does not allow the private sector to invest in experiments whose payoff may not appear for a decade. Federal funding will determine the scope and pace of discovery and the size of the technological workforce required to meet U.S. national security needs.

The President has identified three budget priorities: winning the global war on terrorism, defending the American homeland, and moderating increases in discretionary spending. These priorities address the risks facing the U.S. today, but the U.S. also needs to respond to the long term strategic challenge. A fourth priority must be to accelerate innovation to meet the new strategic challenge to economic growth and national security. We have four recommendations on how to do this:

1. **Restore funding** for basic research in the physical sciences and engineering across all domestic non-defense research agencies to the levels needed to meet long-term economic and national security requirements.

2. **Commit a larger proportion of Defense spending** within current Research, Development, Testing and Evaluation (RDT&E) funding levels to basic research and S&T workforce development.

3. Establish **new mechanisms for partnerships** with the private sector, other agencies and other governments (including both the state governments within the U.S. and allied governments outside) to support university research.

4. Create **new governmental funding vehicles** (such as special purpose bonds, investment incentives, or endowments) to leverage current federal allocations.