Science, Technology, and the Quest for International Influence

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After the industrial revolution, science leadership has been associated with increased national capability through superior commercial and military technology. With the rising importance of soft power and transnational bargaining, when America's hard power cannot be deployed everywhere at once, maintaining leadership in basic science as the quest to know Nature may be key to curbing legitimate resistance and sustaining America's influence in the international system. The catch is that American democracy imposes high demands on the relationship between science, state, and society. Case studies of the Office of Naval Research and U.S. science-based relations with respect to Brazil, as telling examples of U.S. Government science policy via the mission agency, reveal how difficult it is for a democratic power to strike the right balance between applied activities and fundamental research that establishes science leadership.

To discover sustainable hegemony in an increasingly multipolar world, American policy makers will need more than the Kaysen list of advantages from basic science. Dr. Carl Kaysen served President John Kennedy as deputy national security adviser and over his long career held distinguished professorships in Political Economy at Harvard and MIT. During the 1960s, Kaysen laid out a framework with four important reasons why a great power, the United States in particular, should take a strategic interest in the basic sciences.

1. Scientific discoveries provided the input for applied research, which in turn produced technologies crucial for wielding economic and military power.
2. Scientific activity educated a cadre of operators for leadership in industries relevant to government such as health care and defense.
3. Science proficiency generated the raw elements for mounting focused, applied efforts such as the Manhattan Project during World War II to build the first atomic bomb.
4. Scientific progress built a basic research reserve that when necessary could move quickly to shore up national needs.[1]

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These arguments underscored science‘s contribution to new products and services that provided market or military advantages. The pursuit of physics, chemistry, and biology at the frontiers of knowledge could have direct effects on national excellence.

The following sections of this article extend Kaysen‘s list for the present multi-polar world. The United States‘ largest military and economic shares in such a world do not guarantee empire. Soft power from scientific achievement, however, may make up part of the deficit, enough to augment America‘s reputation and American leadership in the international order. The U.S. science establishment is then described and evaluated for its capacity to integrate and leverage the complete list of science benefits: Kaysen‘s nation-based items plus the civilization-based advantages exposited here.

Case studies of the Office of Naval Research and U.S. scientific outreach to Brazil illustrate underlying strengths and weaknesses of the U.S. system for maintaining the lead in basic science. Among the weaknesses, democratic regimes tend to suffocate professions, particularly in the sciences, due to natural hostility between democracy and technocracy. The United States might yet find the right balance by inculcating a politically sophisticated professionalism. In other areas of heavy government responsibility—finance, health care, foreign intelligence, and defense—officials and the public have over time placed considerable trust in expert agents. With greater scientific literacy at the mass level and greater political literacy at the scientific level, America‘s state and society may forge a somewhat freer, healthier relationship with American science, accruing benefits for U.S. material power in the long run and, in the short run, for persuasive influence in the international system.

Science and International Leadership

In their book on *Leading Sectors and World Powers* (1996), George Modelski and William Thompson extended their analysis of innovation back, beyond the birth of industrial capitalism, to the Sung Dynasty in China at the turn of the First Millennium.[2] Modelski and Thompson mentioned inventions like the compass that helped leaders extract wealth from maritime East-West trade routes, but they also noted the Sung rulers‘ cultivation of knowledge and the influence of Chinese intellectuals on administrative reform.

A scientific society has the opportunity to apply methods and models toward political and economic questions. Just before the November 2008 elections, the *New York Times’* David Ignatius sat down with two former national security advisers, Zbigniew Brzezinski and Brent Scowcroft, for a series of interviews on foreign policy.[3] In their discussion of complementary strengths that could lay the groundwork for greater transatlantic cooperation, the advisers noted how impressive it was that the European Union could knit together so many independent states with sophisticated, comprehensive rules and regulations without inadvertently strangling economic growth. It seems improbable that Europe could build the administrative structures for a successful common currency or a single labor market without an ethos that came from scientific competence. Progress in the physical sciences can spill over in a way that supports modern institutions and efficient public policy.

Spillover to social sciences reinforces the notion that scientific progress and scientific literacy are civilizing influences. As such they can fortify what Joseph Nye termed a country's soft power, its capacity to establish appealing precedents for the rest of the world.[4]

Science shares properties with Olympic sport in that it can open avenues for non-coercive cultural hegemony. Foreign emulation in science, though, counts for more than soccer or gymnastics. The demonstration effect in physics may initially appear as man-overcoming-Nature rather than man-versus-man, but great scientific advance is more cumulative than victory in the Games. Anyone seeking to take the next step must accommodate the vernacular of the pioneer and accept his tutelage in the universal logic governing scientific concepts. Moreover, the ingenuity and skills on display as a citizen in a specific nation-state, albeit working at university, unlocks another secret of nature register around the world as excellence that could someday be harnessed by government and adapted to the state-versus-state context.

That fungibility garners international respect and piques interest in greater collaboration. In his study of American science overtures to Europe during the first decades of the Cold War, John Krige related how overlapping interests and in some instances the overlapping community of scientists and government officials infused pure science aid with foreign policy purpose. The construction of CERN (*Conseil Européen pour la Recherche Nucléaire*) for all-European particle research in Geneva. European conferences of the well-connected Ford Foundation and the development of the NATO Science Committee did not simply advance basic knowledge; they also nurtured a special dialogue, unencumbered by normal diplomatic preoccupations. This privileged communication nevertheless facilitated American hegemony and buttressed Western solidarity against intimidation, or alternate offers, from the Soviet Union.

In material balance of power terms, the larger economy and more capable nuclear forces of the United States were seen as less threatening to Western Europe than the Red Army, deployed just over the makeshift border with East Germany.[5] Cultural appeal, including scientific prowess as well as liberal democratic ideals, afforded the United States extra diplomatic margin as it simultaneously expanded its own arsenal and its alliances against a technically inferior opponent.

Finally, during the late-Cold War, after 1970, the economic rise of Germany and Japan, the larger diplomatic role of China, and the greater international participation from post-colonial governments in the developing world reshaped the global agenda. Problems traditionally managed by the great powers—

arms control, arms proliferation, international development, environmental consequences of industrialization and urbanization—were picked up by non-governmental entities who sought to influence state behavior. Given their small budgets and their status as outside observers rather than diplomats or official negotiators, specialized knowledge was their instrument of choice. As transportation and communication technologies improved through the 1980s and 1990s, issue-based groups and public policy institutes proliferated, combining with academic researchers to build epistemic communities.

Expert networks formed around the nuclear strategy of the superpowers, the international treaty for the Law of the Sea, the banning of chlorofluorocarbons (CFCs) and landmines, and eradication of AIDS/HIV. By plugging into the growing list of intergovernmental organizations at the regional and global level, such communities not only supplied new facts to states. Their outside voices acquired editorial and political functions, directing states' limited attention to important issues and highlighting bargains as the basis for new international agreements.[6]

Not surprisingly, many of the political challenges where epistemic communities have won access involve applications of science. At any given time nuclear physicists, geophysicists, chemists, biologists, mathematicians, and social scientists are called upon to clarify the dimensions of the problem or evaluate the effectiveness of proposed solutions. Their scientific credentials are recognizable to every party, regardless of continent or culture. Their desire to maintain their reputation as scientists constrains what they can say, but because this distinguishes them from partisans representing a specific country's government, what they do communicate arrives to other delegations on a different, sometimes clearer channel.[7]

Scientific objectivity notwithstanding, it still matters if the most advanced knowledge about Nature consistently emanates from one of the states at the international bargaining table. Granted, the scientific lead is a subjective concept. No single country will win all the Nobel Prizes or conduct every cutting edge experiment, so what constitutes a dominant share depends on the collective judgment of others. Yet, once a country has this lead, it commands a certain respect in the global commons and in international negotiations. It may not always get its way, but the scientific leader's interests must be taken into account, if for no other reason than the best information—however professionally delivered—is most often being filtered through a British, French, Chinese, or American mind. Even when science does not beget a marketable product or an advanced weapon system for the would-be hegemon, it can serve the national interest, providing subtle endorsement for the lead state through composition of epistemic communities, where the best minds gather to resolve international policy disputes.

In summary, basic science is more than an elixir for economic growth and superior military technology.[8] When a national establishment underwrites unparalleled progress in this essentially cosmopolitan endeavor, it has spillover effects: in the way a state debates domestically and improves upon its organization and policy performance; in whether other countries admire a lead state's culture; and in steering international bargaining via talented scientists who keep their national identity as they migrate to increasingly influential epistemic communities.

The U.S. Science Establishment

In order to capitalize on a scientific lead, the most obvious strategy for sustaining hegemony would maximize the information flowing between basic research labs and the parties responsible for each of the mechanisms discussed, above. These mechanisms, or factors, in a state's appropriation of science broke down into two categories: the Kaysen list, which emphasized direct pathways to products and operations that overwhelmed economic or military competition, and the spillover list, which conveyed benefits to the hegemon through the broad appeal and accommodatingly neutral, man-versus-nature visage of scientific discovery.

Science policy becomes more complicated as initial assumptions shift from a unitary rational actor for the state to a complex bureaucracy embedded in a culture of democratic accountability. First, distinct agencies within the federal government cannot escape the outer limits of the federal budget: a dollar appropriated for the National Science Foundation, for example, has to come from new taxes, new debt, or another government agency. Just within the Kaysen list of objectives, the state cannot avoid trade-offs between support for defense and commercially relevant research, which in general falls under the responsibility of separate executive branch entities working with different classification rules, oversight committees, and sponsors in Congress.

More important than setting budget priorities, the missions of different organizations within the government have to be reconciled. A recent trend in foreign policy consulting urged a proper marriage between the technique of soft power and the coercive instruments of hard power.[9]

The central flaw of Bush administration foreign policy after 9/11 was, in their view, unfortunate matchmaking. Neoconservatives combined ambitious democratization with willingness to press a conventional military advantage. The result was near universal resistance to the U.S. agenda, severe enough to curtail America's international influence. Something approximating hegemony, if not unipolarity, could be sustained if instead the United States threw its military and economic weight behind modest diplomatic ventures to consult and persuade the international community. In simple terms, hard power plus soft power would equal smart power, a kind of currency that could be well invested, not just consumed in terrifying, often violent rampages through global trouble areas.

Basic Science and Great Power Democracy

Science and technology policy may defy this reasonable sounding formula. The list of spillover processes in which scientific success breeds international success muddies the distinction between means and ends.[10] German sociologist Max Weber famously warned that a clear separation between scientific facts and political values was necessary for the well-being of both science as an enterprise and the state.[11] His reasoning anticipated Samuel Huntington‘s analysis of how to harness military expertise under the prerogatives of a liberal democratic state.[12] Grant the professional officers—or in another application of the logic, professional scientists—autonomy to advance in their field but require from them in return prudent comportment in the public sphere.

The dangerous alternative was a politicized professional class, claiming jurisdiction over questions of value and setting policy priorities based on the specious qualification of technical education. Unless they stood down, placing their mastery of science aside when it came to defining the national interest, they distorted civic discourse. Each political faction would grasp for its own scientists to defend its public position from rivals who also claimed the mantle of universal and objective truth, with the end result that the state would deny itself the genuine fruits of science.

The rise and fall of civilizations, particularly the interaction of Chinese, Western, and Islamic polities over two millennia, gives some credence to Weber‘s concern. If a head of government justifies social and religious order on the basis of what scientific theory dictates, both the sciences and the sovereign are primed for disaster. Yet, troubling cases appear at the other extreme of complete separation. The silence of scientists who permitted National Socialism to determine ultimate applications of their discoveries served neither biology nor Germany in the long run. Fastidious distinction of science and politics during the Vietnam War left university laboratories vulnerable to charges of casually arming American imperialism and abetting criminal destruction in Southeast Asia, in flagrant violation of higher education‘s own humanist charters.[13] Almost as quickly as one can call for a safe delineation of roles and missions, opponents ask whether scientists should hitch themselves to the wagon of state, regardless of the driver.

A compromise position, and a useful standard for measuring the appropriateness of the United States science establishment, suggests that scientists should not work for any government that would run the enterprise into the ground. The very practice of science has prerequisites with political implications: individual freedom to question conventional wisdom on the laws of nature regardless of endorsing authority, communal respect to permit the sharing of data and objective replication of experimental results, and cosmic humility to accept the contingent and limited reign of scientific theory.

This primordial soil for the growth of science would seem most conducive to the simultaneous development of constitutional democracy.[14] By comparison, authoritarian rule, in communist Russia or capitalist China, imposes a nonscientific political elite, which is predisposed to contain and eventually suffocate scientific freedom.[15] Pure democracy without the regulating mechanism of a constitution is vulnerable to capture by a wealthy or a populist faction with similarly devastating results for the small scientific minority within a society.[16]

Despite the centrally planned economy and the risk of imprisonment or worse for crossing the likes of Stalin, Russian science posted impressive achievements in both theoretical and empirical fields during the Cold War.[17] Fear for one‘s physical safety, genuine nationalist determination not to remain prostrate before the American juggernaut, and lack of alternatives for personal satisfaction apparently counteracted the handicaps inflicted by centralized authority.

Further dispelling the notion of a tidy relation between political-economic arrangements and scientific success, German material science and chemistry advanced dramatically in the late-nineteenth century, powering its industrial output—in quantity and quality—past that of Great Britain, a more liberal and more democratic rival.[18] Compatibility between pluralist politics, free enterprise, and scientific freedom notwithstanding, market democracies are still vulnerable to losing the scientific lead. Just because researchers enjoy benefits from their status as a professional class in a free society does not mean they proceed as they wish. In democratic regimes, the ultimate guarantor for professional autonomy is the will of the people. Political representatives and executive branch officials may direct public money toward new research, but such funding streams cannot survive without general confidence from taxpayers that the system is working.

True, private companies in the United States have a proud history of funding basic research. Bell Laboratories was famous for producing Nobel Laureates as well as technology breakthroughs. However, as competition intensified—particularly from foreign producers—industry tended to emphasize technology development over basic research.[19] From a business standpoint, basic research posed high risks and offered only heavily discounted rewards, due to the uncertainty of usable results, the length of time to convert basic findings into a marketable product, and the difficulty of patenting rather than publishing scientific findings. In a free enterprise economy, private sector scientists might not chafe under the dictates of central planners, but they still tailored investigations to meet the demands of quarterly earnings reports.

As industry shifted its resources from path breaking science, universities and government institutions had to pick up the slack, but they, of course, feel public pressure to make science pay, and both are expanding vehicles for public-private and academic-industry partnerships. It is still the case that despite China‘s faster rate of growth since 1990, at over $300 billion in 2004, U.S. research and development expenditure dominated the field, exceeding the EU-25 combined total and tripling the estimated investment for China.[20] Nevertheless, a better approach to evaluating whether the U.S. science establishment can help sustain America‘s preeminence in the twenty-first century would describe various government agencies' ability to resist popular and market-based encroachments upon funding for long-term, fundamental research.

Individualistic, creative approaches to verifying new behavior and advancing theoretical understanding of Nature are most likely to produce new knowledge that would drive future lead sectors in the global economy or the next technological revolution in military affairs. Another country, a so-called second mover, might still best the United States in converting a new discovery to improvements for manufacturing, but this incremental process fills out the thin, highly specialized treetops of scientific growth, and its economic value is sooner or later subject to the planting of another species—another profound discovery that completely revises engineering problems.

The basic science lead, for reasons the Kaysen framework specified, provides a nation-state unique flexibility to detect early and ride waves of technological change. Moreover, because of the nondemocratic and nonmarket aspects of science, its predilection to consort with idiosyncratic genius rather than the common pitchman, natural philosophy commands a universal, high culture appeal, which powers positive spillover effects for the state: better rationalization of public policies; international acclaim for the host civilization that spawns scientific achievement; and pride of place in transnational expert communities. A key question, then, asks whether the U.S. science establishment is poised to recognize and nurture good ideas in fundamental science.

Scattering among Mission Agencies

The first impression emerging from a survey of official support for basic science in the United States is that of a ramshackle mansion set upon the richest topsoil. Grounds of this estate represent the nation's universities, which together comprise the largest performer of basic research.[21] Other entities include nonprofit research institutes, industry's research and development centers, and federal government labs.

Every year with the blessing of Congress and the president, servants come rushing out from tiny closets adjoining massive rooms scattered throughout the government establishment to plant seeds and offer a little water to the fecund earth. The seeds are powerful. They were purchased with the largest science and technology budgets in the world, but the servants are still in a precarious situation, for at each harvest they must report to their master how well the seed has grown. The masters run the day-to-day operations of the mansion, each assigned to manage one of the rooms, but collectively they have little reason to coordinate their moves unless it pleases the president—the mansion's chief executive—or the Congress, who owns the building. Each of the individual headquarters has its own function, important to the president's success, approved by Congress, and frustratingly remote for cultivating the garden outside. Congress continues to buy some seeds, though. On rare occasions, the fruits of science in the outer garden beautify or even refurbish agencies inside the government house.

Three qualities that distinguish this U.S. science establishment are fragmentation (closets scattered throughout the government); deep reserves (massive adjoining rooms for each closet); and intense mission orientation within but not necessarily coordinated among the fragments. During the Cold War these qualities were considered strengths compared to the centralized, hierarchical state-science relationship in the Soviet Union.[22]

Fragmentation across different executive departments prevented any one cabinet secretary from concentrating the federal budget for massive spending on a narrow slice of science. Normally, this was advantageous because of the great uncertainty involved in basic research. Since no authority could be certain whether a given experiment would succeed as designed, produce a surprise discovery, or lead to revolutionary technology, it was self-defeating to try and pick winners. The best one could do was set the conditions for talented scientific minds to indulge their intuition and follow where the method took them.[23] The loose structure of many federal sponsors with very different interests in science as their starting point approximated a random search algorithm that would, it was hoped, outperform Soviet program management for cracking Nature‘s hidden codes.

In any case, when the need of the republic was great and the science was sufficiently mature, members of Congress and the Executive showed themselves capable of acting together to access those deep reserves and create new organizations for mega-projects. This happened before World War II with the Randsell Act to sponsor health research and the creation of the National Cancer Institute in the 1930s; during the war with the Manhattan Project to beat Nazi Germany to the atomic bomb; and after the war with the creation of NASA and the Apollo Project to beat the Soviets to the Moon.

In fact, the sterling exception to the American rule, the most prominent federal agency whose mission is *not* to have a specific government function, was the result of one of those extraordinary consensus moments. Yet, the history of the National Science Foundation, created by legislation after three years of struggle that prompted President Truman‘s veto, reveals potential vulnerabilities in America‘s decentralized, mission accountable system.

The original proposal for a ―National Research Foundation" reflected the views of scientists and the wartime experience of the Office of Scientific Research and Development. The vision was to provide scientists with unprecedented resources through government support in peacetime while preserving their traditional autonomy to explore the unknown. The president‘s veto came on Constitutional grounds, that he could not delegate responsibility for spending congressionally appropriated, taxpayer funds to what was essentially a board of private citizens.[24]

When funding legislation finally passed in 1950, it limited the scope of what became the National Science Foundation. Funding for the new organization was integrated into the federal budget process, where the NSF would compete with mission-oriented priorities—and mission-oriented agencies that would quickly elbow the Foundation from health or defense research.[25] Both the president and Congress kept the program for pure science within the confines of democratic accountability, the president appointing NSF's day-to-day director and members of the National Science Board, all subject to Senate confirmation.

Currently, the National Science Foundation operates on an annual budget of just over six billion dollars. While this is sufficient to support twenty percent of fundamental research at universities and colleges, it is less than ten percent of estimated basic research funding in the United States. A large portion of the remaining amount comes from science organizations with the Executive's functional departments.

The National Aeronautics and Space Administration, though functionally tied to managing the nation's space program, is atypical for its independent status within the executive bureaucracy. Most other federal science sponsors are embedded in cabinet level departments; the Office of Science within the Department of Energy; the National Institutes of Health within the Department of Health and Human Services; the National Institute of Standards and Technology and the National Oceanic and Atmospheric Administration within the Department of Commerce; and the Defense Advanced Research Projects Agency along with research offices of each of the services within the Department of Defense.

Individual science specialists within the government departments control billions of dollars, slices comparable to the entire NSF budget.[26] Although not even this much money protects agencies from occasional funding crises, the capacity to maintain a science establishment that is both decentralized and well-funded across the board speaks to the deep pockets and the unparalleled borrowing power of the U.S. Government.

The key vulnerability in this sprawling enterprise is the sheer number of competing priorities that make it hard for the government to keep its collective eye on the prize, in this case research leadership in areas that are not immediately exploitable for economic or military gain. As successful as the United States has been, performing basic science and applied research to be the pacesetter for other countries during the Information Technology Revolution of the late-twentieth century, the U.S. tendency to convert science into public works projects may delay its rendezvous with the next world shattering technological breakthrough. Perhaps more urgently, a science establishment so thoroughly penetrated by the daily needs of U.S. government operations may not be imaginative or neutral enough to win worldwide respect for U.S. institutions and culture. Such a soft power failure could hollow out American hegemony well before U.S. technological superiority collapses.

Science in the Crucible of a Democratic Power: The Office of Naval Research

In order to see weaknesses in the U.S. scientific position, we have to look beyond the budget figures, impressive by global standards, and examine the relationship between science, state, and society. This language appropriately echoes the Clausewitzian Trinity of military, state, and society to establish a similar claim: beyond things we can count such as numbers of tanks or dollars dedicated to research and development, there are crucial relationships where pathologies can cause severe inefficiencies in performance.

Military, state, and society is a special case of *professions*, state, and society. Dysfunctional relationships within Clausewitz's trinity manifested themselves in war, but we can substitute other professions—financial management, medicine, law, engineering—to expose new vulnerabilities for wasting resources and falling behind other states—in economic growth, provision of health care, dispensing of justice, or quality of physical infrastructure. When we substitute career scientists into the trinity, poor relations with constitutional government or democratic society risk decline in international competition for improved technology. Even more rapidly, poor relations between science, the state, and society can hamper a powerful state's quest for international influence.

Despite the United States' margin in material resources, it cannot afford to have the science trinity out of kilter. The fall of the Berlin Wall and the rise of globalization made the world harder, not easier, to organize. American resources under the circumstances are insufficient for sustaining unipolarity, so relying instead on hegemony, the United States will have to economize how it uses its assets. Making efficient use of the professions is another way of expressing Clausewitz's concern. It properly recognizes in modern guise a central challenge from Plato's *Republic* and ties in directly with scholarly investigations during the past half-century of connections between a state's military effectiveness and its civil-military relations.[27]

In the civil-military relations literature, the bare bones logic for analyzing use of the professions follows a class of mathematical models that describe the principal-agent problem. A principal is at the center of a price transaction with the agent, who provides a useful service. In the case where the agent brings specialized skills, the policy question turns on the principal's chief limitation in this interaction: he cannot easily verify that the agent always behaves in a way to maximize his, that is, the principal's, utility.[28] A common way to ensure that net utilities for a policy manager and an implementer remain aligned is to make the laborer's compensation contingent on compliance with regulatory controls.

Unfortunately, regulation, whether for skilled labor, military officers, or government sponsored scientists, imposes costs of its own. A non-expert administrator must extract enough information to at least improve the chances for an accurate evaluation of the agent's choices. This reporting and monitoring, consumes some of the principal's energy, and it affects the agent's behavior. A wellintentioned agent may hold back, or veer from his best judgment, to account for the principal's apparatus and perform to the regulation rather than the principal's enlightened interest.[29]

Once regulation enters the principal-agent relationship, observers quickly appreciate the value of smart regulation: sparing, flexible rules that cost less to implement because they bank on the professionalism, not just the skill set, of agents. In exchange for autonomy, agents accept a code of honor, an ethical system that girds them against temptation to pursue their own preferences over those of the principal.

Just how much credence is lent to the professional's code depends in democratic settings on a kind of wild card: the condition of three-way interaction between principal and agent on one side and each of their relations with the public. When professionals, for example, military officers, banking officers, or natural scientists, enjoy high public confidence, that esteem shifts the bargain between principal, in this case representatives of the state, and the expert agent. Societal trust reduces costly monitoring and raises autonomy for the profession. If trust is well-placed, the lighter yoke upon the professionals' shoulders makes for a more resourceful, more competitive state in the global system.

The notion that principal-agent bargaining applies to science, not just the profession of arms or government bureaucrats, is supported by recent headlines on the American Reinvestment and Recovery Act.[30] The National Science Foundation, the one federal science agency unencumbered by a parent department or conventional executive tasks, still netted three billion dollars from the act in FY2009, an astounding 50% increase over its normal budget. Yet, how the NSF allocated the additional funds depended on more than the needs of pure science.

The money, as part of a controversial stimulus package approved mainly by Democratic majorities in both houses of Congress, had to be spent quickly. So quickly, in fact, the NSF director would not have time to attract fresh proposals. Rejected proposals still on the rolls from FY2008 were the only ones available to receive the three billion dollars. Moreover, NSF scientific grants from the stimulus money would understandably feature extra reporting requirements, including descriptions of jobs created specifically by the new research activity. Even at the NSF and even when the announced goal of the appropriation was to stimulate scientific discovery that might someday invigorate markets, most likely after a long period of diffusion and reconsideration by still unknown applied researchers and engineers, democratic accountability hovered over the negotiations, constraining scientific autonomy and shaping conclusions about where the three billion dollars could best advance basic research.

ONR as a Prominent Case Study

In lieu of a sprawling history for each agency within the U.S. scientific establishment, the Office of Naval Research (ONR) presents an opportunity to focus on a particularly important case. Granted, ONR is not representative of other federal sponsors in all aspects of the science-state-society relationship, but certain fundamentals are in place. At an annual budget of more than $1.8 billion, it has the resources to seek out and launch careers of promising scientists. As the research arm of a service within the Department of Defense, ONR‘s relationship with universities, corporations, and institutes has been complicated by information security concerns. Compared to civilian agencies such as NIH or NIST, ONR is likely to be an easy case for demonstrating bureaucratic and functional pressures that hamper the government‘s effort to pursue pure science.

On the other hand, if the value of studying the science-state-society trinity is in learning how a democratic science establishment can minimize friction and accommodate inevitable contradictions in order to lead science at the global level, first, the outsize forces at play with ONR will be easier to resolve in a case study. Second, if problems within the science trinity can be ameliorated at ONR, this should lay the groundwork for solutions at other military as well as civilian science agencies.

The connection between ONR‘s scientific work and the Kaysen mechanisms for translating science prowess to national capability could not be clearer. ONR‘s stated mission is to promote the kind of scientific discovery and technological development that will help the U.S. Navy maintain its superiority over competitors. Naval superiority has attracted attention from geopolitical thinkers across the centuries from Thucydides to Alfred T. Mahan as one of the most important attributes supporting a state‘s claim to hegemony. Even after the rise of aviation, nuclear weapons, and information technology, naval power remains a crucial instrument for influencing the international order.[31]

At the same time, ONR features a satellite organization, ONR-Global (ONRG), which in principle addresses the spillover benefits, that is, the soft power aspects, of scientific greatness that offer a necessary complement to hard power in this multi-polar era. ONRG‘s five research centers reconnoiter the entire globe. Staff scientists at each office review their designated region for projects, including basic research at the Defense Department‘s 6.1 level of science and technology, that might one day revolutionize naval operations.

On paper, ONRG has a role not terribly different from that of the great European patrons during the Age of Enlightenment. The global office is to connect scientific genius, perhaps in the person of a young lab director or faculty member toiling in relative obscurity at a foreign institution, to the vast infrastructure of U.S. Science. In exchange for brilliant ideas in natural philosophy, ONRG offers a chance to test vision against reality, to succeed in revising human understanding.

As with aristocratic patronage in the past, ONRG‘s activity stands to benefit mankind, which only enhances the reputation redounding back to the Office of Naval Research and the United States. If we are going to see the spillover effects of science at work—greater trust between science and society, greater appreciation abroad for the scientific leader even when this culture also belongs to the hegemon, and greater willingness to cooperate with U.S. science in transnational communities—we should find them close to ONR and ONRG.[32]

ONR and the Erosion of Scientific Leadership

While the overall trend in current dollar amounts devoted to scientific research is upward, the statistic masks periods of stasis or slight decline of government support in constant dollars.[33] The strength of the numbers also relies on the accountant's definition of basic versus applied research. The nature of these categories can vary over time. As Harvard physicist and science policy advisor Harvey Brooks pointed out during the surge in federal funding for basic research that coincided with President Reagan's Strategic Defense Initiative, context matters. The much larger increases in applied projects and technological development for missile defense would condition—and ultimately limit—the benefits of SDI as science policy.[34]

In principle, it would be possible to channel sponsorship of basic research into the National Science Foundation. Having more independence from functional imperatives that justify the departments of Commerce or Defense, NSF could pursue scientific discovery unburdened by the near-term needs of market consumers or military commanders.

The problem with this strategy is that it would over-centralize the nation's science portfolio. With some success, the U.S. grand strategy for science has been to spread the financing and conduct of research across several mission agencies in the public and private sectors, to encourage a fertile mix of competition and cooperation. The ramshackle mansion discussed earlier seems to handle the uncertainty of science investment better than an authoritative Royal Academy sitting atop a unitary government bureaucracy.

Furthermore, some new ideas for science cross back from the applied or operational realms. The intense interest of Commerce or Defense in transitioning new knowledge of Nature to practical application broadens the establishment perspective on scientific problems. The need for such broadening is evidenced by persistent criticism of the standard peer review process for allocating national science funds and the rising age of first-time recipients for NSF grants.[35] Mission-oriented agencies like ONR have an important role in specifically basic research as complements to a robust National Science Foundation.

Under the intense pressure for mission accomplishment and democratic accountability, can ONR strike an appropriate balance between technological leadership for its operators and scientific leadership for the nation? The question is not completely amenable to social scientific standards of inquiry. Ultimately, the answer comes down to a political judgment. If the President, the Secretary of Defense and the Chief of Naval Operations esteem the Chief of Naval Research, if Congressional committees determine that the service's science and technology budget is about right, then in some sense it must be the case that ONR has found a balance to satisfy diverse stakeholders.

At the same time, social science research on bureaucracies can be used to evaluate the logic of the situation, the incentive structure for the Navy, the Executive Branch, and Congress to resource scientific leadership over the long haul. Reviewing the evidence from congressional testimony, from consulting contracts, and from sample 6.1 projects at ONR and ONR-Global, the accountability challenge begins to take shape. Basic research is still funded at government shops like ONR but under constraints that make it hard to produce revolutionary discoveries of the kind that first bestowed scientific leadership on the United States after World War II.

What is more, the constraints are a special case of a deeper principal-agent dilemma faced by democracies. Elected representatives must think twice before delegating power over social choice to unelected experts. Where expertise is required, politicians will want to keep close tabs on their agents. This should be especially true in circumstances of rapid change such as a revolution in military affairs or the creation of a new field for scientific research. Overly cautious restrictions on autonomy impose inefficiencies. They slow national progress, opening opportunities for other states to catch the leader in a key economic or military sector and prompt another power cycle in international affairs.

In the case of ONR, its basic research portfolio struggles to hold the attention of Congress. Typically, 6.1 research is discussed in the context of a subcommittee within the Armed Services Committee in the House or Senate.[36] The *lingua franca* in such settings emphasizes technology and capabilities that exploit previous scientific discoveries. Unmanned Aerial Vehicles, helicopter survivability equipment, and jammers to defeat improvised explosive devices (IEDs) in Iraq are terms that committee members can easily appropriate for budget battles on the floor or for convincing the public that taxpayer science and technology dollars are being well spent.[37] From the standpoint of protecting national scientific leadership—the capacity to stimulate revolutionary discoveries about the workings of Nature—the current system for budget justification has several problems. Research and Development managers can trace today's astonishing technologies back to fundamental knowledge about Nature, but at the time of public investment to solve a *scientific* problem, no one can say where the answer will lead before a new theory of Nature has emerged. Lasers are still touted as a revolutionary technological development stemming from Navy sponsored basic research. Yet, as Charles Townes recounted in his commemorative speech at the fortieth anniversary of ONR, the Navy had something very different in mind than the targeting, cutting, and telecommunications applications it eventually received when it funded Townes' research on microwaves.[38]

The path between stimulated emissions of gas atoms and future naval capabilities has been long and serendipitous. Many other scientists and organizations, including the Air Force, contributed, making it farcical to speak of a precise rate of return on the Navy's down payment in 6.1 research. Yes, the initial bet on Townes was important, but so were many other decisions taken before and after by entities beyond ONR's control.

When testifying before Congressional subcommittees, the Department of Defense's science and technology managers do not want to be seen as wagering taxpayer money on an individual scientist, especially if he has free rein to follow where Nature's surprises take him. Far more persuasive in the public spotlight is a bet on a program, a new Manhattan Project, with a concrete, preferably weapons-related goal front and center.

Rear Admiral Jay Cohen served as Chief of Naval Research during the period of a growing insurgency and rising U.S. troop deaths in Iraq. In appearances before Armed Services subcommittees, he explained the value of basic research as the first step in an integrated Science and Technology enterprise. Cohen advocated an irresistible proposition in the hothouse environment of post-invasion Iraq: implement Navy Secretary Gordon England's vision for a modern day Manhattan Project to ―detect, defeat, and destroy explosives at range."[39]

That sounded suspiciously like a Future Naval Capability driving 6.3 advanced technology development—well downstream from scientific discovery. Cohen did elaborate that Manhattan II's success would depend on harvesting new knowledge from sustained and unfettered basic research. Defeating improvised explosive devices (IEDs) would mean getting the phenomenology right, and explaining new phenomena would involve advances for pure science: chemistry and physics with contributions from the National Academy of Sciences and the National Science Foundation.[40]

Cohen's conception of basic research in his written testimony aligned with the notion of national scientific leadership discussed here, emphasizing the discovery and understanding of new phenomena through disciplines of inquiry such as ocean sciences, materials, physics, chemistry, and mathematics. However, this kernel of basic research was invariably wrapped in technological themes such as Information Superiority and Platform Mobility of interest to the Fleet. In ONR parlance, the discovery of 6.1 often appears with the invention of 6.2, as in the oft-quoted statistic that 40% of the Navy's nearly two billion dollar S&T portfolio addresses long-term issues under the rubric of Discovery and Invention.[41]

This large figure masks the amount within the 6.1 portion of the D&I account actually resourcing American scientific leadership. Not all the services express their 6.1 investment in these terms. The United States Air Force has a dedicated organization, the Air Force Office of Scientific Research (AFOSR), albeit within the technologically oriented Air Force Research Laboratory, to manage 6.1 investment.[42]

Somewhat surprisingly, bracketing basic research under a separate institution has not led the Air Force to protect either its top-line S&T budget (6.1 through 6.3) or the 6.1 component. Following post-

Cold War defense cuts, Congress called out the Air Force for allowing its S&T budget to lapse in favor of continued acquisition.[43] Even when the S&T top line recovered during the years after 9/11, knowledgeable critics still argued that 6.1 was losing out to 6.2 and 6.3 shares of S&T investment. In the case of the Air Force, designating a corporate defender, AFOSR, for basic research identified a vulnerable target for other resource-hungry agencies that enjoyed greater credibility with operators at the top of the organization.[44]

With ONR's approach, applied efforts flank and protect basic research. Navy stakeholders outside the Discovery and Invention funding line have a harder time justifying attacks on a thick category encompassing both 6.1 and 6.2. From the perspective of bureaucratic gamesmanship, the boundary between the behavior of Nature and natural behavior in an operational context is not always clear. 6.2 generally receives more funding than 6.1, and applied research is easier to advocate than pure science when American forces are engaged overseas and the people's representatives are clamoring for faster transition times between the laboratory and the battlefield.[45]

Nevertheless, without a sole manager, 6.1 can still get lost in the shuffle. During a hearing in 2005, Chief of Naval Research Cohen responded to a question on fundamental scientific research from the subcommittee chair. Smaller industrial investments in research were creating an added burden for ONR's 6.1 portfolio, reflecting a drop in American commercial shipbuilding. A shift toward former industrial concerns in naval architecture and marine engineering translated into a move from 6.1 to 6.2 concerns within the Discovery and Invention block.

Admiral Cohen and the chairman went on to discuss re-capitalization of the University Naval Oceanographic Lab Ship fleet. ONR could pool resources with the National Science Foundation but only if it considered the shipbuilding as infrastructure for basic research. Would this financing not deplete 6.1 funds? Cohen acknowledged that although the 6.1 plan made the ships affordable, this was —not the preferred solution."[46] It put ONR in the business of ship contracting and left fewer resources for evaluating and sponsoring research designs to reveal mysteries in Nature, the latter activity holding the key to scientific leadership.

Exchanges between ONR and inquiring Congressional committees in 2005 were typical. They reflected broad, enduring pressure in a system with democratic accountability to envelop 6.1 activity as part of an integrated product development scheme. Such a scheme illustrates for the waiting public, Congress, and combatant commands how scientific research saves lives and contributes to mission accomplishment in places like Afghanistan and Iraq.[47]

The re-contextualizing of 6.1 for wartime budgeting is not innocuous, however. Defining 6.1 in terms of long-term capability privileges product development over a holistic view of basic research as the —elixir of civilization," Man grappling with Nature rather than the political ploys of other men.[48] Singleminded pursuit of superior technology, euphemistically billed as goal-oriented research at the behest of operators distracts from superior phenomenology. It blocks young researchers from challenging conventional wisdom, going back to the drawing board and redefining the problem, asking the right questions to explore Nature‘s vault.

As the product development mentality takes hold of basic research budgets in mission agencies across the government, within DOD and beyond, it becomes more difficult for the nation to maintain its pioneering spirit and the list of accomplishments opening new vistas in science. There appears at the international level an open window for other states, states smaller in terms of their research capital but bolder in their philosophy, to walk through and capture the title of scientific leadership—even from a liberal-democratic incumbent.

Role of ONRG

The Office of Naval Research-Global enjoys advantages for resisting democratic pressures and striking the right balance between mission-oriented technology development and pioneering basic research. ONRG‘s staff in London has been working this area as long as ONR, in some sense longer since British and American naval officials began dismantling barriers to science and technology collaboration before U.S. entry into World War II.[49]

In the gap between the end of the war and the build-up of the National Science Foundation during the 1950s, ONR actually led government sponsorship of scientific research.[50] ONRG was then known as the Office of the Assistant Naval Attaché for Research in London. Once under the auspices of ONR, this small office organized research reconnaissance trips by German émigré scientists during 1947-48. Included among the rapporteurs was Hans Bethe, a senior theoretical physicist on the Manhattan Project who would go on to chair nuclear test ban reports for Eisenhower‘s Presidential Science Advisory Committee and win the 1967 Nobel Prize for physics.

The thrust of the London Office reports, including those endorsed by Chief of Naval Research Thorwald Solberg, advocated more aid for basic research in Germany. In his cover letter to London‘s August 1948 report on the ―Rehabilitation of Science in Europe," the long-time U.S. Navy engineer wrote, ―due regard should be given to the fact that a healthy industrial recovery and recovery of adequate standards of education, health and general welfare may not be secured and maintained without sound and stable conditions with respect to science, both in research and education."[51] Solberg‘s letter reinforced the early vision of Captain Robert Conrad, the first Planning Director and contracts officer for ONR. Conrad understood the importance of science and technology investment for future naval capabilities, but in public, with one ear cocked for the reaction of civilian scientists at the universities, he championed Navy sponsorship of unfettered basic research for the progress of science in general and for the future of civilization in the nuclear age.[52]

MIT political scientist and ONR historian Harvey Sapolsky reckoned —there was hardly an aspect of the scientific enterprise in America in which ONR was not centrally and constructively involved during the period between the Second World War and the Korean War."[53] Yet, he also warned that, forty-five years later, ONR's commitment to remain a world class patron of fundamental scientific research was faltering.[54] Successive waves of what amounted to democratic assertion compelled ONR officers to exaggerate the immediacy of connections between funded projects in basic research and improved technologies for the Fleet.

ONRG, by contrast, enjoys certain advantages in this modern climate, now ravenous for new products and impressive cost-benefit ratios in the annual reports. These advantages include its small size and the geographic separation from Washington. Personnel in the London Office number less than fifty, and the contract, or program, directors are civilian. The Navy, if it chose, could present an entirely academic face to international science, dedicated to unclassified exploration of the physical laws of nature. This would replicate the Science Branch from Conrad's old Planning Division in each of the ONR's satellite offices, in places such as London, Tokyo, and Santiago (Chile).

Interestingly, the Air Force has approximated this ideal with the European Office for Aerospace Research and Development (EAORD), which represents the overseas headquarters for the Air Force Office of Scientific Research (AFOSR), the service's single sponsor for projects in 6.1. As previously mentioned though, AFOSR and EAORD's identification with 6.1 has not always protected them from budgetary depredations by other Air Force agencies. ONRG, possibly with this example in mind, has followed the modern ONR in rejecting a dedicated scientific branch. ONRG's scientific associates in London are tasked to scout both basic and applied research within their region of responsibility.

Small size—about 1% of the $2 billion Navy S&T budget—transoceanic distances, and blending with applied research insulate ONRG from pressures for democratic accountability and the prying eyes of Congressional subcommittees. However, ONRG still does not enjoy the autonomy its parent organization explored in the late-1940s. Oversight in the public interest for the case of ONRG falls to the Chief of Naval Research and a Naval Corporate Board that includes deputies of the Navy Secretary and the Chief of Naval Operations; these senior officials do surface in Congressional hearings and must hitch their fates to the good opinion of the Fleet, the operational masters of the Navy.

The Fleet, being directly responsible for the sailors, submariners, aviators, and marines deployed across the globe, is hardly a less demanding taskmaster than Congress. Even in London or Tokyo, integration of science and technology programs pushes 6.1 to be more like 6.2 rather than the other way around. What is more, the Fleet pays close attention to military relations with other countries. There is always a chance for basic research contracting to find itself drafted in the service of —military diplomacy."

While diplomatic relationships are vital for the Navy and the nation, they come at a cost if a scientific specialist abandons his area of expertise to create geopolitically astute regional profiles for general science and technology. Pursuing politically rewarding projects in South Africa, for example, requires a different skill set from detecting state-of-the-art particle physics research in the Western Hemisphere. The human networks and the appropriate conceptual vocabulary do not overlap sufficiently, so an ONRG university scientist will inevitably drop the pure science trail in order to smooth the way for diplomacy, or country-by-country engagement. Captain Conrad‘s alternative in 1946 would have let particle physics do the initial talking so that countries of interest would end lined up to engage U.S. science.

Benefits of diplomacy accrue in the short term.[55] Contracts for 6.1 funds typically last for just three years with an option to renew. Political good will, while it lasts, adheres closely to the sponsored labs. Other sectors of the foreign economy, bureaucratic competitors within the receiving government, and most important, other governments in the region notice if U.S. scientific agencies are cooking the books—U.S. votes of confidence and financial support are not flowing toward the best science. ONRG or whatever other research organization must suffer a loss in reputation as it becomes clear they actually cannot nurture path-breaking, Nobel quality work across the sub-disciplines, regardless of where it emerges. In the long run, American scientists doling out political favors in the guise of furthering fundamental knowledge—right under the noses of other science ministries and foreign universities—compromises the integrity of America‘s science enterprise and provides further occasion to question U.S. scientific leadership.

Responding to U.S. Science: The Case of Brazil

Based on how U.S. constitutional democracy is structured, we should observe a recurring tension between society‘s desire to benefit from professional expertise and its demand for accountability. In the U.S. case, scientific advice and scientific research sponsored by the state have been articulated across mission-oriented agencies serving an urgent governmental function—defense, commerce, health, agriculture. With few exceptions, even the National Science Foundation is not entirely immune, research sponsors and laboratories within the U.S. Government feel enormous pressure. Operational branches of the Executive agencies, massive in terms of budget and personnel compared to R&D, as well as Congressional representatives on key authorizing committees, push U.S. Science to be technologically relevant. In the language of the Defense Department‘s framework, there is a steep downhill slope running from 6.1 (basic research) to 6.2 (applied research).

We have seen evidence of the tendency to slip away from pure science sponsorship in the budget hearings of Congressional committees on Science and Technology and Armed Services, as well as the evolution of the nation's first post-World War II science agency—the Office of Naval Research—away from basic research. The question remains whether democratic pressure to harvest superior technology, to the point of neglecting what one chair of the Projection Forces Subcommittee, House Armed Services called the seed corn of innovation, levies costs on U.S. foreign policy serious enough to hamper the superpower's bid for sustainable hegemony.

In this regard, Brazil provides an interesting case study. While no single country can constitute a representative sample that would reveal an average score for how well the United States leverages scientific leadership to sustain international hegemony, successes and challenges of the Brazil case tell about the likelihood that the United States can optimize its resources and maintain its leadership role in other regions of the world.[56] Indeed, the scientific and diplomatic relationships with Brazil illustrate why U.S. statesmen are fighting an uphill battle to found a second American Century.

By customary measures, Brazil is a standout power in its region. Fifth in the world by territory and population, ninth in the world by GDP as of 2008, the South American giant is generally recognized along with Russia, India, and China—the so-called BRIC countries—as a regional leader with the potential to tip the scales on global issues. At once, it pursues integration in South America through MEROCSUR and UNASUR while trumpeting its unique qualifications compared to the rest of Latin America for a seat on the United Nations Security Council.[57]

If U.S. scientific leadership does not register here, predisposing the countries for constructive diplomatic relations, the United States will have to play catch-up with many smaller actors in the region in order to leverage scientific achievements for greater international influence. On the other hand, if science and diplomacy proceed apace with Brazil, other countries will be anxious to initiate joint research with U.S. Science for fear of being left behind.

Compared to some other regions—Europe, East Asia, and the Middle East—Latin America struggles to attract sustained attention from world powers. Sophisticated exports and military potential from the region are relatively low. Top priorities on the global agenda from a Latin American perspective—access to commodity demand in North America and Europe; immigration laws; and anti-drug trafficking enforcement—do not match those on the U.S. list. Terrorism, nuclear proliferation, and energy supplies are still important matters in Latin America, but with a finite foreign policy budget, the United States has first addressed these concerns outside the hemisphere.[58]

The paucity of hard power resources the United States can mobilize at present for influencing Latin America creates a vacuum where soft power, or what I have been calling spillover, can be easily observed. Brazilian science made great strides in the twentieth century, and it is not difficult to find U.S. sponsors who consider Brazil to have the most advanced science establishment in Latin America. The Kaysen argument connecting science to economic growth and military advances in great powers also applies to Brazil. Yet, continuing inequality, corruption, and fragility in the finances of certain industrial sectors lead some analysts to speak of two Brazils.[59]

Within a single country, then, U.S. science has the opportunity to engage highly developed as well as emergent partners. While Brazil's response to science in the international arena will not mimic that of China, France, Japan, the Czech Republic, India, or South Africa, there are aspects of this multifaceted case likely to carry over in other contexts and other relationships.

Receiving U.S. Scientific Bounty

How well has leading U.S. science been received in a bellwether country like Brazil? Do we observe the spillover mechanisms expected when linkages between scientific advance and rising international influence are operating at highest efficiency? In fact the United States has only partially rationalized its governmental bureaucracy to engage Brazilian science and leverage any successes there for better cooperation in matters of high politics. The cultural attraction for Brazilian elites attributable to U.S. Science is rather modest. While the United States supplies leaders to transnational groups and epistemic communities that include Brazilian researchers and help shape Brazilian policy toward the international community, input from nongovernmental experts is politely tolerated, not especially sought or treasured.

Along all lines of action—U.S. administration, cultural outreach, and transnational organization—the United States could be performing better, in terms of its science and more so its diplomacy. One hindrance is its constitutionally ingrained habit of breaking up basic research and tying the fragments to wide-ranging mission agencies, which are desperate to deliver not the next great natural discoveries but today's technological applications.

Brazilian Disposition

As the United States reaches out to engage the world and make the case that it should have a leading voice, a benign hegemony rather than an empire, to organize cooperation in the face of global challenges, each target of influence, or potential partner, comprises a unique case. Some principles of diplomacy and power politics apply across regions, but at the same time, successful American leadership will depend on the hegemon's capacity to tailor its approach, to make each partner feel special by granting it unique attention.

Brazil has its own history of national science, with a particular set of advantages and challenges conditioning relations with American researchers and the U.S. Government. For example, Brazil combines impressive science establishments, advanced technology centers, and a demanding development agenda. Multiple Brazils coexist in part because inconsistent national infrastructure, centralized government institutions, and long-standing social inequality disturb the circulation of knowledge within the country.

Among the advantages Brazil possesses for engaging world powers on a scientific dimension is a cadre of well-trained scientists dating back to the transition from constitutional monarchy to a republic in the late-nineteenth century. By the 1920s, elite scientists in biology and medicine, later joined by physics, chemistry, and mathematics, formed a National Academy with close connections to the government through the federally sponsored universities.[60]

A couple of decades later, with Brazil in the midst of rapid industrialization, a second organization formed, the Brazilian Society for Scientific Progress (SBPC) with the intention of offering more democratic representation of scientific interests throughout the nation. Some leading scientists participated in both the Academy and the Society, but SBPC also attracted non-scientists concerned about the ways in which the progress of research would affect ordinary Brazilians.[61]

At the time of the military coup in 1964, SBPC‗s outreach to workers and ordinary civilians might have led it to resist the junta‗s authoritarian program for national renewal. In the event, however, SBPC cooperated with the military government, reaffirming the national authorities‗ dominant role in organizing and sponsoring Brazilian science, a role that traced its history from Dom Pedro II in the nineteenth century and his desire to nourish Brazilian high culture independent of Europe.

Today, the Brazilian science establishment features private universities with sufficient resources to lure talent from the Brazilian federal and state systems. There are also programs to encourage research and development for accelerated innovation in independent firms, including small businesses. Yet, in comparison with the United States, the funding streams are far smaller, and their sources more concentrated in a single agency, Brazil‗s Ministry of Science and Technology (MCT).

The two main funding agencies for fellowships (the National Council for Scientific and Technological Development—CNPq) and project financing (Studies and Projects Financing Agency—FINEP) spent approximately R$ 3 billion in 2007, about half the budget for the United States‗ National Science Foundation, with NSF funding set to grow under the Obama administration.[62] While the National Science Foundation represents only a fraction of Federally sponsored basic research and less than a tenth of all national investment in basic research, Brazil‗s MCT is that country‗s basic research champion: Brazilian industry and higher education are applying to the government rather than anteing in from other sources of revenue.

Moving beyond basic research to the broader category of science and technology, Brazil‗s activities are more diverse. Companies such as Petrobras, the eighth largest oil company in the world by stock evaluation, and Embraer, the fourth largest maker of commercial aircraft, have earned a reputation for beating international competition in high technology niches.[63]

Yet, companies such as these are the exceptions. Brazil‘s export ranking in the world is lower than that for its GDP, and the greater share of goods sold in the global market are commodities—coffee and soy—or manufactures, which do not require a rich scientific foundation for extraction or state-of-the-art technology. Moreover, it is far from clear that Petrobras or Embraer could have achieved their world class status without extraordinary state intervention. The Brazilian Government owns a controlling share of the oil giant, and Embraer was privatized only in 1994.[64] Before then, it was an arm of the Brazilian Air Force. Its offices are still located across from the Defense Ministry‘s technological university, Instituto Tecnológico de Aeronáutica (ITA) within the Comando-Geral de Tecnologia Aerospacial (CTA), outside of São Paulo. The largest metropolitan area of Brazil represents another level of scientific concentration: the state and federal universities of São Paulo (EUSP and UFSP), the federal university of Campinas (UNICAMP), and the Defense Ministry‘s ITA at São Jose dos Campos are all within a radius of sixty miles.

All this poses something of a riddle for any would-be science ambassador from the United States. By comparison, the Brazilian scientific enterprise is centrally directed and funded. The venerable Brazilian Society for Progress in Science (SBPC), over decades of economic development and evolution toward a stable democracy, represented preoccupations of ordinary researchers, technicians, and the interested public to the government without threatening essential control of science by the state. A modern day Royal Academy offers a single point of entry for engaging Brazilian Science, which would make things easier for an enlightened hegemon with research cooperation in mind—if the modern version were itself not torn by bureaucratic divisions.

The Brazilian Ministry of Science reports that scientific papers produced in the country are shooting upward, but high-tech exports have not caught up.[65] This may be in part because some of the leading technology and engineering institutes in Brazil are on the other side of a civil-military gap from basic sciences at the Ministry of Science and Technology. The MCT may wish to accelerate the transition from scientific discovery to a marketable technology, but the ministry must contend with at least two obstacles. The venture capital and small enterprise cultures have not yet taken root in and around Brazil‘s important universities. Professors have little incentive to put their scientific career on hold and risk grant money or loans to develop a new product for sale. Secondly, some of the best applied work to create new technology is being performed under the auspices of the General Command for Aerospace Technology (CTA) or the Military Institute of Engineering (IME), that is, under the watchful eyes of the Ministry of Defense and the Brazilian armed services.

A fault line between basic and applied science, what the American Defense Department might call a disjuncture between 6.1 and 6.2, runs along the bureaucratic borders separating Brazil‘s MCT and MD. The overlay predisposes Brazil to follow the precedent of India in its approach to scientific aid from the West. John Krige and Kai-Henrik Barth's edited volume on *Global Power Knowledge* (2006) documented how U.S. efforts to share cloud seeding technology and institution-building in the image of the Massachusetts Institute of Technology during the Vietnam era raised suspicions in India. As in contemporary Brazil, officials there raised legitimate concerns that the American gift of science could be a Trojan Horse, hooking the recipient country on a dependent relationship with the technology supplier or stripping the nominal beneficiary of its own scientific and engineering talent as it relocated to more appealing jobs in the United States.[66] With regard to Brazil's desire to close the gap between scientific papers and high-tech exports, expertise from the current hegemon could be useful. Unfortunately, a good portion of that experience in applied research falls under the American Department of Defense. Even a relatively autonomous agency like the U.S. Office of Naval Research Global, well-versed in 6.1 and 6.2 research world-wide, and well-positioned to answer the call from Brazil's MCT, cannot walk into the advanced institutions for physics, chemistry, or biology in Brazil without setting off alarm bells at the heart of Brazil's engineering and technology development, within the Ministério da Defesa.

U.S. Institutions: Still Suboptimal

Given the obstacles Brazil presents for U.S. engagement, the United States has not responded in optimal fashion. Brazilian researchers certainly respect and welcome American scientific accomplishments, but government institutions and national culture downplay the notion that the Americans have the lead. Despite the lopsided figures for research and development spending by nation, Brazilian universities aim for a diverse portfolio of joint projects. Work involving American scientists takes place in Brasilia, Rio de Janeiro, and São Paulo, but science and technology centers in those places do not appear anxious to elevate connections with the United States above those in Europe. In at least one case, the university seemed equally if not more concerned with adjusting allocations among South American neighbors.

The language barrier and restrictive visa policies probably discourage some Brazilian scientists and administrators from pursuing scientific resources in the United States, but these nuisances are secondary to a rising sentiment among young Brazilians that they can access technical education and project support elsewhere. They are not primed to seek out the United States, unlike a previous generation at the Brazilian Center for Physics Research (CBPF), famous for prize-winning research and for attracting top foreign physicists, including a young Richard Feynman in 1950[67]

CBPF still has projects with the United States, of course, but often these are based on the personal networks of individual Ph.D.s. What is lacking is the strong gravitational pull one might expect from the mass of world class universities in the United States, Feynman's MIT, Cornell, and Cal Tech, among others plus the network of national laboratories. The science is present in America, but U.S. Government institutions are not recognizing and leveraging this asset to encourage cooperation with scientific counterparts abroad.[68]

The Committee for Science and Technology in the U.S. House of Representatives might counter that while the generalization might hold for developing countries in Latin America, Brazil is an exception, due to the importance the American State Department must accord Brazil's civilian nuclear program.[69] Yet, despite high-level attention to technical cooperation in the nuclear field and a dawning realization that surplus energy production from resource-rich Brazil using non-nuclear fuels will also depend on S&T relations, key U.S. science agencies struggle to solve the Brazil puzzle.

The U.S. National Science Foundation must work within its limited budget—just $3 billion in recent years—and its restrictive mandate. Foreign partners pay their own way. The mission agencies, collectively, have money to spend on basic science, more like $30 billion in 2007, according to the NSF statistical division, and they often have authorization to pay for the best science as long as it helps them fulfill their charter. The National Institute of Health sponsors the Fogarty International Center that includes the development of other countries' science establishments as part of its mission, which makes it very attractive to foreign talent, but the fields of science where it operates are tied to medicine. NIH still covers just a narrow slice of the world scientific enterprise.[70]

Defense science agencies have an interest that ranges across the physical and life sciences, broad like the NSF. Collectively the annual Science and Technology (S&T) investment for these agencies is on the order of $10 billion, and in principle, they can sponsor the best science wherever it is found.[71] Here, where we find perhaps the greatest potential to enlist America's scientific leadership in the cause of an enlightened, sustainable hegemony, the scientific mindset falters. Basic science is not organized or administered by the leading state in an optimal way. This failure raises the possibility for revolutionary change in the international enterprise of natural discovery, and eventually in the power distribution among nations.

The trajectory of the U.S. Office of Naval Research (ONR) away from pure science and the trouble ONR has had in the past few years engaging the Brazilian science establishment illustrate a Tocquevillian tension between democratic accountability and scientific greatness on behalf of the State. In the course of surveying nineteenth century America, the French diplomat incisively showed how love of equality—even in a society inspired by freedom extolled in the Declaration of Independence—could be enemy to the good. Moreover, accountability through elections or public opinion could act as a scythe, cutting down the best and brightest in the name of equality among men.[72]

In a sense, democracy caught up to ONR. Had ONR's first Director of Plans, Captain Robert Conrad, managed today's level of resources, including global affiliates in every major region of the world, ONR would likely have been sponsoring science and technology in Brazil long before nuclear reactors, biodiversity in the Amazon, or petroleum in the pre-salt layer off Brazil's coast complicated matters. After all, Richard Feynman, before visiting CBPF-Rio, worked for Army General Leslie Groves. Despite his detour through applied research for the Manhattan Project, in 1950 Feynman was still one of the best young physicists in the world. That opened doors in Rio, and it set an example for Navy leadership at ONR.[73]

Yet, ONR and its global affiliates have not been able to sustain Conrad's vision, nor have they maintained quite the same connections to American scientists at the universities on the leading edge of discovery. Imperatives of democratic accountability whittled away at ONR's reputation. Applied and technological concerns of the Navy weigh down basic research, inevitably justified to Congress as investment in long-term naval capabilities rather than new knowledge for the progress of civilization. Chiefs of Naval Research labor before Congress to carve out space in the Federal personnel system to hire the best talent.

In general, the Department of Defense science and technology sponsors do not have the same access to the Richard Feynmans, the world's elite scientists, they once enjoyed. This has, in turn, hampered DoD's scientific reconnaissance in significant countries like Brazil. Though the United States has civilian science agencies erecting fewer diplomatic or cultural barriers, these cannot compensate for DoD's global reach, in particular the resources Defense can bring to bear on the challenges of international scientific cooperation.

Consequences for Cultural Attraction and Epistemic Influence

Understandable pressures related to democratic accountability for U.S. Executive Branch agencies have placed a tight-fitting collar on sponsored research. It would be unfair to call it a stranglehold: the Federal Government enables more than it distorts pure research, and the American science establishment remains respected throughout the world. Yet, the interference does perturb how the best of American science engages the rest of the world. Since the technology for sophisticated experiments is diffusing over time and since foreign scientists find it increasingly feasible to travel and collaborate internationally, in the long run, U.S. missteps with regard to science as a cosmopolitan enterprise could jeopardize the scientific lead.[74] In the shorter term, U.S. neglect or ham-fisted outreach to scientists abroad diminish positive spill-over from American scientific achievement to influence in international affairs.

Returning to the bilateral relationship between the United States and Brazil, several items on the agenda inspire only modest levels of confidence and trust, even though the bargaining involves high quotients of scientific and technical information. On issue after issue—trade, alternative fuels, oil, climate change, U.S. military operations in Latin America, or the global financial crisis—Brazil demurs on the notion that American power heralds a civilizing hegemony that lifts up the rest of the world.

Instead, Brazil maintains important preferences at odds with U.S. priorities. In this relationship, soft power—combining the gentle currents of legitimacy and cultural attraction—has a lot of work to do.

At the Summit of the Americas in 2005 and again at the Doha Round of international trade talks in 2008, Brazil was cordial but adamant that whatever world economic growth lower barriers to investment and greater market access in developing countries might achieve, it would not be purchased by the concessions of low-cost agricultural producers in the Global South.[75] Brazil‗s producers of sugar-based ethanol already face anti-competitive import tariffs in order to prop up corn-based suppliers in the United States.[76]

Moreover the United States has not taken the bold steps required to control its appetite for oil such as manufacturing flex engines that could run on ethanol or gasoline, and building alternative energy power plants. Brazil, meanwhile, reached self-sufficiency in oil under President Lula da Silva and figures to become an exporter to the United States on the scale of Venezuela or Mexico, due to recent discoveries in the ocean basins off the coast from Rio de Janeiro. Exploiting those deposits, embedded under a layer of salt deep below the ocean surface, will require technical assistance. Yet, Brazil has not exactly embraced American sources.[77]

President Lula‗s party had discussed preserving remaining fields under the control of Petrobras, offering limited joint production agreements rather than concessions to foreign concerns, even if national control delayed extraction. The group of leading companies poised to offer technical assistance includes just one American marquee name, and Exxon asssets in Brazil are highly dependent on Brazilian legal representation, in particular, before the country‗s national oil regulator.[78] Again, these outcomes betray little of the cultural attractiveness that might reduce bargaining costs or nudge settlements in the direction of the hegemon.

On environmental and climate change issues, Brazil has vigorously defended its sovereign right to utilize its natural resources, including its enormous tropical rainforest, for natural development.[79] Even as Brazil has engaged the international community and foreign-based non-governmental organizations on ways to make the forest productive without clear-cutting or burning it, government representatives point out that Brazil‗s hydroelectric power and sugar-based ethanol are providing relatively clean energy. Also notable, the Brazilian Institute for Space Research (INPE) rather than the larger agencies in Europe or the United States takes responsibility for publishing authoritative data on deforestation.[80]

The two items on the bilateral agenda with greatest immediate effect on U.S. national security are American force projection in the Western Hemisphere and cooperative responses to the global financial crisis. On both issues, Brazil has been a willing interlocutor but hardly eager to follow the U.S. lead. In 2007, the United States reactivated the Fourth Fleet, and in 2009 signed an agreement to operate drug interdiction missions out of bases in Columbia. In these instances, Brazil‗s president legitimized the anti-

American vitriol of Venezuela‘s Hugo Chavez and challenged the United States to be more transparent in its intentions and more restrained in its actions. For rhetorical purposes, Lula has used the Fourth Fleet as justification for greater investment in the Brazilian Navy, including production of a nuclear submarine that was foregone during the Collor de Mello administration of the early 1990s.[81]

At the 2009 summit meeting of the G20 to discuss cooperation between developed and developing nations for stemming the global financial crisis, it was U.S. President Barak Obama caught on tape glad-handing Lula, calling him ―the most popular politician on Earth."[82] England‘s prestigious *Financial Times* marveled at how Brazil‘s middle way, pursuing policies friendly to foreign investors and at the same time permissive of state involvement in the financial sector and strategic industries, was rapidly winning adherents among the world‘s economic powers. Presiding in a large country that was last in and likely to be one of the first ones out of the global recession, Brazil‘s finance minister could address his counterparts in the G20 with growing confidence. Taking a page from Thomas Paine‘s *Common Sense*, Washington may boast the world‘s most powerful military and claim to provide a civilizing influence in an otherwise chaotic world, but it is illogical, if Brazilian policy is any indication, for a distant capital to dominate a continent-sized nation across vast stretches of the Caribbean and Atlantic.

Paine was writing of imperial rule rather than leadership by persuasion and negotiation, certainly a lighter burden on the U.S. treasury but still a difficult proposition for measuring costs and benefits. No one can say how much U.S. leadership or positive influence with a key country like Brazil would improve if America‘s scientists were unleashed to pursue their investigations of Nature in full collaboration with research elites around the world. In the area of international science, the U.S. Government has it in its power to set the truth free, but it faces a problem not unlike the fictional Lilliput‘s in deciding whether to untie Gulliver. No doubt there is great potential for winning influence over other nations, but once that potential is released, who or what influences Gulliver?

Regarding America‘s best scientists, there is a fair chance that genuine curiosity and immortal glory motivate their extraordinary achievements. Given greater autonomy, most could be counted on to utilize that freedom to more vigorously pursue their research rather than hoodwink the state or betray its people. As these state-sponsored scientific agents foraged abroad for unique data or expertise, they would in the course of their professional activities develop cooperative relationships with intellectual elites that could pave the way for broader cultural accommodation and a greater willingness to trust the United States—despite its superior resources—when it came time to settle conflicts of interest.

Of course, granting scientists a high degree of independence raises concerns. The bilateral agenda with Brazil, for example, consists of issues that have global scope and present obvious opportunities for scientific and technically charged *advocacy*. Just like the case with civil-military relations, responsible politicians cannot readily separate the expertise of unelected professionals from policy debates over the public interest.

Energy, climate change, military posture, and financial security all involve physical or social systems that touch on questions of science. Not just national advisory councils but transnational epistemic communities have grown around each one of these policy dialogues. In the case of independent-minded Brazil, councils at the federal and local level have demonstrated their capacity to accept technical arguments on sensitive issues like protection of the Amazon rainforest. In 2009, non-governmental organizations, a primary channel of influence for transnational epistemic communities, participated in the Brazilian debate over Provisional Measure 458, national legislation that would revise and expand private property rights in the forest.[83]

Evidence that powerful countries with capacity to upset U.S. plans and enervate American leadership pay attention to scientific and technical advice does not guarantee they will always listen or that epistemic communities will inevitably line up alongside the U.S. Government during international negotiations. Still, an international jury of scientific peers, that is, an epistemic community not any government, decides which nation has the scientific lead. If scientific members of these communities hope to maintain their credibility in forums where officials defend competing national interests, these professionals, even if they are not yet cosmopolitan citizens of the world, must hew close to their evidence and the laws of Nature.

Given the negative alternatives of no credible epistemic communities or communities dominated by a foreign scientific establishment, there is a case for the U.S. Government to allow its funded scientists a free hand, so they can respond to incentives beyond government operations when designing basic research. Professional autonomy is likely to be the best way to ensure American education, professional training, and cultural values claim several seats at the table as transnational epistemic communities form. American policy makers, if they wish to court legitimacy and collect the highest diplomatic return on U.S. provision of public goods, will in turn take note when these epistemic communities announce their findings.

Conclusion: Science and Democracy

As this article is being written, the United States is in a soul-searching mood. A new president and Congress lead a nation-wide review of American foreign policy, in particular questioning U.S. commitments in Iraq and Afghanistan. At the same time, budget deficits are growing, iconic American businesses are struggling, and unemployment for the first time in a quarter century approaches double digits.

On the one hand, leaders of both political parties in the United States recognize the traditional links between scientific progress and international leadership. The President has found broad support in an era of tight budgets for research that can prompt technological development for ground units of the Army or Marines scrambling to solve counterinsurgency problems or for U.S. carmakers urgently redesigning their products in a volatile global market. With respect to its military crisis and its economic crisis, the most powerful nation-state reserves space in its accounts for science to help innovate its way out.

Less appreciated is how scientific progress facilitates diplomatic strategy in the long run, how it contributes to Joseph Nye‘s soft power, which translates to staying power in the international arena. One possible escape from the geopolitical forces depicted in Thucydides‘ history for all time is for the current hegemon to maintain its lead in science, conceived as a national program and as an enterprise belonging to all mankind.

Beyond the new technologies for projecting military or economic power, the scientific ethos conditions the hegemon‘s approach to social-political problems. It effects how the leader organizes itself and other states to address well-springs of discontent—material inequity, religious or ethnic oppression, and environmental degradation. The scientific mantle attracts others‘ admiration, which softens or at least complicates other societies‘ resentment of power disparity. Finally, for certain global problems—nuclear proliferation, climate change, and financial crisis—the scientific lead ensures robust representation in transnational epistemic communities that can shepherd intergovernmental negotiations onto a conservative, or secular, path in terms of preserving international order.

In today‘s order, U.S. hegemony is yet in doubt even though military and economic indicators confirm its status as the world‘s lone superpower. America possesses the material wherewithal to maintain its lead in the sciences, but it also desires to bear the standard for freedom and democracy. Unfortunately, patronage of basic science does not automatically flourish with liberal democracy.

The free market and the mass public impose demands on science that tend to move research out of the basic and into applied realms. Absent the lead in basic discovery, no country can hope to pioneer humanity‘s quest to know Nature. There is a real danger U.S. state and society could permanently confuse sponsorship of technology with patronage of science, thereby delivering a self-inflicted blow to U.S. leadership among nations.

Perhaps all these observations reflect Thucydides‘ cycle—the rise and fall of great powers—and nothing can be done. Yet, such pessimism ignores the successful record of the United States in negotiating comparable dilemmas, notably the contradiction between *capitalism*, an economic system that concentrates wealth, and *democracy*, a political system that diffuses the vote.

Fareed Zakaria, editor at *Newsweek* magazine and author of rare books that travel across highbrow international relations theory and popular culture, offered some room for maneuver when he characterized the current crisis in capitalism as a crisis in professions for American democracy.[84] Adam Smith's *laissez-faire* market could not survive without Adam Smith's theory of moral sentiments. Today's sophisticated global economy will not create wealth without professions that are both technically competent and socially conscious.

A growing literature in American politics applies principal-agent dynamics to explain how democracies respond to policy challenges demanding technical expertise.[85] Typically, the agents are professionals responsible for conveying expert knowledge to politician principals representing the public interest. Whether the professionals are military officers, intelligence agents, or diplomats, American democracy faces a dilemma of control.

Too much monitoring or intervention politicizes the agents, binds them from speaking truth to power and guts their value as expert professionals. Too little direct involvement means the experts can use their information advantage to manipulate the principal: technocracy replaces government by the people.

The social science literature recognizes that the best practical solution is somewhere in between, and anticipating Zakaria, that the dilemma is less acute if the professionals develop Adam Smith's moral sentiments, that is, if the expert advisers see themselves as officers with a stake in the larger system. The more seriously professionals take this moral code to serve the principal and not game the system by exploiting asymmetric knowledge for their individual benefit, the more autonomy they can be granted, and the more the republic can gain from expertise in military affairs, intelligence analysis, or economic strategy.

Particularly after the U.S. government's dramatic expansion of patronage for science through the Office of Naval Research in 1946, science is home to one of those professions vital for maintaining national power and position in the international system. Furthermore, a familiar principal-agent dilemma confounds democratic attempts to strike the balance between technocratic virtuosity and public accountability.[86] At present, the difficulties mission-oriented bureaucracies like ONR have in detecting and nurturing Nobel quality work in the basic sciences suggest that democratic constraints are set too tight. To regain the reputation abroad for outstanding American Science, government sponsors will have to grant scientists more autonomy at home, especially in the field of basic research.

Program directors and scientist beneficiaries at university will garner more freedom from politicians and policymakers if they can embrace a professional ethos both patriotic and moral. If these professionals internalize social benefits to science, to mankind, and to America's international influence from fulfilling the public trust, American democracy can scale back its regulations. It can also subdue debilitating demands for timely material results without fretting over the loyalty of experts serving on the remote frontiers of science.

Congress should set aside a percentage of executive agency budgets, not just for *Science & Technology* or *Research & Development* as broad categories, but for basic research, what Defense calls 6.1 in particular. Politicians understandably worry that with fewer strings attached to this money, science experts will unavoidably have greater temptation to defraud the public or substitute their preferences for those of political masters in the mission agencies. Nevertheless, more progress reports, more assessment rubrics, and tighter integration with technology demands increase accountability only at the cost of enervating the national effort to expand the frontiers of knowledge. Zakaria had it correct: in the long run no system, certainly no democracy, can retain the lead internationally in scientific, economic, or political development if its professionals will not hew to duty, especially when no one is looking.

Endnotes

[1] Robert Gilpin, *France in the Age of the Scientific State* (Princeton, NJ: Princeton University Press, 1968), p. 58.

[2] George Modelski and William Thompson, *Leading Sectors and World Powers: The Coevolution of Global Economics and Politics* (Columbia, SC: University of South Carolina Press, 1995).

[3] Zbigniew Brzezinski, Brent Scowcroft, and David Ignatius, *America and the World: Conversations on the Future of American Foreign Policy* (NY: Basic Books, 2008).

[4] Joseph Nye, Jr., *Soft Power: The Means to Success in World Politics* (NY: Public Affairs, 2005).

[5] Stephen Walt, ―Alliance Formation and the Balance of World Power," *International Security* Vol. 9, No. 4 (Spring 1985): 3-43.

[6] Peter Haas, ―Special Issue on Epistemic Communities," *International Organization* Vol. 46, No. 1 (Winter 1992): *passim*; Matthew Evangelista, ―The Paradox of State Strength: Transnational Relations, Domestic Structures, and Security Policy in Russia and the Soviet Union," *International Organization* Vol. 49, No. 1 (Winter 1995): 1-38; Jeffrey Knopf, *Domestic Society and International Cooperation: The Impact of Protest on U.S. Arms Control Policy* (Cambridge, UK: Cambridge University Press, 1998); Emanuel Adler, *Communitarian International Relations: The Epistemic Foundations of International Relations* (London, UK: Routledge, 2005); Elizabeth Hanson, *The Information Revolution and World Politics* (Lanham, MD: Rowman & Littlefield, 2008).

[7] Science advice in domestic and international affairs is the subject of Roger Pielke, Jr., *The Honest Broker: Making Sense of Science Policy and Politics* (Cambridge, UK: Cambridge University Press, 2007). The transition between the Bush and Obama administrations renewed interest in principles of scientific participation in politically charged policy debates, global warming for example, while remaining true to norms of the scientific method and ethics of professional science. Barak Obama, ―Remarks of the President –Elect Barak Obama, Science Team Rollout Radio Address," Chicago, IL, December 17, 2008, available at http://change.gov/newsroom/entry/the_search_for_knowledge_truth_and_a_greater_understanding_of_the_world_aro/ <<June 29, 2009>>; Angelo Codevilla, ―Scientific Pretense v. Democracy," *The American Spectator* Online (April 2009): http://spectator.org/archives/weekly/2009-04-12 <<June 30, 2009>>.

[8] These benefits were emphasized by Fareed Zakaria explaining America's staying power atop the international hierarchy in Fareed Zakaria, *The Post-American World* (NY: Norton & Co., 2008). For the perspective emphasized here, see Donald Braden, *Scientific Freedom: The Elixir of Civilization* (Malden, MA: Wiley-Interscience, 2008).

[9] Brzezinski, Scowcroft, and Ignatius (2008); Joseph Nye, Jr., *The Powers to Lead* (Oxford, UK: Oxford University Press, 2008); Zakaria (2008). Leslie Gelb took pride in reviving Machiavelli, but even in Gelb's scheme, there is

still room for persuasion because the United States does not possess sufficient resources to coerce all the other powers. Leslie Gelb, *Power Rules: How Common Sense Can Rescue American Foreign Policy* (NY: Harper, 2009).

[10] Such confusion is a core theme from science fiction literature, usually with horrific consequences. Classic examples from the nineteenth century include the novels, Frankenstein, by Mary Shelley (1831), and *The Island of Dr. Moreau*, by H.G. Wells (1896). Hans Morgenthau, a leading voice for international realism in the twentieth century, wrote an extended essay on *Science: Servant or Master?* (NY: W.W. Norton & Co., 1972). In the wake of inhumane Nazi experiments sponsored by the German state, he argued that science was best and properly perceived as both means and an end in itself.

[11] Max Weber, ―Science as Vocation," originally delivered as a speech at Munich University, 1918, republished in H.H. Gerth and C. Wright Mills (trans. and ed.) *From Max Weber: Essays in Sociology* (NY: Oxford University Press, 1946), pp. 129-56.

[12] Samuel Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (Cambridge, MA: Belknap of Harvard University Press, 1957).

[13] Richard Lyman, *Stanford in Turmoil: Campus Unrest, 1966-1972* (Stanford, CA: Stanford University Press, 2009). An excerpt on classified research appeared in *Stanford Magazine* Online (January/February 2009): http://www.stanfordalumni.org/news/magazine/2009/janfeb/features/lyman.html. Edward Teller, ―Science and the Military Mission," speech delivered at the Office of Naval Research Thirtieth Anniversary (1976), appearing in *The Office of Naval Research 50^{th} Anniversary*, available online at www.onr.navy.mil/about/history <<June 30, 2009>>.

[14] Bertrand Russell, ―The Power of Ideas," in Harold and Margaret Sprout, *Foundations of National Power*, 2^{nd} ed. (NY: D. Van Nostrand Co., 1951), pp. 61-64.

[15] Etel Solingen, ed., *Scientists and the State: Domestic Structures and the International Context* (Ann Arbor, MI: University of Michigan Press, 1994), Ch. 1.

[16] This follows James Madison‘s argument in *The Federalist* No. 51 for the double protection of a constitution that provided checks and balances at the national level and autonomy for local affairs within individiual states of the union. Alexander Hamilton, John Jay, and James Madison, *The Federalist*, George Carey and James McClellan, eds., Gideon Edition (Indianapolis, IN: Liberty Fund, 2001).

[17] Paul Cocks, *Science Policy: USA/USSR* Vol. II: *Science Policy in the Soviet Union* (Washington, D.C.: National Science Foundation Division of International Programs, 1980). Loren Graham, *What Have We Learned about Science and Technology from the Russian Experience?* (Stanford, CA: Stanford University Press, 1998).

[18] Christopher Layne, ―The Unipolar Illusion," *International Security* Vol. 17, No. 4 (Spring 1993), reprinted in Michael Brown, Sean Lynn-Jones, and Steven Miller, eds., *The Perils of Anarchy* (Cambridge, MA: MIT Press), pp. 149-50 and n. 81. See also Paul Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500-2000* (NY: Vintage, 1987), pp. 199-203; A.E. Musson, ―British Industrial Growth during the ‗Great Depression' (1873-1896): Some Comments," *The Economic History Review* Vol. 15, No. 3 (1963): 529-33, esp. 531-32. Germany repeated the feat in military science during the 1920s and 1930s, surpassing Britain and France‘s technology for armored operations. Adam Stulberg and Michael Salomone, *Managing Defense Transformation* (Hampshire, UK: Ashgate, 2007).

[19] United States House of Representatives, ―Views of the NIST Nobel Laureates on Science Policy," Hearing before the Subcommittee on Environment, Technology, and Standards, Committee on Science, 109^{th} Congress, Second Session, may 24, 2006, pp. 38-39; Braben (2008).

[20] Lawrence Rausch, Project Officer, *Asia's Rising Science and Technology Strength: Comparative Indicators for Asia, the European Union, and the United States Special Report* NSF-07-319 (Arlington, VA: National Science Foundation, Division of Scientific Resources Statistics, R&D Expenditures, May 2007), available at www.nsf.gov/statistics/nsf07319/content.cfm?pub-id=1874&id=4.

[21] National Science Foundation statistics for 2007 show universities and colleges ($37 billion) performing basic research at a far higher rate than either industry ($9 billion) or the Federal Government ($5 billion). See www.nsf.gov/statistics/nsf08318/pdf/tab2.pdf <<June 29, 2009>>.

[22] Cocks (1980: 305-10).

[23] Today, this is almost certainly a minority view, but one still expressed on occasion in Congress. ―The best way to administer science in my book is to find smart people, give them good resources and ample funds, and not have them worry about any other administrative deals" (Subcommittee Chairman Vernon Ehlers, United States House of Representatives, ―Views of the NIST Nobel Laureates" (2006: 38).

[24] Mazuzan, George, *The National Science Foundation: A Brief History* (Washington D.C.: National Science Foundation, 1994): www.nsf.gov/about/history/nsf50/nsf8816.jsp; William Blanpied, ―Inventing U.S. Science Policy," *Physics Today* Vol. 51, No. 2 (February 1998): 34-40.

[25] Harvey Sapolsky, *Science and the Navy: The History of the Office of Naval Research* (Princeton, NJ: Princeton University Press, 1990), pp. 54-56; Blanpied (1998).

[26] A 1995 Inspector General Audit of the Office of Naval Research focused on $80 million in alleged reserve accounts, said to be five percent of a programs budget totaling $1.6 billion. Rear Admiral William Landay quoted $1.8 billion with $400-500 million in additional funds from Congress in 2006 for basic and applied research. The budget for the National Institutes of Health was around $29 billion in FY2008, and the National Institute for Standards and Technology requested $638 million for FY2009, with about eighty-four percent slotted for basic research. Testimony of Dr. James M. Turner, Acting Director, NIST, U.S. Department of Commerce before the Subcommittee on Technology and Innovation, Committee on Science and Technology, U.S. House of Representatives, March 11, 2008; available at www.nist.gov/testimony/budget.htm <<July 1, 2009>>. Interview with Rear Admiral William E. Landay, Chief of Naval Research on the Sixtieth Anniversary of the Office of Naval Research; available at www.chips.navy.mil/archives/06_Oct/PDF/RADM_Landay.pdf <<July 1, 2009>>.

[27] Huntington (1957); Deborah Avant, *Political Institutions and Military Change: Lessons for Peripheral Wars* (Ithaca, NY: Cornell University Press, 1994); Peter Feaver, *Armed Servants: Agency, Oversight, and Civil-Military Relations* (Harvard University Press, 2003).

[28] Matthew McCubbins and Thomas Schwartz, ―Congressional Oversight Overlooked: Police Patrols versus Fire Alarms," *American Journal of Political Science* Vol. 2 (1984): 165-179; Matthew McCubbins, Roger Noll, and Barry Weingast, ―Administrative Procedures as Instruments of Political Control," *Journal of Law, Economy, and Organization* Vol. 6 (1987): 243-77; Terry Moe, ―The Politics of Bureaucratic Structure," in John Chubb and Pauo Peterson, eds. *Can the Government Govern?* (Washington, D.C.: Brookings, 1989); John Brehm and Scott Gates, *Working, Shirking, and Sabotage: Bureaucratic Response to a Democratic Public* (Ann Arbor, MI: University of Michigan Press, 1997).

[29] David Ignatius, ―Slow Roll Time at Langley," *Washington Post* Online (April 22, 2009): http://www.washingtonpost.com/wp-dyn/content/article/2009/04/21/AR2009042102969.html. Also, see the argument against *post hoc* persecution of CIA officials as interrogation policies tightened during the first months of the Obama administration. Michael Hayden and Michael Mukasey, ―The President ties His Own Hands on Terror," *Wall Street Journal* Online (April 17, 2009): http://online.wsj.com/article/SB123993446103128041.html. Intelligence agents, for example, are aware that regulations can change. If political authorities signal willingness to tighten (or loosen) regulations for partisan advantage, this could affect interrogators, encouraging them to be less aggressive (or more risk acceptant) regardless of what current legal guidelines say.

[30] National Science Foundation, ―NSF Information Related to the American Recovery and Reinvestment Act of 2009," (2009) www.nsf.gov/recovery/ <<June 30, 2009>>.

[31] Robert Kaplan, ―Revenge of Geography" *Foreign Policy* (May/June 2009): www.foreignpolicy.com/story/cms.php?story_id=4862.

[32] The National Institutes of Health also has a robust international presence. Its Fogarty Center sponsors programs to reduce the health gap and promote scientific research in low to middle-income countries. The Kaysen and spillover effects of scientific leadership should be found at NIH as well, so it represents an opportunity for further research. ONR is still justified as a lead case due to its broader portfolio, which includes more projects beyond the life sciences.

[33] National Science Foundation, ―SRS Publications and Data," www.nsf.gov/statistics/showpub.cfm?TopID=8 <<June 30, 2009>>.

34 Harvey Brooks, ―The Strategic Defense Initiative as Science Policy," *International Security* Vol. 11, No. 2 (Autumn 1986): 177-84.

35 Susan Morrissey, ―COVER STORY: Elias A. Zerhouni" (NIH Director), *Chemical and Engineering News* Online (July 3, 2006): http://pubs.acs.org/cen/coverstory/84/8427zerhouni.html; Braben (2008); Douglas Melton, ―Obama's First 100 Days—Research Funding," *Harvard University Gazette* Online (April 29, 2009): http://www.news.harvard.edu/gazette/2009/04.30/99-obamamemo.html <<June 30, 2009>>.

36 United States House of Representatives, ―Hearing on National Defense Authorization Act for FY2006 and Oversight of Previous Authorization Programs." Hearing on Navy Research and Development: Programs in Support of the War on Terrorism, Naval Transformation, and Future Naval Capabilities before the Subcommittee on Projection Forces, Committee on Armed Services, 109th Congress, First Session, March 2, 2005; United States Senate, ―‗Leap Ahead' Technologies and Transformation Initiatives within the Defense Science Technology Program." Hearing before the Subcommittee on Emerging Threats and Capabilities, Committee on Armed Services, 107th Congress, First Session, June 5, 2001.

37 United States House of Representatives (March 2, 2005), statement of Assistant Secretary of the Navy for Research, Development, and Acquisition John Young.

38 Charles Townes, ―Early Days of Quantum Electronics and the Office of Naval Research," speech delivered at ONR's Fortieth Anniversary (1986), appearing in *The Office of Naval Research 5oth Anniversary*, available at www.onr.navy.mil/about/history <<June 30, 2009>>.

39 United States House of Representatives, ―Hearing on National Defense Authorization Act FY2006 and Oversight of Previous Authorization Programs," Hearing on Defense Science and Technology Programs before the Subcommittee on Terrorism, Unconventional Threats, and Capabilities, Committee on Armed Services, 109th Congress, First Session, March 10, 2005, p. 14.

40 Ibid., p. 15.

41 Emelie Rutherford, ―Need Seen for Early-Stage Applied Research Funding in Navy," *Defense Daily* (December 16, 2008; United States House of Representatives, ―Hearing on FY2010 National Defense Authorization Budget Request for Department of Defense Science and Technology Programs," Hearing before the Subcommittee on Terrorism, Unconventional Threats, and Capabilities, Committee on Armed Services, 111th Congress, First Session, May 20, 2009, statement from Chief of Naval Research Nevin Carr, Jr.

42 This reverses the Navy's flowchart, which places the Naval Research Laboratory under ONR as the parent organization.

43 Air Force Science and Technology Board, *Effectiveness of Air Force Science and Technology Program Changes* (Washington, D.C.: National Academies Press, 2003), Appendix E.

44 Sapolsky (1990: p.91, n. 56) provides an expert commentary on AFOSR against the benchmark of ONR. His critique and subsequent Congressional interventions may not stand as the final verdict on Air Force 6.1. AFOSR and its chief scientist, Herb Carlson, led the charge during President Bush's first term to implement Congressionally mandated reform. The Air Force response included a report on Long-Term Challenges that explained the importance of basic research and connections to pure science scholarship for the future Air Force. Carlson personally advocated closer relationships with leading scientific universities in Asia and Europe through two satellite offices of AFOSR, collocated with similar (but not identical) Army offices and ONRG in London and Tokyo. Robert White, ―Research Pioneer in Atmospheric and Space Sciences Retires after Three-Decade Career." Wright-Patterson Air Force Base (Dayton, OH), October 5, 2006, www.wpafb.af.mil/news/story.asp?id=123062421 <<June 30, 2009>>.

45 Sapolsky (1990); United States House of Representatives, ―Hearing on National Defense Authorization Act FY2006 (March 10, 2005): 15.

46 United States House of Representatives, ―Hearing on National Defense Authorization Act FY2006," (March 2, 2005): 39-40.

47 There are at least two interpretations for ONR's *Naval S&T Strategic Plan* from 2007. It supplied crucial justification in a democratic context for greater S&T investment, clarifying the connection between new knowledge

at 6.1-6.2 (Discovery & Innovation) and new capabilities for Naval operations. Yet, it also buried 6.1 efforts that would simply advance frontiers of science. If a 6.1 proposal was not something that looked like it would transition to a valuable product, it was not included in the strategic plan (www.onr.navy.mil/about/docs/0703_naval_st_strategy.pdf <<July 7, 2009??).

[48] See Braben (2008) on this description of science.

[49] James Leutze, *Bargaining for Supremacy: Anglo-American Naval Collaboration, 1937-1941* (Chapel Hill, NC: University of North Carolina Press, 1977). Sapolsky (1990: 49) shows the London Office as the only overseas branch in the ONR organization chart for October 1946.

[50] Robert Conrad, ―The Navy Looks Forward with Research," speech delivered at the University of Illinois, Urbana, October 27, 1946, appearing in *The Office of Naval Research 50th Anniversary*, available at www.onr.navy.mil/about/history <<June 30, 2009>>; John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe* (Cambridge, MA: MIT Press, 2006), p. 31.

[51] Krige (2006: 32).

[52] Navy Captain Robert Conrad merits quoting at length: ―Our powers of self-destruction appear like a baited trap which mankind is powerless to evade. Where is the new hope? Where is the new security?...In a more limited sense, the study of our research results will reveal the evil possibilities against which we must guard ourselves, and this is a natural responsibility of the Navy. But in the broad sense, the common enemy of mankind is man's ignorance…Research to create knowledge, and education to spread it to all people, are the basic safeguards of civilization, and the only weapons which will succeed against ignorance, our ultimate enemy" (Conrad 1946: 3).

[53] Sapolsky (1990: 38).

[54] Ibid., p.120.

[55] This is why the Defense Department's Missile Defense Agency (MDA) rushed to let science contracts to Czech universities and research institutes in 2008, the same year the United States sought agreement for placing a controversial missile defense radar in the Czech Republic. Czech News Agency, ―USA to Provide 600,000 Dollars in Support of Czech Science," *CNA* (Prague) (October 31, 2008).

[56] This broad framework, where in the absence of clear-cut, bilateral rivalries the international analyst looks at global powers' capacity to manage challengers at the regional level, has inspired a series of influential studies. Samuel Huntington, *The Clash of Civilizations and the Remaking of World Order* (NY: Touchstone, 1997) belongs in this category. Though his regional boundaries are cultural rather than legal-political, the primary agents driving events in these regions are still powerful states. For more traditional regions combined with a global intervening power, that is, an aspiring hegemon, see Karen Rasler and William Thompson, *The Great Powers and Global Struggle 1490-1990* (Lexington, KY: University Press of Kentucky, 1994); Henry Kissinger, *Does America Need a Foreign Policy? Toward a Diplomacy for the 21st Century* (NY: Simon and Schuster, 2001); Barry Buzan, *The United States and the Great Powers: World Politics in the Twenty-First Century* (Cambridge, UK: Polity, 2004); Jakub Grygiel, *Great Powers and Geopolitical Change* (Baltimore, MD: Johns Hopkins University Press, 2006).

[57] Paul Taylor, ―Why Does Brazil Need Nuclear Submarines?" *Proceedings* (U.S. Naval Institute) (June 2009): 42-47 (esp. p. 46).

[58] Jorge Castañeda, ―The Forgotten Relationship," *Foreign Affairs* Vol. 82, No. 3 (May/June 2003): 67-81; Omar Encarnación, ―The Costs of Indifference: Latin America and the Bush Era," *Global Dialogue* Vol. 10 (2008): www.worlddialogue.org/content.php?id=432; Abraham Lowenthal, Ted Piccone, and Lawrence Whitehead, eds., *The Obama Administration and the Americas: Agenda for Change* (Washington, D.C.: Brookings Institution Press, 2009).

[59] Jonathan Wheatley and Richard Lapper, ―Surfing a Big Wave of Confidence," *Financial Times* Special Report on Brazil (July 8, 2008): 1; Jonathan Wheatley, ―Dancing through the Economic Crisis," *Financial Times* Special Report on Brazil (July 7, 2009): 1; BBC News (Brasil), ―Brasil Começou a Ser Levado a Sério pelo Mundo, Diz ‗FT'", July 7, 2009, available at www.bbc.co.uk/portuguese/noticias/2009/07/090707_brasilftml.shtml.

[60] Ana Maria Fernandes, *A Construção da Ciência no Brasil e a SBPC*, 2nd Ed. (Brasilia, DF, Brazil: Universidade de Brasilia, 2000).

[61] Ibid., p. 27, *passim*; SBPC—Sociedade Brasileira para o Progresso da Ciência, www.sbpcnet.org.br/site/home, link to ―ASBPC" for profile and history <<September 14, 2009>>.

[62] Ministry of Science and Technology (MCT), Brazil Brochure in English, c2008a, available from Ministry of Science and Technology, Brazil, pp. 9, 11, 13.

[63] Peter Wertheim and Dayse Abrantes, ―Brazil's Petrbras Defies Global Credit Crunch," *Oil and Gas Financial Journal* (July 1, 2009): http://www.ogfj.com/index/article-display/9450648007/s-articles/s-oil-gas-financial-journal/s-volume-6/s-Issue_7/s-Cover_Story/s-Brazil_s_Petrobras_defies_global_credit_crunch.html <<September 14, 2009>>; Michael Molinski, ―Embraer," *Investing Across Borders* (2003): www.investingacrossborders.com/story.embraer.htm <<September 14, 2009>>. A more recent source puts Petrobras as the fourth largest oil producer [Helder Marinho and Andre Soliani Costa, ―Petrobras Loses $7 Billion Value as Lula Seeks Stake," *Bloomberg.com* (September 1, 2009): www.bloomberg.com/apps/news?pid=20601087&sid=aJ7FWMHQIj_w].

[64] Ibid.

[65] Ministry of Science and Technology (MCT), Brazil (c2008a: 15); Ministry of Science and Technology (MCT), Brazil, *Action Plan 2007-2010* Summary Document, available from the Ministry of Science and Technology, Brazil, c2008b, p. 16; Taylor (2009).

[66] John Krige and Kai-Henrik Barth, eds., *Global Power Knowledge: Science and Technology in International Affairs* (Chicago, IL: University of Chicago Press Journalsm, 2006). See chapters by Ronald Doel and Kristine Harper, ―Prometheus Unleashed: Science as a Diplomatic Weapon in the Lyndon B. Johnson Administration"; and Stuart Leslie and Robert Kargon, ―Exporting MIT: Science, Technology, and Nation-building in India and Iran".

[67] Richard Feynman, *Surely You're Joking, Mr. Feynman!* (NY: W.W. Norton, 1985). Interestingly, on the technology and engineering side, ITA under the Ministério da Defesa appointed during its formative years an American president from MIT.

[68] This impression accords with Nina Federoff's. Federoff, after a career in bio-genetics, wore two hats as science advisor to Condoleezza Rice and chief scientist for USAID. Her concern was harnessing advanced science for international cooperation and development. The dynamic with Brazil would involve transfer for development as well as peer exchange with a mature scientific establishment. Federoff actually challenged answers from witnesses representing the White House Office of Science and Technology Policy, the National Science Foundation and the State Department science office, concluding that we are ―not doing enough" scientific diplomacy in Latin America (United States House of Representatives Committee on Science and Technology, Subcommittee on Research and Science Education, ―International Science and Technology Cooperation," 110th Congress, Second Session (April 2, 2008), p. 63.

[69] Ibid., p. 63; Claire Applegarth, ―Brazil, IAEA Reach Inspection Agreement," *Arms Control Today* (January/February 2005): www.armscontrol.org/print/1720.

[70] Online at www.fic.nih.gov/.

[71] Congressional Budget Office, *A Comparison of Science and Technology Funding for DOD's Space and Nonspace Programs* CBO Analysis (January 15, 2008), available at www.cbo.gov/ftpdocs/89xx/doc8913/01-15-DOD.pdf, p. 2.

[72] Tocqueville argued that elite institutions under the Constitution like the Senate or the Judiciary would not check the democratic tide from swamping aristocratic virtue in the sciences, arts, or diplomacy. Only extraordinary civic spirit, inspiring near frenetic participation at the local level, could keep the American national government from taking on too many tasks to serve everyone's ordinary needs and losing its opportunity for greatness among the society of nations [Alexis de Tocqueville, *Democracy in America* (NY: Vintage Books, 1945), Vol. I, p. 55; Vol. II, pp. 114, 334]. In our context, scientific literacy might stand as a variant on local participation, allowing mission agencies at the Federal level to further scientific excellence rather than simply harvest it for quotidian needs. Nina Federoff, the science advisor to Condoleezza Rice, called for more literate participation among non-scientists at the State Department (United States House Hearing, ―International Science and Technology Cooperation," April 2008, p. 84). A similar mechanism operates in democracy at-large: improving scientific literacy among the general population should also free American scientists to pursue excellence and maintain international leadership.

[73] This is Harvey Sapolsky‗s conclusion, that Admiral Bowen persisted and overcame daunting bureaucratic obstacles, creating an independent office of research within the Navy in order to prevent an Army monopoly over nuclear research and applications (Sapolsky 1990: 24-25).

[74] William Bonvillian, ―The Innovation State: Why Federal Support for Science Is Essential for American Prosperity," *The American Interest* Vol. 4, No. 6 (July/August 2009): 69-78.

[75] Reese Ewing and Inae Riveras, ―Brazil to Harden Line on U.S. Farm Aid Post Doha," *Reuters* (July 30, 2008): www.reuters.com/article/politicsNews/idUSN3047082320080730.

[76] Juan de Onis, ―Brazil‗s Big Moment," *Foreign Affairs* Vol. 87, No. 6 (Nov/Dec 2008): 110-22.

[77] Alexei Barrionuevo, ―Brazil Seeks More Control of Oil beneath Seas," *New York Times* (August 18, 2009): A1.

[78] Barrionuevo (2009); Joe Carroll, ―Exxon Says Brazil Find Needs Study, Plans Third Well," *Bloomberg.com* (June 3, 2009): www.bloomberg.com/apps/news?sid=apw651feU;XI&pid=20602099; Economist, ―Preparing to Spend a ‗Millionaire Ticket‗ Offshore," *Economist* (September 3, 2009): www.economist.com/displayStory.cfm?story_id=14370680.

[79] Elisabeth Rosenthal, ―In Brazil, Paying Farmers to Let the Trees Stand," *New York Times* (August 22, 2009): A1; Economist, ―The Future of the Forest," *Economist* (June 11, 2009): www.economist.com/displayStory.cfm?story_id=13824446.

[80] Mongabay, ―20% of Land Deforested in the Brazilian Amazon Is Regrowing Forest," *Mongabay.com* (September 6, 2009): http://news.mongabay.com/2009/0906-amazon_forest_recovery.html <<September 17, 2009>>.

[81] Taylor (2008); Federation of American Scientists, ―Nuclear Weapons Programs," *fas.org* (October 2, 1999): www.fas.org/nuke/guide/brazil/nuke/ <<September 16, 2009>>.

[82] ―Obama: Lula Is ‗Most Popular Politician on Earth,‗" *Huffington Post* (April 2, 2009): www.huffingtonpost.com/2009/04/02/obama-lula-is-most-popular_n_182437.html.

[83] Economist, ―Dancing with the Bear," *Economist* (April 16, 2009): www.economist.com/world/americas/displaystory.cfm?story_id=13496075; Gary Duffy, ―Amazon Bill Controversy in Brazil," *BBC News* (June 23, 2009): http://news.bbc.co.uk/2/hi/science/nature/8113952.stm.

[84] Fareed Zakaria, ―The Capitalist Manifesto; Greed is Good (To a Point)," *Newsweek* Online (June 13, 2009). ―But we are suffering from a moral crisis, too…No system—capitalism, socialism, whatever—can work without a sense of ethics and values at its core" (www.newsweek.com/id/201935/page/5).

[85] See n. 24, above, and in addition Richard Betts, *Enemies of Intelligence: Knowledge and Power in American National Security* (NY: Columbia University Press, 2007); Risa Brooks, *Shaping Strategy: The Civil-Military Politics of Strategic Assessment* (Princeton, NJ: Princeton University Press, 2008); Christopher Gibson, *Securing the State: Reforming the National Security Decisionmaking Process at the Civil-Military Nexus* (Hampshire, UK: Ashgate, 2008).

[86] Ruth Grant and Robert Keohane, ―Accountability and Abuses of Power in World Politics," *American Political Science Review* Vol. 99, No. 1 (February 2005): 29-43.