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United States The Need for Continuity

For the nation to achieve its ambitious goals, it must establish a permanent home for innovation policies and programs in the Department of Commerce.

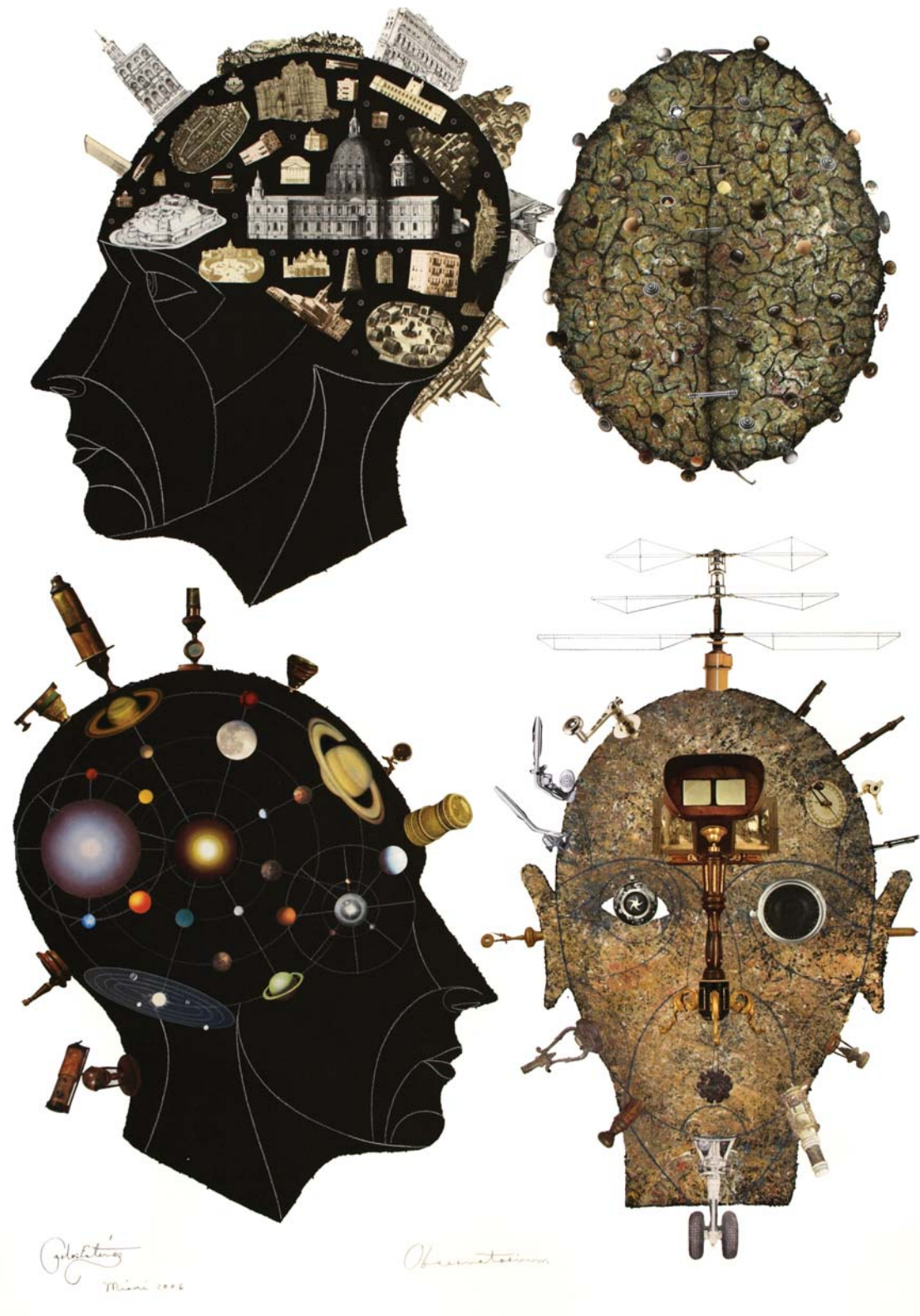
The time is ripe to reassess U.S. national innovation policies and programs and to consider new initiatives. A transition in political control of the White House inevitably produces a change in economic strategy, and the recession that gripped the country when Barack Obama took office required the new administration to come to terms not only with the immediate crisis but also with the nation's long-term prospects for productivity growth and economic strength. President Obama made it clear from the outset that he viewed innovation as essential to the nation's future well-being.

Businesses, governments, and institutions the world over embrace innovation. Innovation is hailed as a major factor driving economic growth. It is called on to address a myriad of societal problems, from the high cost of medical care to global climate change. Fighting and winning the war against extremism around the globe requires innovation in weapons, intelligence gathering, military tactics, medical treatment, and peacemaking strategies.

Innovation is more than new technology. Our intensely competitive global economy demands a relentless search for innovation-based advantage in services, marketing, and management. Information technology enables and accelerates innovation across the economy, even changing the way that knowledge is created, managed, communicated, and transformed. Innovation itself faces innovation. Many companies have adopted new models for accelerating the pace of innovation, including open innovation, multidisciplinary teams, user-driven innovation, and interinstitutional collaborations of unprecedented richness, intensity, and scale.

No wonder then that nearly every nation of the world has launched an array of innovation policies designed to spur innovative activity in its companies; to encourage the widespread adoption and use of innovative products, services, and approaches; and to create the environment and infrastructure that will enable successful innovation in every sector.

The United States has an outstanding record of producing world-renowned innovations. Its culture fosters innovation, it has excellent institutions of higher education and research, its marketplace is large and well-integrated, and it has diverse and efficient capital and equity markets. Yet there are indications that U.S. innovation is not keeping pace with the rest of the world and that other countries are redoubling their efforts to move ahead in the race to innovate. At the same time, the United States is looking to innovation to help resolve some of its most important chal-



CARLOS ESTÉVEZ, *Observatorium*, Collage on paper, 39 x 27 inches.

lenges, such as combating climate change and making health care more efficient.

History

The U.S. federal government has long had an interest in innovation policies, although calling them “innovation policies” is new. In his first State of the Union address to Congress in 1790, George Washington said,

The advancement of agriculture, commerce, and manufactures by all proper means will not, I trust, need recommendation; but I can not forbear intimating to you the expediency of giving effectual encouragement as well to the introduction of new and useful inventions from abroad as to the exertions of skill and genius in producing them at home, and of facilitating the intercourse between the distant parts of our country by a due attention to the post-office and post-roads.

Clearly, President Washington thought it proper for the new federal government to support innovation at home and encourage imports of innovations from abroad. He also appreciated the importance of federal investment in infrastructure.

Throughout the 19th century and into the first several decades of the 20th, isolated efforts were made to enhance what we now understand to be innovation. In addition to implementing the patent system, government supported research in fields such as agriculture, mining, and geology and funded technologies such as Morse’s telegraph and the early railroads and aircraft.

Large-scale federal support of R&D during World War II changed forever the government’s engagement in supporting innovation and knowledge creation. Driven largely by Cold War priorities, federal investments in R&D increased dramatically in the decades after the war, including support for atomic energy, the space program, biomedicine, and the Internet.

In addition, after the Soviet Union’s test of a hydrogen bomb and its launch of Sputnik in the mid-1950s, new educational programs were adopted to improve the perform-

Carlos Estévez

Carlos Estévez’s art works, filled with a feeling of mystery, magic, and invention, are constructed with traditional materials and found objects in nontraditional and strikingly original ways. The imagery that he creates, inspired by an appreciation for the history of Western art, aims to push the boundaries of the imagination. Estevez is interested in the visual representation of the complexities of emotion and ideas and where they collide poetically with the physical world. His work alludes to the process of discovery and invention, referencing imagery of the Renaissance and Enlightenment in his whimsical, dream-like constructions. His humans are comprised of machines, and his animals are assemblies of pulleys, wheels, levers, and springs. Estévez seems to be building a playful visual vocabulary for innovation.

Based in Miami, Estévez was born and educated in Havana, Cuba, graduating from the Instituto Superior de Arte in 1992. Estévez also studied conservation and restoration at the Instituto, photography at the Fototeca de Cuba, and film at the International School of Film and Television in Havana. Though his supplemental studies have focused on photography and film, many of Estévez’s most recent works involve installation, sculpture, painting, and drawing. He paints and draws in diverse mediums such as watercolor, ink, pastel, and pencil to produce dynamic images of human and animal forms over technical, linear drawings. These figures often reference constellations and the greater space of the cosmos by using lines to connect star-like dots, while at the same time alluding to the more mundane figures of marionette puppets.

Images courtesy of the artist.

The Commerce Department remains the natural home for implementing a White House initiative on innovation, but it also remains a stove-piped agency with a limited political constituency and very limited resources to address innovation.

ance of U.S. students at all levels, from kindergarten through graduate school. Special emphasis was placed on widening and deepening students' understanding of math and science to prepare them for careers in a technology-rich society.

The first attempt at articulating the foundations of a federal innovation policy took place during the Johnson administration. In 1967, an advisory committee to the Department of Commerce issued a report entitled *Technological Innovation: Its Environment and Management*, which laid out many of the principles that guide innovation policy discussions today.

Nearly every subsequent presidential administration has articulated a strategy or policy for innovation, technology, or competitiveness. President Nixon offered the short-lived New Technology Opportunities Program. President Carter oversaw a comprehensive "domestic policy review of industrial innovation," which set forth a wide range of actions to encourage innovation.

During the "competitiveness crisis" inspired by Japan's economic ascendance in the 1980s, Congress assumed the initiative, passing a number of new laws, including policies intended to strengthen innovation across the economy by encouraging cooperative R&D among and between firms, universities, and government laboratories. Tax incentives were adopted to encourage private-sector expenditures on R&D. The Bayh-Dole Act of 1980 and the Federal Technology Transfer Act of 1986 created new incentives and mechanisms to enable the commercialization of R&D results obtained with federal funds at universities and federal laboratories. Programs were set up to financially assist innovative activities in small firms and in consortia of large and small firms. These efforts culminated in the Technology Competitiveness Act of 1988, which created the office of the undersecretary for technology in the Department of Commerce.

President George H. W. Bush's Office of Science and Technology Policy (OSTP) issued its *U.S. Technology Policy in 1990*. President Clinton and Vice President Gore wasted no time in issuing *Technology for America's Economic Growth* under their own names a mere month after taking office in

1993. President George W. Bush released the *American Competitiveness Initiative*, which helped pave the way for the passage of the America COMPETES Act in 2007. And, in September 2009, with little fanfare, the Obama administration released *A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs*, which outlines federal activities for encouraging and using innovation.

Political considerations

There is a certain consistency among all of these high-level reports and strategies. They characteristically call for new incentives to encourage private-sector innovation; new programs to strengthen higher education and research in fields such as math, science, and engineering; new modes of cooperation among industry, universities, and government agencies and laboratories; and intellectual property protection in pursuit of the constitutional purpose to "promote the progress of science and useful arts."

However, although they share a deep commitment to funding basic research, Democratic and Republican administrations and Congresses favor different sorts of innovation strategies and policies. Democrats tend to focus on specific, identifiable national goals, such as safe and clean energy, exploring and learning about space, or wiring the nation. Democrats are also willing to create new programs that provide targeted resources to the private sector to, in effect, directly subsidize early-stage commercial innovation. Examples include the Small Business Innovation Research Program, which provides grants to new small firms and the recently ended Advanced Technology Program (ATP), which provided cost-shared grants to consortia of firms to develop precompetitive technologies. Republicans, on the other hand, prefer to focus on the general conditions for, and incentives to encourage, innovation in many areas. They prefer low corporate taxes, tax incentives for R&D performance, and free trade regimes to encourage innovation, while eschewing subsidies for specific technologies and sectors.

Party lines are not strictly determinative, however. Republicans have sponsored their favored innovation projects

[e.g., Nixon and the Supersonic Transport (SST), Reagan and SEMATECH, and G. W. Bush's hydrogen-powered "Freedom Car"]. On the other hand, Democrats have been willing to support tax preferences for R&D performance and, with some exceptions, fair and open trade among nations.

Owing in part to these partisan differences of view about the proper government role in innovation, federal programs and policies to support innovation in the United States tend to be fragile, subject to the changing fortunes of political party control of the White House and Congress. It is, of course, fitting that in the risky business of innovation promotion, some projects come to an early end. The SST, the fast-breeder nuclear reactor, synthetic fuels, and the high-speed commercial transport aircraft initiative were all high-profile efforts that were abandoned before completion. Programs such as the Technology Reinvestment Project of the Clinton era, the ATP adopted in 1988, and the Experimental Technology Incentives Program put in place by President Nixon were too controversial from the outset to survive over long periods. Institutional vehicles such as the Technology Administration in the Department of Commerce, the National Critical Technologies Plans initiated in the early 1990s, and Congress's Office of Technology Assessment appeared to offer substantial value but were eliminated.

The irony is that innovation policies, which seek to improve national performance over the long run, are often short-lived. Promoters of innovation programs often live in a state of heightened anxiety, concerned that their programs will be terminated, reorganized out of recognition, or "defunded" just as they reach their stride.

The complex of innovation policies and the multiplicity of constituencies concerned with their own pieces of the puzzle add to the challenge of building and sustaining sensible policies. Individual companies and trade associations, labor unions, professional and technical societies, academic institutions, and state and local government officials all have stakes in innovation policy discussions and do not always agree on what should be done or how. Think tanks and advocacy organizations contribute to the debates over innovation policy with competing studies, reports, and policy proposals. The Council on Competitiveness, whose members are chief executives of corporations, labor unions, and academic institutions, has long sought to find common ground for action and has issued important reports on innovation policy. The National Research Council (NRC) of the National Academies has played an important role in convening the interests and clarifying the debate. The NRC study *Rising Above the Gathering Storm* stimulated the enactment of the America COMPETES Act in 2007. Organi-



CARLOS ESTÉVEZ, *Lo que no he podido alcanzar es lo que me hace seguir adelante*, Oil and pencils on canvas, 48 x 54 inches, 2007.

zations such as the Council on Competitiveness and NRC help reinforce the relatively limited capacity of the federal agencies to address innovation policy needs in depth. Yet their ad hoc nature underscores the problems of ensuring agency continuity and building sustained capacity within the government.

The Obama strategy

The Obama administration's *A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs* is a rich matrix of policies, initiatives, and programs focused on innovation as a driver of productivity and economic growth and as a means for addressing key problems facing U.S. society. The strategy makes a strong case for an economy based on sustained innovation as the answer to the bubble economies of the recent past. It speaks less directly to the competitiveness issues that motivated earlier congressional action, such as the America COMPETES Act. And by focusing broadly on innovation rather than narrowly on technology, it implicitly embraces the panoply of Internet-enabled business, marketing, and social innovations.

The strategy presents itself as a middle-of-the-road approach that avoids both interventionist and laissez-faire extremes. It avoids suggesting new programs similar to the ATP that would be likely to draw strong opposition, and it argues against "picking winners." The strategy's elements are laid out in a three-part framework of building blocks, competitive markets, and national priorities. It begins with investments and markets needed for innovation generally and ends by addressing technological "Grand Challenges," in which the role of the federal government is modestly described as "Catalyz[ing] Breakthroughs for National Priorities."

The 35 bulleted items in the "building blocks" and "competitive markets" sections may seem overinclusive in the sense that many of the components are broad policy prescriptions such as promoting open capital markets that do much more than support innovation. Sound economic, trade, and education policies help provide an environment that is conducive to innovation, but including this broader array of policies diminishes somewhat the focus on innovation and sometimes misses the mark. For example, the section on physical infrastructure speaks of increased funding and accountability but doesn't mention intelligent transportation systems. At the same time, the strategy is underinclusive, because key innovation-related institutions and initiatives are not mentioned.

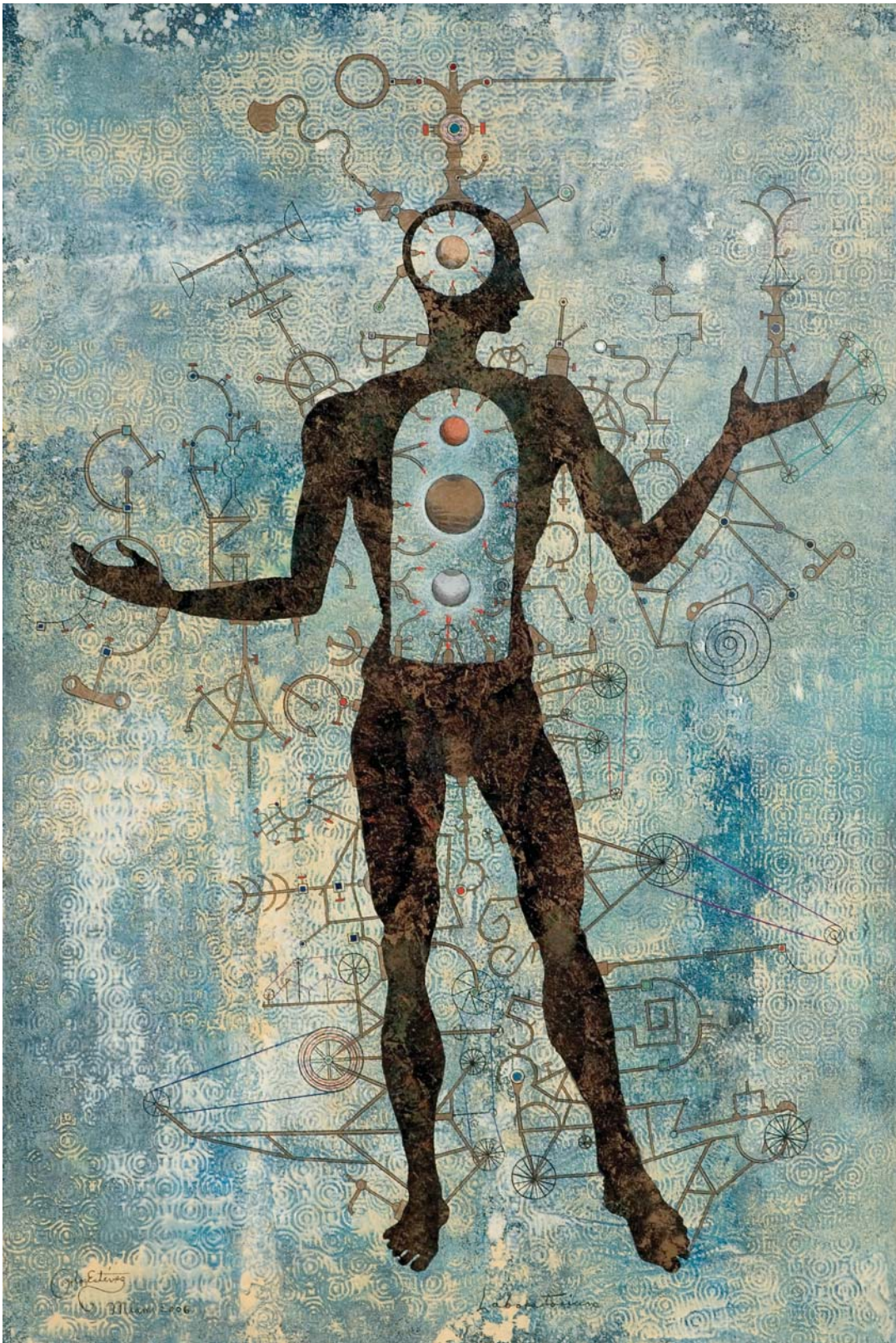
To date, the most concrete embodiment of the administration's innovation strategy is that it has directed more than \$100 billion of the American Recovery and Reinvestment

Act (ARRA) funding toward broad background activities, targeted R&D efforts, and education programs. Significantly, much of the innovation agenda supported by ARRA funds contributes little to short-term stimulus, and the attendant political benefits, but embodies the commitment to long-term sustainable economic growth articulated in the strategy. Nevertheless, the ARRA funding was only a one-time infusion that operated as an extraordinary exception to the annual budgeting and appropriations processes that had earlier constrained implementation of the America COMPETES Act.

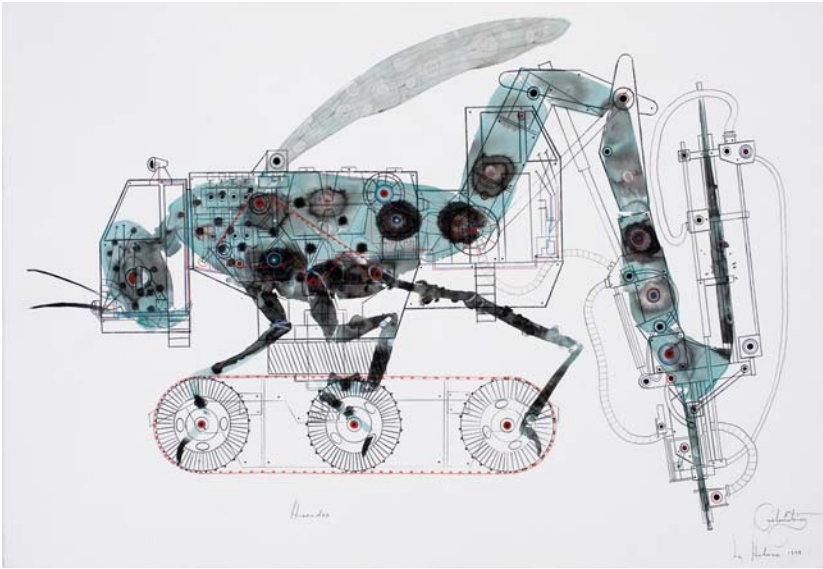
Two new elements of the strategy have received considerable political attention and support: the regional clusters initiative and the open government initiative (OGI). Regional innovation clusters are not a new idea. They have been understood as drivers of innovation at the state level as well as in many countries around the world. Until recently, the federal government has been content to leave innovation cluster development to state and local authorities, public universities, and the private sector, inasmuch as clusters are inherently local. Now, however, it is widely believed that a small amount of federal funding can play a limited but catalytic role in encouraging collaboration and planning at the local level, leveraging both local and field-specific resources, and in building a community of practice that spans clusters.

The OGI breaks new ground by adding collaboration to the traditional principles of transparency and participation. Although in part a reaction to certain Bush administration policies limiting access and accountability, this initiative seeks to use information technology to enhance and redefine the engagement of public agencies with each other and with the public, academia, and industry so as to move beyond the limitations of advisory committees and conventional requests for information and comment. Collaboration might be suspect in some circumstances, but if it is openly disclosed and illuminated, and empowered by the Internet, standards, and well-designed software, it could prove extremely effective in enhancing information gathering, analysis, and decision-making. Unfortunately, the most cited example of such collaboration, the experimental peer review of patent applications, has been suspended despite the fact that substantial support was provided by foundations and the private sector. More pilot projects and generalizable guidelines are needed to show that collaboration technologies can work effectively to marshal knowledge needed for agency decisionmaking.

Although standards are not mentioned in the strategy, the White House OSTP is engaged in an important initiative on the development and adoption of standards for sharing data and information in complex environments such as health care, manufacturing, the "smart grid," and govern-



CARLOS ESTÉVEZ, *Laboratorium*, Oil and pencil on canvas, 56 x 38 inches, 2006.



CARLOS ESTÉVEZ, *Horadar*, Mixed media on paper, 43.5 x 29 inches, 1997.

ment operations and services. In these areas, many differently positioned stakeholders, including government agencies, operate and often work together, voluntarily or by necessity, because they must share and reuse data that are subject to different constraints, purposes, and business processes. Work in some of these areas, such as electronic medical records that travel with the individual patient, has been under way at the National Institute of Standards and Technology (NIST) for some time. What is different here is the recognition that high coordination costs among many and potentially biased heterogeneous interests create the need for a stronger role for government engagement than is the case for conventional standards, where the stakeholders might be limited to perhaps a dozen similarly sophisticated technology companies.

Finishing the job

The strategy is the first effort by a U.S. administration to address innovation comprehensively rather than as simply the development of technology or the ability to compete in a global economy. Although it reflects some decisions already made, including funding provided under ARRA, it does not lay out an action plan for who will do what, nor does it provide a framework for how and where the elements of the strategy might be developed and implemented. It gives no line agency this responsibility. The strategy is the result of an interagency working group led by senior White House officials, but it is our understanding that the group responsible for the strategy no longer meets. In addition, the lack

of legislated authority and budgets, as well as limits on staff size, mean that the White House faces real limits on its ability to transform strategy into sustained action.

For leaders in Europe and leading Asian nations who are accustomed to sustained public dialogue on innovation, the absence of a designated coordinating office, indeed of any sustained high-level public dialogue on innovation in the United States, is striking. This is all the more remarkable in light of the congressional call for a President's Council on Innovation in the America COMPETES Act of 2007. Relegated by President Bush to a subcommittee of the technology committee of the National Science and Technology Council, the President's Council on Innovation has never met and remains dormant even in an administration that has made a strong and explicit commitment to innovation.

It is ironic that major portions of the America COMPETES Act went unfunded and unimplemented until ARRA gave the White House the flexibility to direct funds to COMPETES initiatives such as the Advanced Research Projects Agency–Energy. It is also ironic that legislation intended to strengthen the nation's ability to compete abolished the Commerce Department's Technology Administration, the undersecretary for technology, and the Office of Technology Policy. Although these agencies had a mixed track record in recent years, rather than being eliminated they could have been redesigned and refocused to provide the institutionalized support and coordination for innovation policy that is now missing.

The Commerce Department remains the natural home

for implementing a White House initiative on innovation, but it also remains a stove-piped agency with a limited political constituency and very limited resources to address innovation. It is promising that Secretary of Commerce Gary Locke has spoken frequently on innovation and has established an innovation policy team within his office. In a public/private partnership with the Kaufmann Foundation, he has established within the Office of the Secretary an Office of Innovation and Entrepreneurship and a National Advisory Council on Innovation and Entrepreneurship. These new activities seem to be focused heavily on the important but relatively narrow topic of entrepreneurship rather than on innovation more broadly. At present, they have no congressionally authorized programmatic or operational authority and no funding.

Under the president's fiscal year (FY) 2010 budget proposal, the Economic Development Agency (EDA) was to have launched a small program to fund incubators and regional clusters of innovation. However, Congress provided mixed signals on how those funds were to be made available within the EDA appropriation. This left the EDA to make the case for the new program against the expectations of its traditional constituency of local government officials and economic development organizations, and the new initiatives were not funded. It is encouraging that this program has reappeared in the president's FY 2011 Budget.

The absence of a line agency with responsibility to coordinate and implement U.S. innovation policy leaves the various agencies with some responsibilities in this area free to focus their innovation policy activities on the needs of their traditional constituencies. The result is likely to be more of the same in both practice and politics. Although more of the same can be a good thing, without the capacity for analysis, deliberation, and experimentation, it becomes reflexive and, ironically, favors inertia over innovation. In the worst case, it leads to capture, as reflected in the mission adopted by the U.S. Patent and Trademark Office (USPTO) in the 1990s, "to help customers get patents."

The continued dominance of the linear model of innovation in framing the current innovation policy debate is symptomatic of the absence of mechanisms for integrating new thinking into policymaking. Numerous observers, including the present authors, have pointed out the limitations of this model as a description of how innovation actually occurs, yet it continues to be invoked often as the framework for policymaking.

Integrated thinking about innovation can be inhibited by the way Congress oversees some of the agencies. For example, within the Department of Commerce, two agencies

with major responsibilities for innovation, NIST and the USPTO, fall under the jurisdiction of different House and Senate committees.

In short, current policy is biased toward enhancing the supplies of inputs to innovation (basic research, invention, and basic skills) and away from encouraging demand and building absorptive capacity for the new. Little attention is paid to the processes that shape increasingly complex value chains. Linear supply chains tied to jobs, money, and shipments may be easy to grasp, but the ebb and flow of knowledge and other intangibles in loosely defined, easily reconfigured networks based on social acquaintance, contract, or common interest are not. Although the importance of networking is widely cited in business and academic literature, along with phenomena such as "open innovation" and "markets for technology," there is as yet no discernable impact of these new realities on federal innovation policy.

An innovation administration

The Obama strategy makes the case that innovation policy should be a key element of economic policy. However, in the present environment of 10% unemployment and slow growth, the short-term demand for jobs upstages the possibilities of acting on the strategy's long-term vision. Other than discussions of the opportunity provided by the impending expiration of the program authorizations under the American COMPETES Act, there is little evidence that the administration or Congress is considering major actions to follow up on the strategy articulated in fall 2009.

A national innovation strategy naturally involves many agencies and many policy mechanisms, ranging from mission-driven funding programs to tax credits to patents to regulatory insights. Yet the strategy does not address the need for agency capacity-building, coordination, and sustained public policy development. A number of approaches to filling this need have been suggested. Some advocate a new free-standing National Innovation Foundation. Others have suggested a new innovation policy coordination office within the Office of Management and Budget to ensure that innovation is taken into account in regulatory decisionmaking.

The United States is unusual among leading industrial countries in not having a top-level administrative agency responsible for innovation programs and analysis. The most straightforward way to address this need would be to reestablish an Innovation Administration within the Department of Commerce with responsibility for developing, promoting, and coordinating national innovation policy. From 1988 through 2007, this role was played by the office of the undersecretary for technology and a subordinate assistant secre-

tary for technology policy. Predecessors of this office existed as far back as 1962, when President Kennedy created the position of assistant secretary for science and technology and gave that office oversight over NIST's predecessor, the National Bureau of Standards, the USPTO, the National Technical Information Service, and the Weather Bureau. The role of this office evolved over the next two and a half decades, but it always served as the focal point for discussion and promotion of technology and innovation policies. An important agenda item for the America COMPETES reauthorization or other legislative initiative would be to reinvent this office and make it the central agency for innovation programs and policy analysis.

Commerce already houses the two line federal agencies most directly responsible for promoting innovation today, NIST and the USPTO. Both agencies have considerable potential to play more aggressive and successful roles in encouraging innovation and should be key elements of the Innovation Administration. NIST is home to the Technology Innovation Program, the Manufacturing Extension Partnership, the Malcolm Baldrige Quality Award, and a program services unit that does studies and analysis for the director. The USPTO examines and grants patents, but presently pays little attention to how patents are used, or abused, in the marketplace or to how experience in the marketplace might suggest patent reforms to better promote innovation. To the agency's credit, it recently hired its first chief economist to help with policy matters, albeit six years after the European Patent Office led the way.

In addition to NIST and the USPTO, an Innovation Administration within Commerce should house an office of innovation policy with the capacity to support evidence-based innovation policy analysis development anywhere in the government. It would coordinate closely with the National Economic Council, OSTP, and the President's Council on Innovation to ensure breadth of input and to inhibit capture by any narrow set of internal or external constituencies. It need not be large. A staff of 10 to 20 professionals could conduct in-depth studies and special analyses, develop metrics and methodologies, track business practices and policy initiatives around the world, and represent the United States in the increasing number of international forums, such as the Organization for Economic Cooperation and Development, in which innovation policies are ad-

ressed. It would be of particular value as a resource in support of interagency activities related to innovation, such as those led by NSTC and NEC. The office should have sufficient budget to be able to contract with outside researchers to do data- and model-intensive studies, as well as to collect the specialized data needed to conduct one-off analyses.

Two other Commerce Department candidates for the Innovation Administration are the National Telecommunications and Information Administration (NTIA) and the EDA. The NTIA develops policy and manages funding programs, including the \$7.2 billion broadband component of the stimulus package, for a sector in which the government has traditionally had a broader set of interests than promoting innovation. The EDA has historically been focused on investments to help revitalize disadvantaged or distressed regions. However, during the Bush administration, its mission statement was revised to focus on innovation and competitiveness as needed for participating in the global economy. If this mission is effectively implemented in programs on clusters and incubators, the EDA may well belong within an Innovation Administration.

The United States has had elements of innovation policy in many forms and for quite some time, but under other labels. The importance of innovation to rebuilding the economy, increasing productivity, sustaining economic growth over the long term, and addressing national priorities now demands that innovation policy move to center stage. The approach must be comprehensive and balanced; treating innovation issues in isolation will be insufficient.

The Obama administration has embraced a culture of innovation and understands why innovation is important. Success, however, will require more than White House strategy and planning. The United States also needs a permanent institutional framework for innovation that can outlive the stimulus package and survive through election cycles, independent of the presence at the top of talented individuals with good ideas.

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