Remarks of John P. Holdren at the
AAAS S&T Symposium
(As Prepared)
May 2, 2013

Good morning! Thank you, Phil, and thanks to AAAS for inviting me back to this year's S&T Forum.

There is an overabundance of topics I might touch on in these opening remarks before I sit down for a more free-flowing discussion with Phil. So, to shorten the list, I am going to largely dispense with my usual review of the President's proposed S&T budget for the coming fiscal year.

I think everyone here has either studied the President's FY 2014 R&D Budget already or knows where to look (one option is www.ostp.gov, under the "budgets" tab, where you can find all the numbers as well as our lay-language summaries of R&D highlights). And you will hear all about it from AAAS' own Matt Hourihan later in the program.

All I will say here is that the Budget reflects President Obama's clear understanding of two related points:

> that S&T are central to addressing most of the major challenges and opportunities facing the United States today—including economic recovery and job creation; bio-medicine & health-care delivery; clean, safe, reliable & affordable energy; climate- change mitigation & adaptation; land & water resource management; maintaining the health & productivity of the oceans; and ensuring our national & homeland security; and
>
> that support for basic research—the most organized way in which humans scratch the deeply ingrained itch of curiosity about themselves and their surroundings, as well as the way we expand the reservoir of fundamental understandings from which all future applied advances will flow—is and must remain primarily the responsibility of government, because for well-understood reasons the private sector will never do as much of it as society's interests require.

Accordingly, the President's budget continues to call for substantially increased support for NSF, DOE's Office of Science, and the NIST laboratories, which together carry much of the basic-research funding load. And, among other priorities, the Budget would support NASA's exciting mission to capture and visit an asteroid as a key stepping stone to manned missions to Mars; it would implement the Administration's plan for sustaining civil Earth observations; and it would fund a network of advanced-manufacturing institutes helping to recover American manufacturing jobs through innovation. And it would do all this without increasing the debt, because all of its increases are offset by strategically selected cuts.

In that last connection, it shouldn't need saying for this audience—but I will say it anyway—it is far better to choose budget increases and decreases strategically, as the President's FY14 Budget does, than to suffer the dumb, across-the-board cuts that the sequester has imposed.

It is still not the budget we in the S&T community would want and expect if the overall fiscal constraints facing the Nation were less severe, but it is far better for the future of science, technology, and innovation—and thus for our economy, our quality of life, and our security—than what the sequestration approach would deliver.

Gratifyingly, the ST&I communities have been out in front on this issue. Your letters, reports, and willingness to speak up about the damage the sequester is doing to the S&T enterprise—and will continue to do going forward if it is not replaced with a more balanced and strategic approach to deficit reduction—have been very helpful in this debate, and the Administration is grateful for that.

I want to make a further point about the kinds of research that the Federal government is and should be funding. Members of Congress have recently suggested, variously, either that the social sciences are not really science and should not be supported by the tax-payers at all; or that research in political science, at least, should only be supported if the NSF will certify to Congress, for each grant, that the research will advance either the economy or national security (a provision now actually embodied in law in the most recent Continuing Resolution governing spending for the remainder of FY13); or that all taxpayer-funded research should have to pass the test of offering a predictable benefit for some national interest.

Let me therefore be clear about the position of this Administration, as President Obama was in his remarks on Monday at the 150th anniversary meeting of the National Academy of Sciences.

First, the social and behavioral sciences—which of course include economics, sociology, psychology, and anthropology, as well as political science—are sciences. Researchers in these fields develop and test hypotheses; they publish results in peer-reviewed journals; and they archive data so that others can replicate their results.

Second, while much of the work in these sciences meets the definition of basic research—expanding our understanding of ourselves and our surroundings—much work in the social and behavioral sciences is aimed at having (or ends up having without being aimed that way) practical applications to society's direct benefit.

Political science research helps us understand the motives and actions of nations and peoples around the world, strengthening our foreign policy, and it helps understand our own democracy and how to make it stronger. Economics research has clarified not only the economic importance of innovation, but also its determinants, which in turn have helped us craft policies that effectively promote innovation and thus economic growth.3

Social and behavioral research has helped us make hurricane warnings more effective, improve methods of instruction and training in school and in the workplace, and manage common resources efficiently without centralized regulation. And it has taught us that social-distancing strategies, like staying home from work or school, can be a crucial complement to vaccination strategies when it comes to breaking the transmission of influenza from person to person.

Third, whether we are talking about research in the social and behavioral sciences, or in the natural sciences, it makes no sense at all to confine taxpayer support to those projects for which a likely direct contribution to the national interest can be identified in advance. (Unless, of course, the national interest is defined to include expanding the boundaries of knowledge, which would be fine with me but is not, I think, what members of Congress proposing the criterion have in mind.)

Imposing such a national-interest criterion in the form its sponsors seem to have in mind would throw out the basic-research baby with the bathwater, inasmuch as basic research constitutes precisely that subset of research activity that is aimed at expanding knowledge without reference to possible applications.

My friend Professor Charlie Townes got the Nobel Prize in physics for his work in quantum electronics that led to the maser (a term now nearly forgotten, standing for "microwave amplification by stimulated emission of radiation") and the laser, where the "m" for "microwave" is replaced by "l" for "light". Neither Charlie nor anybody else at the time he and his colleagues were doing this pioneering basic research, in the 1950s, could have imagined that some decades later the laser would be the basis of how we photocopy, play music, cut metals, and perform eye surgery, among a host of other practical uses.

Of course there is a fuzzy middle ground of fundamental research that is use-inspired rather than just curiosity inspired, for which beneficial applications can be imagined but not narrowly specified or confidently predicted. But this category, too, would be imperiled by some of the formulations circulating on what assurances funding agencies would need to provide to Congress.

Should the NSF Director of the time have had to predict, for Congress, that the NSF grant to Stanford graduate students Larry Page and Sergey Brin for an investigation of search algorithms would lead to a global revolution in how people find information? Or to the founding of a company whose market capitalization stood yesterday at $271 billion?

The fact is that nobody can predict where new understandings developed in fundamental research will ultimately lead—and what benefits to society will ultimately result. Even in

applied research, it is rarely possible to predict with confidence whether the work will achieve its intended goal or not, never mind what ultimate benefit might follow from achieving that goal, or some other outcome of the research that was not even envisioned at the outset of the work. A corollary of this reality is that some well conceived research projects will fail utterly. That is the nature of research. If you do not end up funding some failures, you are not funding anything very interesting. Certainly you are not funding the sort of cutting-edge, high risk research that, if successful, can be transformative.

No system of deciding what research the Federal Government should fund will succeed perfectly, whatever the standard of perfection. But the overall degree of success of the competitive, peer-reviewed grant process that is employed by the NSF, the NIH, and in much of the rest of the government's R&D funding—success measured by the pace of advance in basic science and the pace of the applied breakthroughs—has made that peer-review-based process the gold-standard, recognized around the world.

The President made it very clear on Monday that this Administration will do everything it can to protect that gold standard—to ensure [and I quote]: "that our scientific research does not fall victim to political maneuvers or agendas that in some ways would impact on the integrity of the scientific process." [unquote] I couldn't agree more.

Of course, this doesn't mean that the way this peer-review process is implemented in different agencies shouldn't itself be reviewed from time to time to make sure it is as good as it can be. But fiddling in any fundamental way with the model of judging research proposals via review by scientific experts in the relevant fields would place at risk the world-leading quality of this Nation's scientific and engineering enterprises.

Now let me turn for a moment to another aspect of this Administration's agenda for science, technology, and innovation—that of science, technology, engineering, and math education—STEM education for short. It's the STEM-education "pipeline" if you will, running from pre-school to grad school and beyond, that we must expand and strengthen not only to populate the next and subsequent generations of researchers, inventors, and innovators, but also to prepare the tech-savvy workforce that so many of the jobs of the 21st century are going to require, and to educate the science-savvy citizenry we need for our democracy to work in an era when more and more of the decisions before our elected officials have important scientific and technological dimensions.

The President's Budget provides $3.1 billion—an increase of 6.7 percent over 2012 enacted—for STEM education, including support for a number of programs to achieve the President's goals of producing one million new STEM graduates over the next decade and recruiting and preparing 100,000 excellent STEM teachers.5

And if you had any doubts about how much the President cares personally about this priority, those doubts would have been soundly dispelled had you attended last week's third White House Science Fair, or if you saw any of the video from the event which ended up on the evening news. In addition to showcasing more than 100 young innovators from across the Nation and the President's enthusiastic interactions with them, the event was a launching pad for a number of new private-sector commitments to advance his long-standing *Educate to Innovate* campaign.

One of those commitments, US2020, sets an ambitious goal to enlist one million STEM mentors by the year 2020. The effort will match STEM professionals with student-mentoring opportunities, targeting especially girls, minorities, and other groups underrepresented in the STEM fields. The founding partners of US2020 are ten prominent education non-profits and U.S. technology companies, including the Fortune 500 firms Cisco, Cognizant, and SanDisk.

That project is but one of many examples of how this Administration has been engaging the private sector—as well as the philanthropic sector and indeed also our colleges and universities and national labs—in partnerships to advance not only STEM education but the pace of innovation in domains as diverse as clean and efficient energy, drug and vaccine development, and additive manufacturing.

I could say more, but in light of the time I'm going to sit down and let Phil have at me.

###