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Historical Trends in Federal R&D

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The President's budget shows continued support for science and innovation when one bears in mind the fiscal constraints facing policymakers. The FY 2014 request proposes a nearly $6 billion increase (9.2 percent) for nondefense R&D and a $1.5 billion increase (1.1 percent) overall. These sums, if enacted, would allow nondefense R&D expenditures to expand far faster than inflation. But how does the proposal fit with recent history? We shall review some key trends.[1]

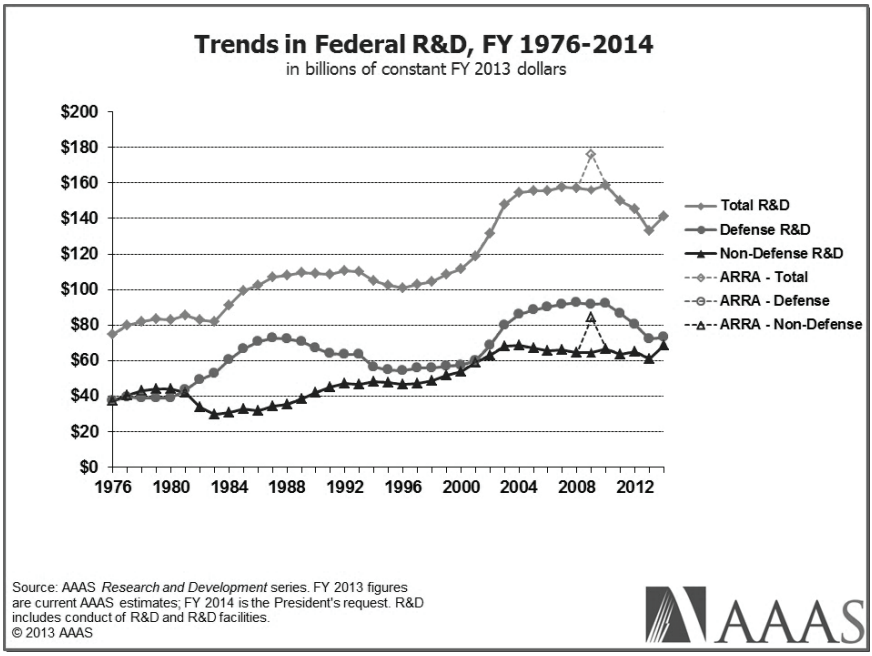
Nondefense R&D has been inching downwards since 2004, but the President's budget would attempt to counteract this trend. Nondefense R&D funding over the past few decades is generally a story of real-dollar growth, but in fits and starts (see Figure 1). Nondefense R&D funding reached a low point in 1983, after being reduced by a third over the first three years of the decade. For the rest of the 1980s, though, nondefense R&D grew steadily, and it more than recovered by the end of the decade. This gradual growth continued into the 1990s, reaching a plateau in the decade's middle years before accelerating with the campaign to double the National Institutes of Health (NIH) budget, in the face of growing health concerns with an aging baby boomer population. In real dollars, nondefense R&D grew by 132 percent – more than doubling – between 1983 and its all-time peak in 2004, and by 45 percent between 1997 and 2003, the prime years of NIH funding growth.

But since the 2004 peak, nondefense R&D has generally either ticked downward or held steady, save for the one-time contribution of the American Recovery and Reinvestment Act of 2009 (the stimulus bill), which contributed $19 billion to R&D in FY 2009. The current fiscal year, FY 2013, has so far

1 See Tables I-10 and III-1-6 for historical data. More historical data are available on the AAAS R&D web site, at http://www.aaas.org/spp/rd.

seen the largest reductions yet. Adjusted for inflation, estimated FY 2013 funding for nondefense R&D would fall to its lowest level since FY 2001, and 10.7 percent below the FY 2004 peak, primarily due to sequestration. Indeed, sequestration has put in place the largest reductions to R&D in 40 years. The President's budget, however, would more than offset this decline. If enacted, it would put nondefense R&D funding at an all-time high in constant dollars, only slightly ahead of FY 2004.

Figure 1. Trends in Defense and Nondefense R&D

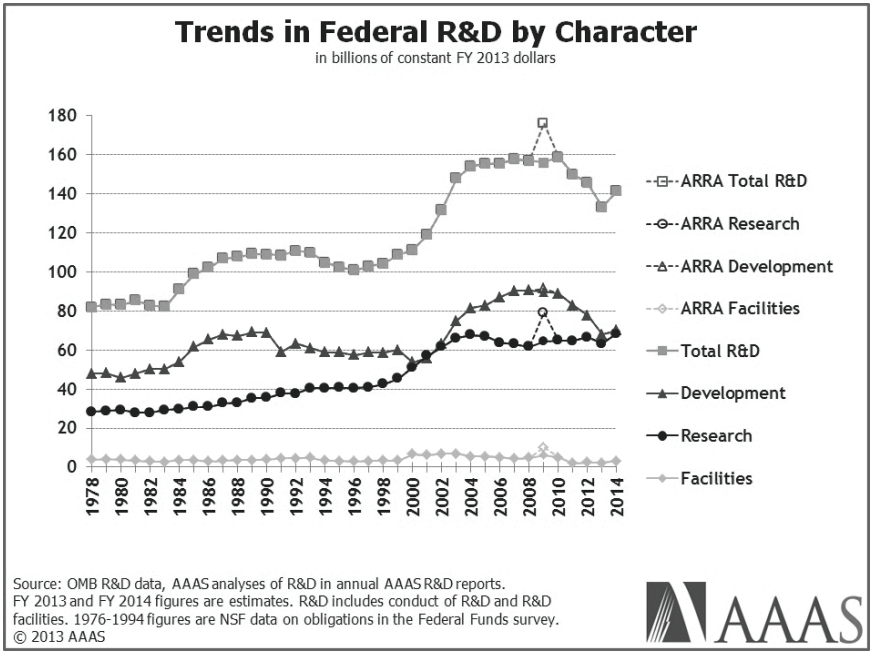


Though nondefense R&D overall has ticked downwards, research trends have recovered somewhat in recent years. The Administration's budget would accelerate this growth. Historically, development activities, which are dominated by weapons development at the Department of Defense (DOD), have received the greater share of federal funding (see Figure 2). But the difference between research and development funding has varied. At times, development funding has been twice as high as research, as was the case during the Reagan defense buildup. At other times, research has managed to catch up to development, as was the case in 2000 and 2001, after a few years of increased NIH budgets but before the defense

R&D spending surge driven by the terrorist attacks on September 11.

Between FY 2008 and FY 2013, development activities have fallen by 25 percent, with sequestration accounting for nearly half of the decline. The drop in technology development has served to pull down the overall R&D figure in the process. Over the same time period, total research – including basic and applied research – saw some very modest incremental growth, but this growth only came after years of decline. Further, sequestration has accelerated this long-term decline path. The Administration's budget would increase research spending significantly, by 6.9 percent, surpassing the all-time high in FY 2004.

Figure 2. R&D Trends by Character.



Defense R&D, after reaching a plateau earlier this decade, has declined in recent years. The President's request would accelerate this trend. Defense R&D is composed of two sources: DOD – which spent roughly $133 billion on R&D in FY 2013 after sequestration – and the Department of Energy's (DOE) atomic defense activities, primarily the National Nuclear Security Administration. DOE defense R&D stood at roughly

$4.1 billion in FY 2013 after sequestration. There have been two clear periods of defense R&D buildup over the past 35 years, both followed by relative declines: the aforementioned Reagan defense buildup in the 1980s, and in the immediate aftermath of September 11. In both cases, DOD and DOE defense R&D followed similar trajectories of growth and decline, though they have begun to diverge recently.

For DOD R&D, nearly all increases between 2000 and 2008 were in weapons systems development, "6.4" or higher in the DOD R&D classification system (see Chapter 5 for details). DOD's science and technology investments – in basic research ("6.1"), applied research ("6.2"), and early technology development and testing ("6.3") – peaked in 2005, and have been on a downward trend since then. However, the relative reductions have been much greater for weapons development. The President's budget would continue the downward trend in defense R&D overall and in weapons development, while DOD's science and technology accounts would receive a smaller reduction, and basic research specifically would grow. Lastly, in recent years DOE atomic defense R&D has been showing growth, in part to allow the Administration to fulfill the responsibilities prescribed in the New START nuclear arms reduction treaty. The President's request would accelerate these funding increases and put DOE defense R&D at its highest point since FY 2004.

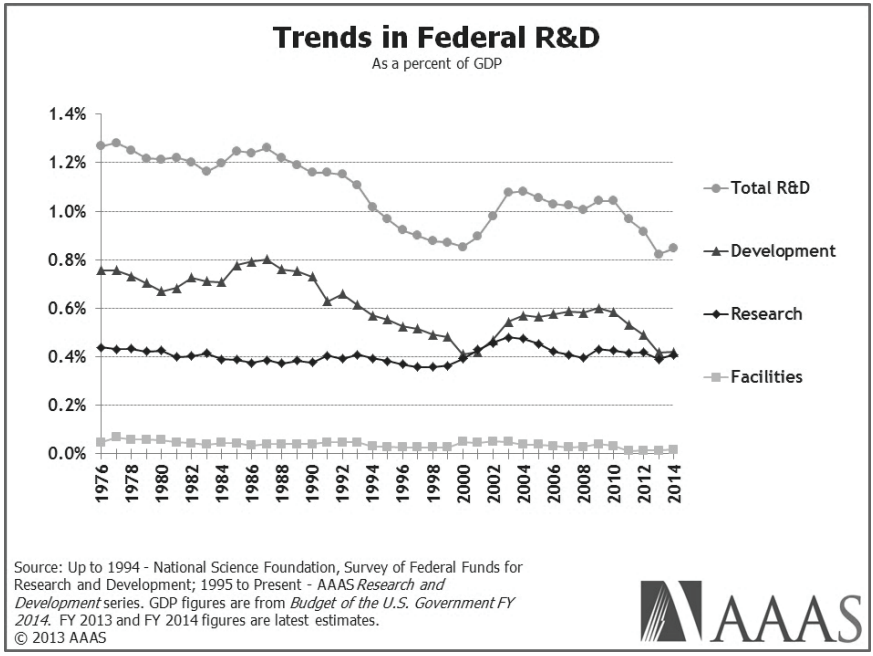
At the agency level, many long-term trends would continue. While agency R&D budgets fluctuate annually, clear trends emerge when comparing across multiple years. The Administration's budget would in large part follow these longer-term trends. As mentioned above, NIH funding increased by more than 80 percent in real dollars between 1998 and 2003. Since then, funding has either remained flat or slightly declined in most years (excepting the Recovery Act boost), and the Administration's budget would again hold NIH funding below inflation, representing a real-dollar decline. Conversely, National Science Foundation (NSF) funding has steadily increased since 1998, in some years significantly, and this trend would likewise continue under the President's 2014 budget. NSF R&D funding in FY 2014 would be approximately 78 percent higher than in 1998, representing the largest relative increase for any agency over that period. The long-term trend at DOE's Office of Science has also been positive, though not as positive as NSF's, especially in recent years, and the Administration's budget would seek to return the Office of Science to a growth trajectory. NASA would also see a continuation of relatively flat budgets under the request, while the

Department of Homeland Security and the National Institute of Standards and Technology appear set to continue R&D gains of recent years.

There are some points of divergence from the historical norm, however. Most notable, perhaps, would be the growth in intramural and extramural R&D funding at the U.S. Department of Agriculture, which has lost substantial ground over the past decade. The President's budget also stakes out R&D increases for the U.S. Geological Survey and the National Oceanic and Atmospheric Administration, both of which have experienced their share of cuts since FY 2000.

The Administration's budget would not counteract the long-term decline in federal R&D investments as a share of U.S. gross domestic product (GDP). In spite of the real-dollar growth described above, federal research investments are shrinking as a share of the U.S. economy, as shown in Figure 3. Gains in the NIH budget and defense R&D increased the ratio briefly in the first years of the 21st century, but the long-term trend is clearly downward. While the Administration's budget would start to reverse this decline, failure to lift the post-sequestration discretionary

Figure 3. Trends in Federal R&D as Percent of GDP



spending caps would almost certainly force federal R&D below 0.8 percent of GDP, the lowest point since at least before the space race. Put another way, if federal R&D had kept up with GDP growth since the early 1980s, the federal R&D budget would today surpass $200 billion.

It is true that some of this decline has been offset by increasing R&D investment from the private sector, but it is also true that private sector R&D tends to be more focused on short-term returns, and thus does not offer the same potential for breakthrough discoveries as the more radical research the government is able to pursue. Whatever the composition, private industry will frequently tend to underinvest in R&D, given the nature of private versus social returns to R&D and the difficulty for individual firms to capture the returns on their research investments. Lastly, it is also important to remember that even as U.S. investments in public R&D have declined as a share of the broader economy, other nations have accelerated their own investments in research over the past few decades. As a result, R&D growth as a share of GDP has been far more rapid elsewhere, particularly in Asia.[2]

2 See NSF's *Science and Engineering Indicators 2012* for additional information.