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2009 Global R&D FUNDING FORECAST Update

Making Sense of 2009's R&D Changes

A recession, stimulus, new administration, continuing resolutions, and globalization effects have altered the picture of R&D spending from just six months ago.

For the past 51 years, the editors of *R&D Magazine* have created an annual R&D funding forecast at the beginning of each year to document R&D spending in government, industry, and academia. This forecast was expanded in 2008 to include a global analysis, which was published in the December 2008 issue.

In just the past six months, however, multiple external forces have affected the accuracy of that 2009 forecast. The American Recovery and Reinvestment Act of 2009 (ARRA), for example, was signed in mid-February and adds more than \$18 billion of government funds to the R&D coffers. The recession has also deepened measurably over the past six months, with notable R&D effects in automotive, biopharm, computer, and other industries. And then, the Omnibus Budget Resolution completing the FY 2009 federal budget process was also finalized and signed in March, while the Obama administration recently submitted its first federal R&D budget proposal (FY 2010) in May.

In the following article, these effects are

evaluated in terms of the U.S. R&D funding forecast, the global picture, and the ARRA's short-term and long-term effects on R&D.

U.S. R&D changes

The results of an Industrial Research Institute (IRI) survey "R&D Trends Forecast for 2009," conducted in the summer of 2008 and aimed at assessing R&D plans for 2009, revealed a behavior quite different from that which had been expressed in recent years. While the previous five years indicated that both R&D spending and investment in R&D facilities were increasing monotonically, the anticipation for 2009 was generally much less optimistic. To be sure, recent years' results indicated increases in facilities and performance that were slightly greater than rates of inflation. However, the weighted result of the latest survey revealed that expectations for 2009 were, at best, barely keeping up with inflation.

Furthermore, the so-called "Sea Change Index" showed a marked decrease in the number of respondents who anticipated increased investment in capital equipment for R&D.

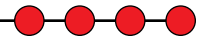
While there were expectations relative to the overall investment in R&D performance and facilities, it's instructive to examine the changes in emphasis within the R&D menu

of the participating survey respondents. For more than a decade, the emphasis has consistently been placed on new business projects, with slowly declining shares on the support of existing businesses and on directed basic research. However, for the first time since 2002, there is a decline in the anticipated growth rate of effort directed toward new business. In brief, the results of this part of the survey indicate a greater degree of caution relative to the near-term execution of long-term plans.

Other indicators of changing patterns in industrial R&D are seen in the expected slowdown in the growth of professional staff, and the hiring of new graduates, and in the outsourcing of R&D. Each of these measures appears to be in response to the need to control costs while maintaining core competencies in preparation for future business 'turn-arounds.'

Reader survey research

In early 2009, an additional survey was directed to the readership of four Advantage Business Media (ABM) publications whose audiences have distinct perspectives on the world of R&D, namely the readers of *R&D Magazine* (RD), *Laboratory Equipment Magazine* (LE), and *Drug Discovery & Development* and *Bioscience Technology* (life



science publications, LS). The emphasis in these surveys was directed at anticipations relative to near-term changes in R&D support and the impact of the economic stimulus packages that have been proposed and implemented by the federal government.

Overall, approximately 20% to 35% of all respondents expect cuts in the 2009 R&D budget by more than 10%. The variations among the respondents are suggested to be indicators of the differences between specialized high-tech, bio-related companies (the LS group) and the broader multiple-disciplined (RD) clientele. To be sure, the majority of all groups expected some significant decreases, including budget cuts in real (inflation-adjusted) dollars. However, there are two additional features that stand out:

- Approximately one-third of all respondents opined that there would be no changes in their R&D budgets, and
- Only a small percentage felt that the economic stimulus package would have a significant effect upon their R&D budgets.

Of those who expected that the stimulus package would result in 1% to 5% increases in R&D budgets, the Life Sciences group was the most optimistic, certainly a reflection of the general emphasis (by government and industry alike) that has been given to the field over the past several years.

Some of the opinions and expectations of the survey respondents raise questions relative to the manner in which short-term economic stimulus packages will have significant effects on the research community as a whole.

While not being critical of the general approach toward revitalizing and jump-starting the economy, the survey responses indicate that the nature of R&D is such that the program would have relatively little impact, with one possible exception: the acceleration of initiatives in capital equipment acquisition.

The distinction is that such equipment falls into the category of “shovel-ready” activities—something that is already specified, designed, and constructed, merely waiting for sale. On the other hand, the conduct of much R&D is an entirely different matter, except at the latter stages of applied research and of development (e.g., clinical trials,

sharpening of specifications, and adding “the fine touches”).

Perhaps the most consistent and popular response to the issue of the stimulus package is the note that additional support will be required in subsequent years, and that the one-time infusion of funds could be necessary, but not sufficient.

Not unexpectedly, academic response to the package is mixed: delighted to have the additional funding (stated in light of decreased funds from industry), but concerned over the short time frame over which the stimulus funds are to be spent.

For the most part, the survey respondents do not expect that the stimulus package, as presently designed, would provide much in the way of benefits to the R&D activities of their organizations.

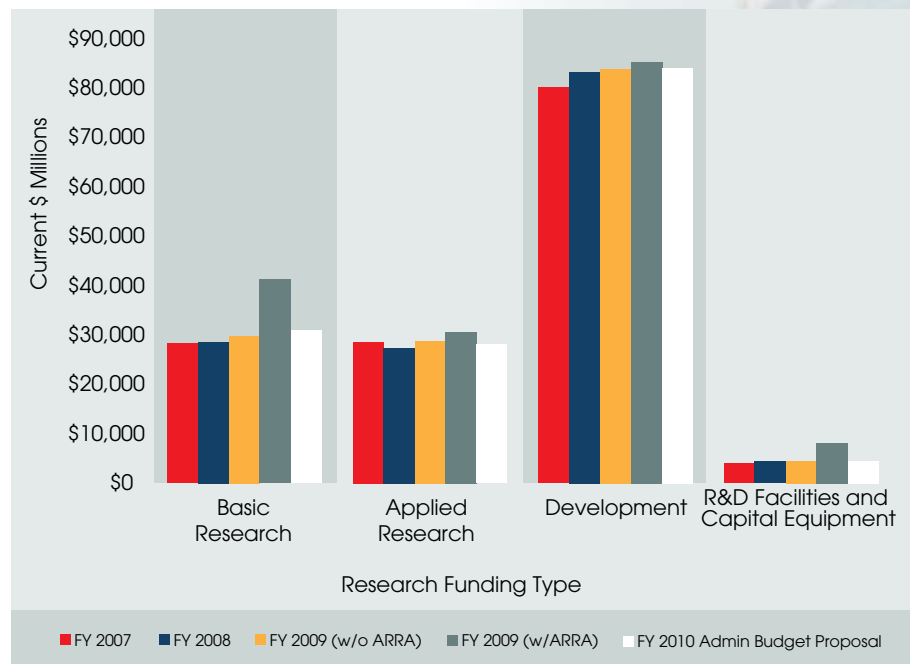
It should come as no surprise that the survey respondents’ viewpoints and experiences are consistent with the expectations raised in the IRI survey (taken nine months earlier). Approximately half of the ABM survey respondents have reported budget cuts, hiring freezes, and increased cost-savings efforts; about a third have experienced

project cancellations, staff reductions, and increased workloads; outsourcing has been reduced in about 14% of the cases—although increased in 5%; and about a fourth of the respondents note salary freezes, budget freezes, and reorganizations.

Among the three classes of survey respondents, there is general agreement that economic recovery will progress markedly in the fourth quarter of 2009 and be largely attained by the end of the third quarter of 2010. Based upon past experiences and observations of earlier slow-downs (and reversals) in R&D spending, this pattern of behavior suggests that the recovery in R&D spending will be evidenced in the first half of 2011. To the extent that this is a reasonable expectation of reaction to general economic conditions, the current and near-future trough in spending would not last as long as other similar past slow-downs and/or reversals.

There is a considerable amount of mention in the media regarding the need for sustainability of funding in R&D, and the manner in which additional stimulus and budget-expansion programs will continue to

Recent Federal R&D Investments/Plans, FY 2007–FY 2010



Source: Battelle/R&D Magazine with data from AAAS and OSTP

Basic research will see the most significant “blip” in funding in 2009 due to stimulus funds, seeing more than a 35% one-year increase.

advance the state of science and technology and the nation's economy.

However, a companion consideration must be given to the issue of sustainability of the kinds of support and activity that evolve from special funding packages. The America COMPETES Initiative of 2007, for example, has many of the characteristics of the R&D doubling of the National Institutes of Health (NIH) budget from the FY 1998 to FY 2002 budgets. As a consequence of this impetus, considerable advances were made in both the training of new researchers and practitioners and the development of better understandings of basic biomedical phenomena.

However, at the end of this extended stimulus package there came a period where research funding returned to approximately what it would have been as an extrapolation of historical behavior. The "blip effect" resulted in a significant reduction in the number of research proposals that could be supported through the normal peer-review process.

Researchers who depend upon the NIH for their basic research support will feel the early impact of the stimulus package. The immediate infusion of additional funds into the NIH budget will have the effect of adding new projects and new support activi-

ties over a very short period of time—and influence the overall government support of R&D.

The good news for the medical research community is that the support will be forthcoming in the very near future—from Feb. 2009 to Sep. 2010. The bad news is that this short-term augmentation of funds may again turn out to be a non-sustainable spurt, thus merely postponing the next round of frustrating minimal increases in government research funding.

In spite of the fact that many companies are reducing their R&D expenditures, as noted in the ABM survey, there are still two themes that pervade the industrial R&D picture.

First, there is the realization that R&D is not a product, but a process: it is not a production line commodity that can be readily turned off and turned on with only short-term consequences in terms of inventories. To the contrary, it's an activity that can influence the long-term competitive position and survival of an enterprise.

Second, much research is undertaken in a manner similar to a marathon race: a long and oftentimes arduous journey that does not allow even a brief hiatus lest a slower competitor might pass on the way to an earlier finish.

Indirect R&D Impacts of ARRA Investments

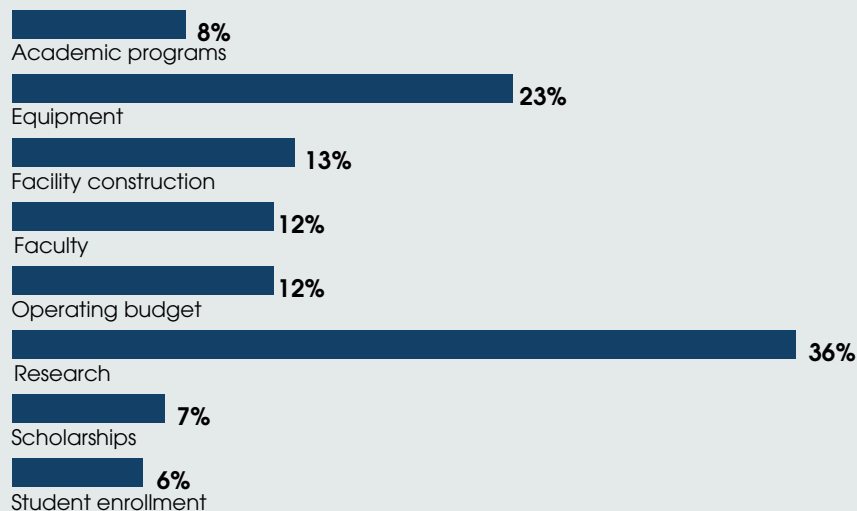
While the direct federal R&D investment within ARRA amounts to \$18.34 billion, the impact of other ARRA funding may also play a role in U.S. R&D efforts. Assuming a direct relationship between "purchases" and GDP, the investments of at least \$113 billion for physical and environmental infrastructure, and new (non-research) facilities will generate approximately \$5 billion in additional non-federal R&D or a potential 1.8% indirect increase in industrial R&D.

Within this context, strong research-intensive industries are continuing to fund critical R&D programs, recognizing that the present economic situation will not last forever. They are positioning themselves to build and maintain the "just-in-case" capacity and pipeline of knowledge, practice, and flexibility, and to thus be in a "just-in-time" position when new products or processes are ready for launching.

For example, Daimler has adopted the posture that the R&D budget will be positioned to take advantage of the "good times to come" after market rebound. Similarly, Germany's top software maker SAP plans to keep investment in R&D relatively stable to weather what it calls the worst economic crisis since the 1930s. Furthermore, 3M CEO George Buckley noted, "In these extraordinary times, 3M employees around the world are energized by the challenges ... and are steadfastly committed to building for the future. In 2009, we will ... [maintain] a significant investment in R&D. Our strategy will strengthen the company and position us for even greater success when global economies recover."

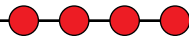
In keeping with the philosophy that R&D is important to maintain or create the tools for long-term survivability, it's important to note a recent investigation by *The Wall Street Journal* in which a large number of technology companies—with few exceptions—made relatively few cuts to their

Where Will Academics Apply Stimulus Funds?



Source: R&D Magazine

Academics, who are more likely to receive stimulus funds than industrial or government researchers, expect to spend about three-quarters of the funds on research-based items.



most recent quarterly R&D budgets, as compared with the same period a year ago. In addition, a survey undertaken by the *Minneapolis/St. Paul Business Journal* revealed that “the economic downturn has Minnesota companies trimming their budgets, but many are leaving one line item intact: R&D spending.”

The same theme—preparation for the good times—continues to hold forth. However, at the other end of the spectrum, both Motorola and Toyota have announced significant decreases in their R&D budgets for 2009.

The International Scene

The global recession has affected the level of R&D spending in most countries to obviously different degrees. Citing economic effects, the world’s largest auto manufacturer, Japan’s Toyota, recently announced that it would cut its expected \$9 billion in 2009 R&D spending by about 11% to \$8 billion.

The online version (<http://www.rdmag.com/pdf/2009GlobalFundingForecast.pdf>) of the Gross Domestic Expenditure on R&D (GERD) chart (Dec. 2008, page 5) listing the top 40 countries in the world in terms of their R&D spending has been adjusted to reflect the recession effects on R&D spending. Most of these effects are attributed to industrial cuts, since most government R&D funding is being maintained (and in some cases augmented with one-time stimulus packages similar to the U.S. ARRA program).

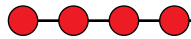
As a result, those countries with a higher ratio of industry-supported R&D vs. government-supported R&D (such as Germany with 68% industry and 28% government R&D funding) will see the largest adjustments. Overall, the top 40 countries account for about 85% of all R&D spending in the world. The total R&D spending estimate for these 40 countries changed from \$1.143 trillion in the Dec. 2008 forecast to \$1.125 trillion in the current forecast—an increase of only 1.6% from the \$1.108 trillion spent in 2008 (in comparison to the originally forecasted 3.2% increase).

As a result of these adjustments, there were two changes in the overall rankings—# 22 Belgium and # 23 Mexico exchanged places. An interesting effect of these adjustment—mostly down except for some Asian countries—was that while the absolute value of R&D was adjusted downward from the original forecast, the values for R&D spending as a function of the countries’ GDP (gross domestic product) actually rose—a result of the GDP falling faster than the R&D values. The GDP for those countries is expected to drop about 2.8% overall for 2009 (neglecting China and India

Changes in Direction

Conventional wisdom has led to the observation—or perhaps mostly conjecture—that R&D spending is closely related to business volume and profitability. To be sure, there are correlations that would lead one to expect that the recent general economic news and the behavior of the stock market would result in the reduction of all manner of expenses, including R&D. And conventional wisdom also leads many to look at R&D as being an expense (which it very well may be for short-term activities), rather than an investment (which it is for the next generation of processes or products).

However, there is selected evidence in the current R&D environment that “conventional wisdom” is neither conventional nor wise.



effects), per current forecasts by the International Monetary Fund (IMF).

While most Asian countries' GDP values are expected to drop in 2009, the drops are from elevated levels in 2008 and, as a result, China and India will still see substantial growth in 2009 (7.5% and 5.5%, respectively—down from double-digit levels in 2008).

There are exceptions on how economic recoveries are being supported. Canada, for example, contrasts the U.S. stimulus package (ARRA) and its orientation toward R&D with their own "stimulus budget" that is said to cut the Natural Sciences and Engineering Research Council's budget by 5%. Canadian research has gone through several ups and down in the last two decades. Underfunded during the Jean Chrétien government's early deficit-busting years, its funding increased dramatically in the late-1990s. But after the peaks of the early 2000s, funding has been somewhat flat under the Tories. Canadian government funding for science and technology—63% of which goes to R&D—was set to decline 3% in Aug. 2008/09 from the year before. It would be the first decline in five years. Canada's R&D investment as a percentage of GDP has also declined, going

to 2.08 in 2004 to 1.88 in 2007.

On the other hand, China continues to be very aggressive in its support of R&D. The Chinese government currently has plans to:

- implement plans to restructure and reinvigorate key industries.
- improve the country's capacity for independent innovation.
- accelerate development of high-tech industries and equipment manufacturing.
- take more effective measures to support development of small and medium-sized enterprises.
- work to resolve transportation bottlenecks and continue to upgrade its energy infrastructure.

China's investment in its Guangdong region, for example, is impressive: About 100 state laboratories for engineering innovation and R&D will be established over the next three years in this area and the goal is that by 2012 it will have three to five industrial clusters powered by high-technology that will generate nearly \$15 billion in industrial output. By 2012, R&D expenditure will account for 2.5% of the region's annual GDP.

Europe, alternatively, is drifting further behind the U.S. in R&D funding, according

to a recent study. The study shows that the EU may never close the research gap with the U.S. if it fails to boost investment in the services sector. The study also shows that the EU is likely to fall short of achieving the Lisbon Strategy goal of investing 3% of GDP on research by 2010.

Impact of stimulus investments

Federal R&D budgets have experienced some "unique" growth thus far under the Obama administration and the 111th Congress. Though the stimulus act/supplemental (ARRA) was signed into law first, this update will turn to the FY 2009 final budget first.

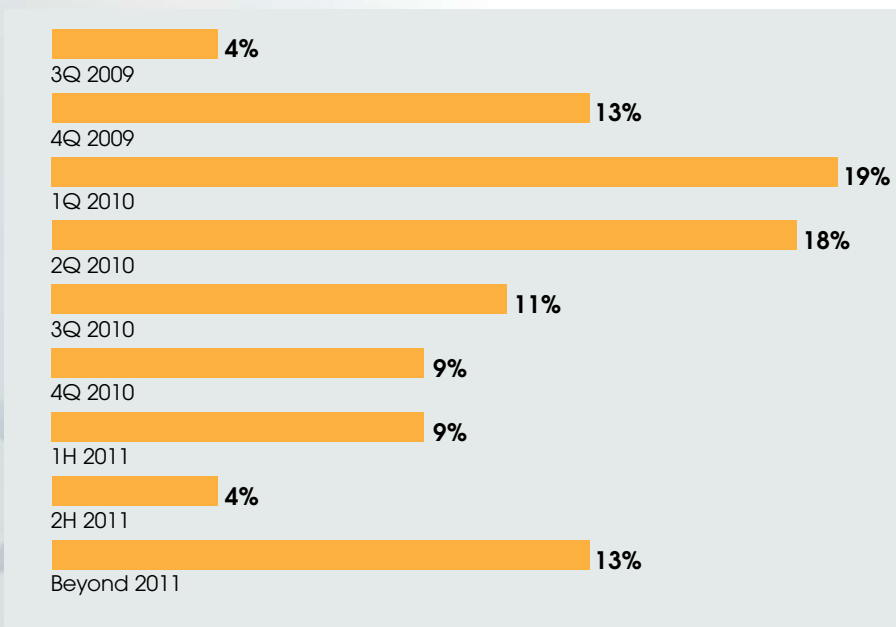
According to data developed by AAAS and OSTP, the overall federal R&D budget increased by 2.3%—from \$143.7 billion in FY 2008 to \$147.1 billion in FY 2009. Those agency budgets completed in March under the Obama administration and the 111th Congress did slightly better (budgets for the Dept. of Defense (DOD), Homeland Security, and Veteran's Affairs were completed under the Bush administration/110th Congress), receiving an average 3.0% increase. With 2009 inflation estimates in the 1.5 to 2.0% range, the final FY 2009 federal budget for R&D (excluding the ARRA) leads to a slight (around 1.0%) real increase over FY 2008 (similar to recent years).

In terms of actual funding, both DOD and the NIH received increases of more than \$1 billion from FY 2008 to FY 2009—DOD received a \$1.34 billion increase and NIH received a \$1.2 billion increase. The Dept. of Energy (DOE) received an increase of \$814 million over its FY 2008 budget to reach \$10.62 billion in total R&D funding. The National Science Foundation (NSF) received a 6.0% increase of \$277 million to \$4.86 billion in FY 2009.

NASA was the only agency to see a decline in its FY 2009 R&D budget (in current dollars) from FY 2008 levels. This decrease of \$781 million (-7.0%) is primarily due to cuts in astrophysics and heliophysics research, aeronautics research, and some advanced exploration capabilities. However, the total NASA budget received a 2.2% increase in FY 2009.

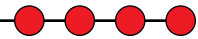
While all of the remaining federal agencies received R&D funding increases over FY 2008, in total these increases amounted to

When Will Economic Recovery Occur?

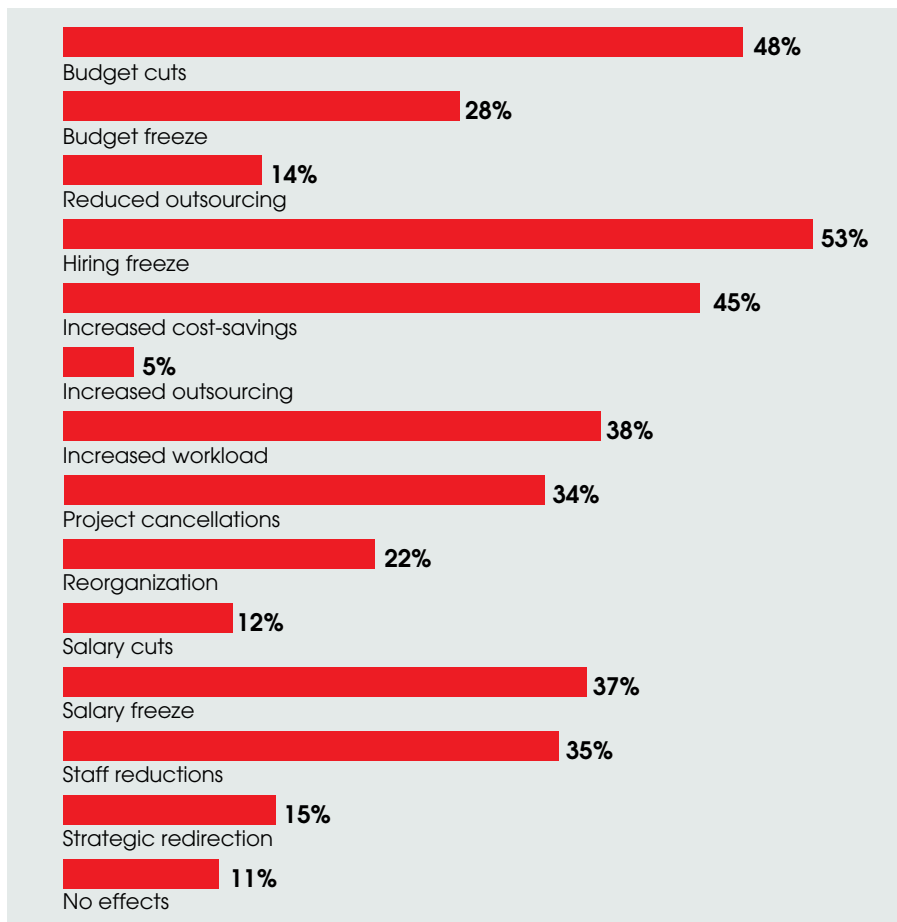


Source: R&D Magazine

Most researchers expect the economic recovery to occur in the spring of 2010. More than a quarter of the survey respondents feel it won't occur until 2011.



How Has the Recession Affected Your Company?



Source: R&D Magazine

Cost-cutting measures have dominated the effects seen by researchers as a response to the current deep recession.

\$521 million additional dollars, with budgets totaling \$9.16 billion in FY 2009. Two departments, Commerce and Homeland Security, did receive double-digit increases over FY 2008—increasing by 11.4% and 10.2%, respectively.

R&D and the ARRA

Amidst the traditional budget process, R&D efforts (to the surprise of many observers) were also included within the ARRA at a funding level of \$18.34 billion (amounting to 2.3% of the overall stimulus investment). Of these funds, \$14.69 billion directly funds R&D efforts and \$3.64 billion is provided for R&D facilities and capital equipment. The importance of the “stimulus” effect of construction and capital expenditures cannot be overstated—at \$3.64 billion, the ARRA alone provides an amount

equal to approximately 80% of recent years’ facilities and equipment budgets.

Four agencies (NIH, NSF, DOE, and NIST) account for 88.1% of the ARRA R&D investment. Overall, NIH is the big R&D winner within the ARRA, accounting for \$10.4 billion or 56.7% of the total ARRA R&D investment. Investments related to the basic research agenda of the America COMPETES Act of 2007 also see significant funding from ARRA—accounting for an additional 31.4%. The NSF received \$2.90 billion or 15.8% of the ARRA R&D funding. It’s interesting to note that this additional amount equals nearly 60% of the base NSF FY 2009 R&D budget. The DOE received \$2.45 billion or 13.3% of the ARRA R&D funding, with this amount increasing its available FY 2009 R&D funding by 23.0%.

Finally, NIST received \$410 million in ARRA R&D funding. While only accounting for 2.2% of the total ARRA R&D funding, this amounts to 74.5% of the base FY 2009 R&D budget for NIST.

NASA received \$925 million in ARRA R&D investment, primarily in the areas of science and exploration. However, approximately \$150 million of these ARRA funds for NASA are also for aeronautics research, one of the areas seeing a decrease in funding under the base FY 2009 R&D budget.

Overall, including the ARRA investment, federal R&D budgets for FY 2009 reach \$165.4 billion or an increase of 12.5% over base level FY 2009 R&D funding. At the current annual growth rate of 2.3% (FY 2008 to FY 2009) this level would be reached, on base level R&D funding only, in slightly more than five years.

Given the recent release of the FY 2010 budget proposal from the Obama administration, the ARRA is indeed viewed as a one-time stimulus with limited, to no visible impact on the FY 2010 budget planning—as overall R&D funding is currently slated for a modest 0.4% increase from non-stimulus FY 2009 to FY 2010 levels. Though it’s too early to truly understand the ultimate FY 2010 budget, from the president’s initial perspective most federal agencies’ R&D budgets will return, in general, to the growth path followed from FY 2007 to FY 2009. This is potentially an early indication that these stimulus investments and the R&D levels obtained with them will not be renewed ... at least in the near term.

Note: Various charts have been updated in the online version of the “2009 Global R&D Funding Forecast” published in the Dec. 2008 issue of R&D Magazine. For updated information go to: www.rdmag.com/pdf/2009GlobalFundingForecast.pdf.

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