SUBCOMMITTEE ON SPACE AND AERONAUTICS
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

Spurring Economic Growth and Competitiveness Through NASA Derived Technologies

Thursday, July 12, 2012

10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

NASA is often considered an incubator for technology development, and history has shown a vast array of technologies that owe their start to NASA programs. Despite decades of demonstrated success, federal investment in NASA remains essentially flat even as other R&D agencies are seeing increases. Furthermore, investment in NASA's technology transfer activities has seen a drastic decline in recent years.

The purpose of this hearing will be to examine the direct economic and societal benefits that investments in NASA have generated and highlight those areas where continued investments could help stimulate the pipeline for future economic growth.

Witnesses

- **Dr. Mason Peck,** NASA Chief Technologist
- **Mr. George Beck,** Chief Clinical and Technology Officer, Impact Instrumentation, Inc.
- **Mr. Brian Russell,** Chief Executive Officer, Zephyr Technology
- **Mr. John Vilja,** Vice President for Strategy, Innovation and Growth, Pratt & Whitney Rocketdyne
- **Dr. Richard Aubrecht,** Vice President, Moog, Inc.

Background

The National Aeronautics and Space Act of 1958 established NASA as the leading agency for aeronautical and space sciences, and specifically directed that the new agency would "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."[1] Since then, NASA has developed innovative technologies that are ubiquitous to daily civilian and military life in the United States – and even the world. Besides

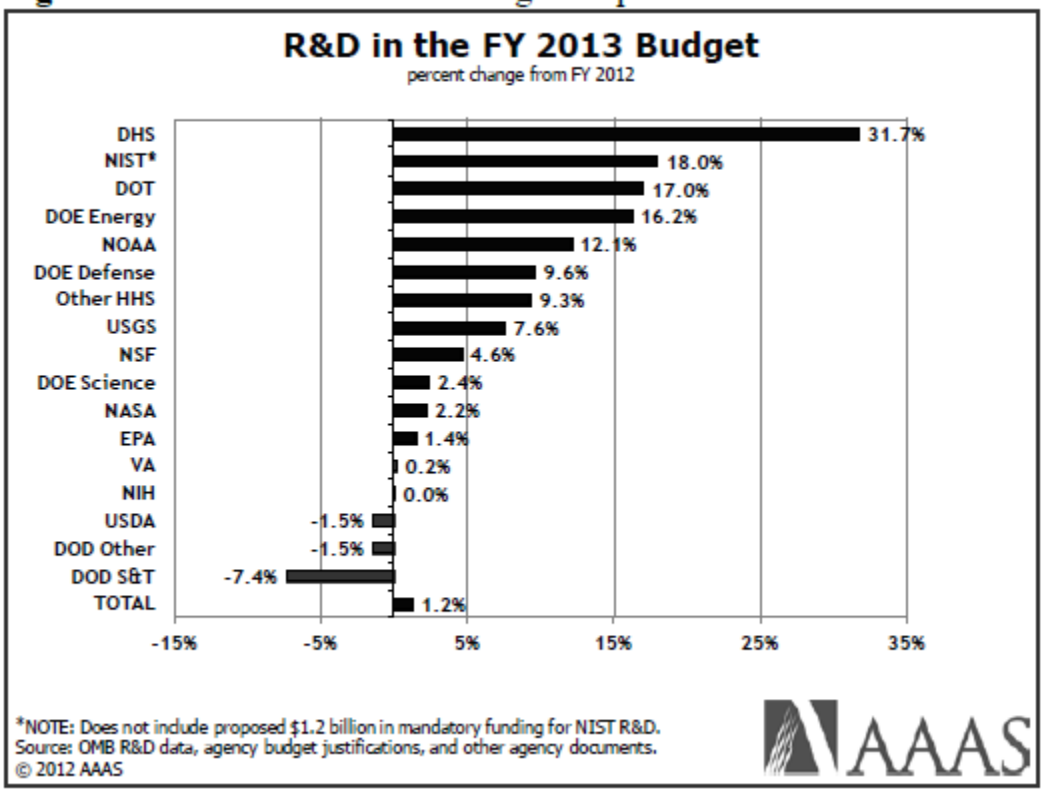
[1] http://history.nasa.gov/spaceact.html

being the global leader in advanced aircraft and spacecraft design, NASA technologies have paved the way for advances in the medical field, environmental stewardship, and public safety.

The Stevenson-Wydler Technology Innovation Act of 1980 and the Federal Technology Transfer Act of 1986 also support NASA's technology transfer activities. Each mandate the promotion of federally-funded research and technology transfer to the commercial sectors, and state and local governments. They also grant authority to Government-owned and Government-operated laboratories to enter into cooperative research and development agreements with the private sector and with academia.

On October 28, 2011, President Obama issued a memorandum entitled, "*Accelerating Technology Transfer and Commercialization of Federal Research in Support of High Growth Businesses*," requiring all Federal agencies to identify opportunities for, and plan transitions to, increase the number of technology transfer and commercialization activities. [2] As the chart below demonstrates, however, funding for research and development at NASA is barely keeping pace with inflation – even as other agencies are reaping the benefits of increased investments.

Figure 4. R&D in the FY 2013 Budget Request



[3]

[2] http://www.whitehouse.gov/the-press-office/2011/10/28/presidential-memorandum-accelerating-technology-transfer-and-commerciali

[3] AAAS Report, Federal Research &Development FY 2013, p. 14

It should be noted that the FY 2013 budget request for the Space Technology Directorate was $699 million, an increase of $125.3 million. The SBIR and STTR programs are required by federal law to represent a base percentage of R&D (currently 2.7% for FY 2013). The Partnership Development and Strategic Integration Program – central to carrying out the agency's technology transfer and commercialization efforts – would receive only $29.5 million.

	Actual	Estimate		Notional			
Budget Authority (in $ millions)	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**FY 2017**
FY 2013 President's Budget Request	**456.3**	**573.7**	**699.0**	**699.0**	**699.0**	**699.0**	**699.0**
SBIR and STTR	164.7	166.7	**173.7**	181.9	187.2	195.3	206.0
Partnerships Dev & Strategic Integration	26.6	29.5	**29.5**	29.5	29.5	29.5	29.5
Crosscutting Space Tech Development	120.4	187.7	**293.8**	272.1	266.6	259.7	247.0
Exploration Technology Development	144.6	189.9	**202.0**	215.5	215.7	214.5	216.5

Office of Chief Technologist

The Office of Chief Technologist (OCT) manages NASA's Space Technology programs and coordinates and tracks all technology investments across the agency. The office is also the primary point of contact with other government agencies and outside entities and is responsible for managing innovative technology partnerships, technology transfer and commercial activities. There are four programs that support the transfer of technology:

- The Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) Programs – which apply to all federal departments and agencies - were established by Congress in 1982 to aid small and disadvantaged businesses to partner with federally funded research and development programs.
- The Crosscutting Space Technology Development Program focuses on developing capabilities that advance future space missions.
- The Exploration Technology Development Program focuses on advancing the development of technologies to enable human missions.
- The Partnership Development and Strategic Integration Program provides for the transfer and commercialization of NASA-developed technologies, coordinates interagency technologies, and manages intellectual property rights. This program also seeks out opportunities for partnership with other government agencies and industry.

While the first three of these programs seek to identify and develop technologies specifically to meet agency mission objectives, the fourth program seeks to push NASA-derived technology out into the private sector. The Innovative Partnerships Office (IPO), part of the Partnership Development and Strategic Integration Program, seeks to promote innovative partnership opportunities to commercialize technology that can be transferred from NASA's programs and projects. Each NASA Center also has an IPO and a Chief Technologist that work directly with OCT.

It should be noted that the SBIR/STTR programs – while focusing on technologies that can be infused into NASA's missions – have consistently yielded spinoff technologies into the private

sector. As a result, approximately 30% of all spinoff technologies reported by NASA over the last decade can be attributed to SBIR/STTR partnerships.

NASA Inspector General Report on Technology Transfer

In March 2012, the NASA Inspector General issued an *Audit of NASA's Process for Transferring Technology to the Government and Private Sector*. The report concluded:

> NASA has missed opportunities to transfer technologies from its research and development efforts and to maximize partnerships that could provide additional resources, and industry and the public have not fully benefited from NASA-developed technologies.[4]

For example, the primary tracking mechanism for reporting potentially transferrable technologies is through New Technology Reports (NTRs). NTRs are submitted by NASA employees and contractors who develop new technologies and are reviewed by the IPO and Patent Counsel to determine their technical merit. But as the table below highlights, NASA's ability to adequately process NTRs and consequently move promising technologies forward has been declining. The table notes that despite having over 1,800 NTRs filed in FY 2011, the number of patents filed was only 82 (contrasted to FY 2004 when only 585 NTRs were submitted yielding 131 filed patents).

Table 3. NASA NTR and Patent Filing Status at the End of Each Fiscal Year and Fiscal Year Technology Transfer Funding Levels

Fiscal Year	Cumulative NTRs under Evaluation	Cumulative NTRs Awaiting/ Preparing Patent Application	Patent Application under Prosecution	Patent Filed	Technology Transfer Funding (million)
2004	585	6	20	131	$60.00
2005	654	6	28	135	$45.30
2006	725	7	41	127	$38.25
2007	844	11	81	109	$26.60
2008	1,017	14	140	117	$38.10
2009	1,493	26	322	115	$23.60
2010	1,504	30	296	98	$20.54
2011	1,878	34	372	82	$20.54

[4] *Audit of NASA's Process for Transferring Technology to the Government and Private Sector*, IG Report No. IG-12-013, March 1, 2012, p. iv

As demonstrated above, the percentage of NASA's overall budget for technology transfer funding has steadily declined. According to the NASA IG:

> Since fiscal year 2004, funding for NASA's technology transfer efforts has decreased by 68 percent, from $60 million in 2004 to $19.2 million in FY2012 [from within the Partnership Development and Strategic Integration funding line]. In addition, personnel resources dedicated to the technology transfer effort have similarly declined. For example, since FY 2003 the number of patent attorneys at the Centers has dropped from 29 to 19 and Headquarters IPO staff has decreased from 13 in FY 2010 to just 2 in FY 2012.[5]

The IG provided recommendations to the NASA Chief Technologist to improve NASA's technology transfer and commercial efforts. Specifically, the Chief Technologist should:

- Implement procedures to ensure appropriate personnel are held accountable to the [NASA] requirements
- Provide relevant periodic training to NASA personnel
- Reassess the allocation of resources for technology transfer
- Coordinate with the Chief Engineer to ensure NASA Policy Requirements emphasized the importance of developing Commercialization Plans
- Coordinate with the General Counsel to ensure NTRs are accessible to NASA project managers and innovators as appropriate

The Chief Technologist concurred with the IG recommendations and is currently undergoing evaluations and implementing changes to improve the policies governing technology transfer and the training necessary to ensure Agency employees and contractors are following procedures to maximize effectiveness.

NASA Spinoffs

NASA defines a spinoff as "a commercially available product, service or process that takes NASA-related technology and brings it to a broader audience."[6]

Since 1976, NASA has documented successful examples of technology transfer and commercialization in its annual *Spinoffs* publication. Over 1,750 case studies have demonstrated the tremendous economic and societal benefits that have been generated in fields as diverse as computer technology, manufacturing, health and medicine, public safety, consumer goods, and energy conversion and use.

Examples from the most recent publication, *Spinoffs 2011* include:

- ***Impact Instrumentation, Inc., West Caldwell, New Jersey***. Drawing on the expertise of Johnson Space Center space medicine experts under the auspices of a Space Act Agreement, Impact Instrumentation Inc. made advances in medical ventilator technology

[5] IG Report No. IG-12-013, March 1, 2012, p. iii
[6] *Spinoff 2010*, Forward, p. 7

now incorporated into emergency medical solutions for soldiers and civilians around the world.

- ***Zephyr Technology, Annapolis, Maryland:*** Through a Space Act Agreement with *Ames Research Center*, Zephyr Technology worked with NASA physiology experts on motion sickness experiments, resulting in improvements to the company's wearable vital-sign monitors. Zephyr's monitors are now used to monitor the health and fitness of soldiers, first responders, pro athletes, and average consumers looking to get in shape. The company sells thousands of its U.S. manufactured NASA-enhanced products each month.
- ***Pratt & Whitney Rocketdyne, Canoga Park, California***: The Space Shuttle Main Engine was designed under contract to NASA by Rocketdyne, now part of Pratt & Whitney Rocketdyne (PWR). After working with *Marshall Space Flight Center*, PWR used its rocket engine experience to make clean energy gasification technology with 10-20 percent lower capital costs and a 10-percent reduction in carbon dioxide emissions, compared to conventional technology.

NASA's Technology Commercialization Policy

NASA has established formal procedural requirements for technology commercialization. Accordingly, NASA project managers must consider commercialization potential early in the project's life cycle and, where appropriate, develop a Technology Commercialization Plan and strategy for achieving that potential. The policy outlines considerations for the commercialization plan, including pursuing partnerships, cooperative agreements and Space Act Agreements. In addition, the policy requires that new technologies and inventions and resulting success stories must be reported.

The policy provides specific and detailed guidance to NASA program and project managers related to formulating, approving, implementing, and evaluating their technology commercialization activities. Specifically, "NASA managers are challenged to use their expertise and apply innovative techniques to ensure that the technological assets (technologies, innovations, facilities and expertise) from their activities have maximum commercial application."[7]

[7] NASA Procedural Requirements 7500.1, "NASA Technology Commercialization Process w/Change 1 (4/9/04)" http://nodis3.gsfc.nasa.gov/npg_img/N_PR_7500_0001_/N_PR_7500_0001_.pdf, p. 9-10