



ACCELERATOR R&D: RESEARCH FOR SCIENCE – SCIENCE FOR SOCIETY

<http://www.acceleratorsamerica.org/report/index.html>

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Why do we talk about it?

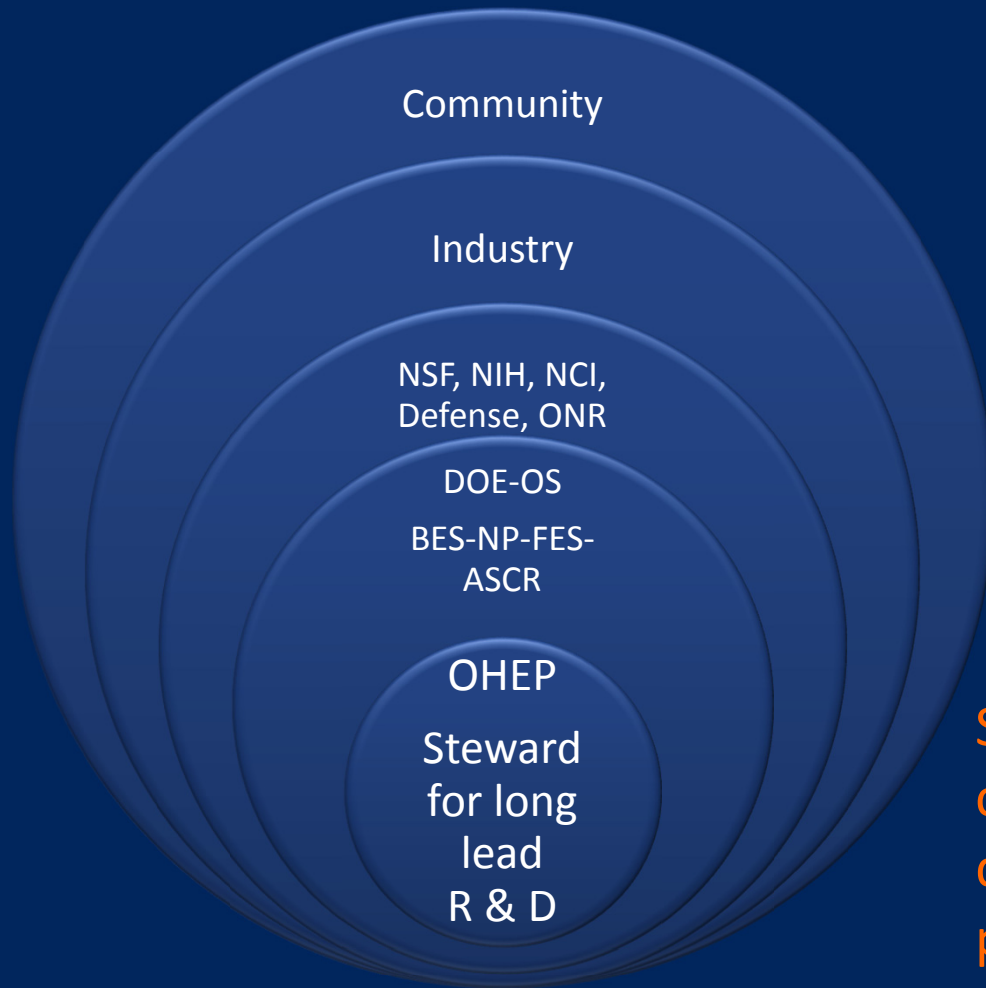
Senate mark-up

"The Committee understands that powerful new accelerator technologies created for basic science and developed by industry will produce particle accelerators with the potential to address key economic and societal issues confronting our Nation. However, the Committee is concerned with the divide that exists in translating breakthroughs in accelerator science and technology into applications that benefit the marketplace and American competitiveness."

"The Committee directs the Department to submit a 10-year strategic plan by June 1, 2012 for accelerator technology research and development to advance accelerator applications in energy and the environment, medicine, industry, national security, and discovery science. The strategic plan should be based on the results of the Department's 2010 workshop study, Accelerators for America's Future, that identified the opportunities and research challenges for next-generation accelerators and how to improve coordination between basic and applied accelerator research. The strategic plan should also identify the potential need for demonstration and development facilities to help bridge the gap between development and deployment."



What did we do? How did we do it? Why are we here today



- Involve all the stakeholders
- There were three panels '86 Tigner, '96 Marx, '06 Marx.

Share our Goal: engage with customers through the science we deliver—have the customer promote our science since it adds value to them

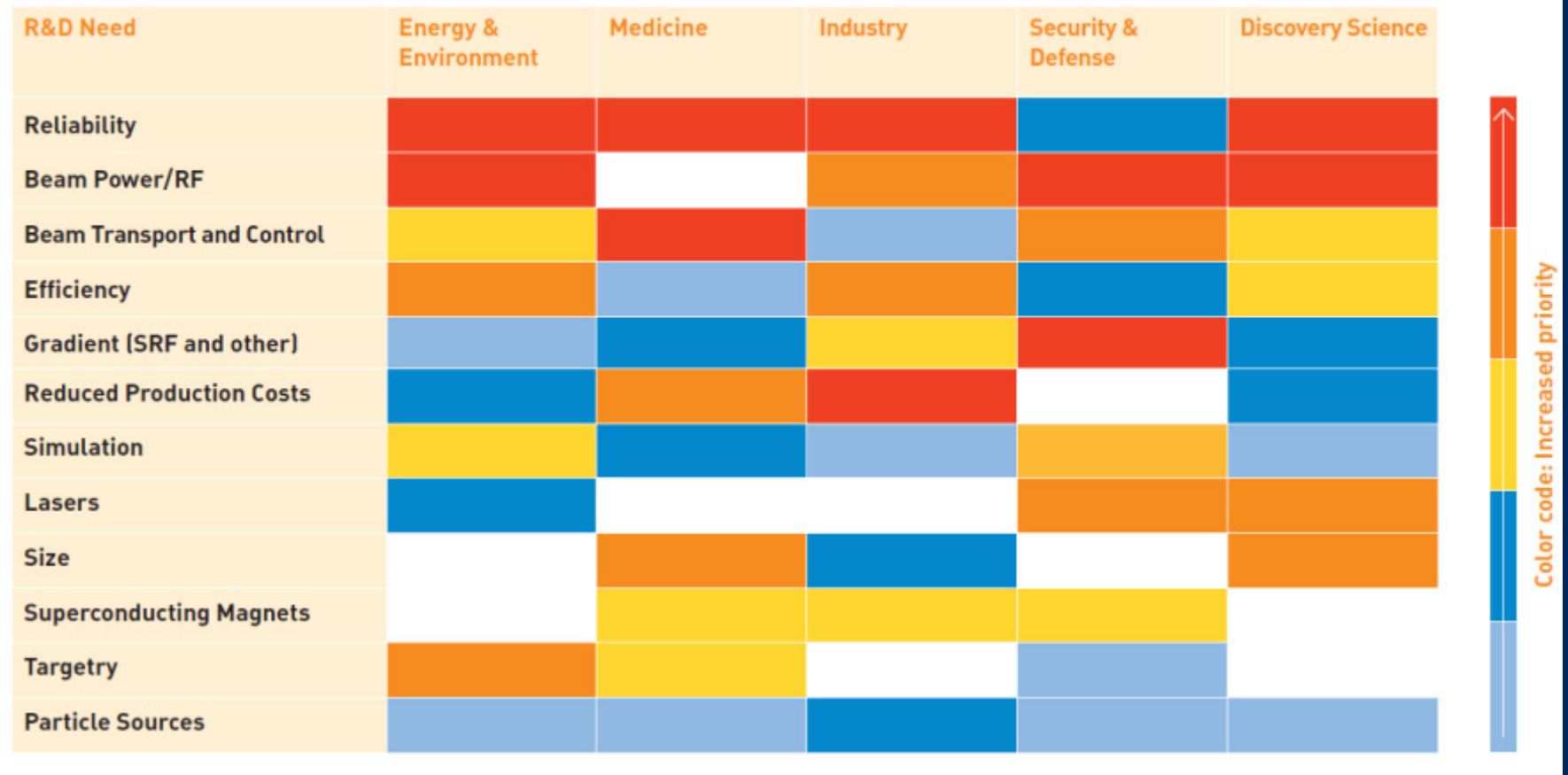
Results from *Accelerators for America's Future* Workshop in 2009



Courtesy: W. Henning, C. Shank

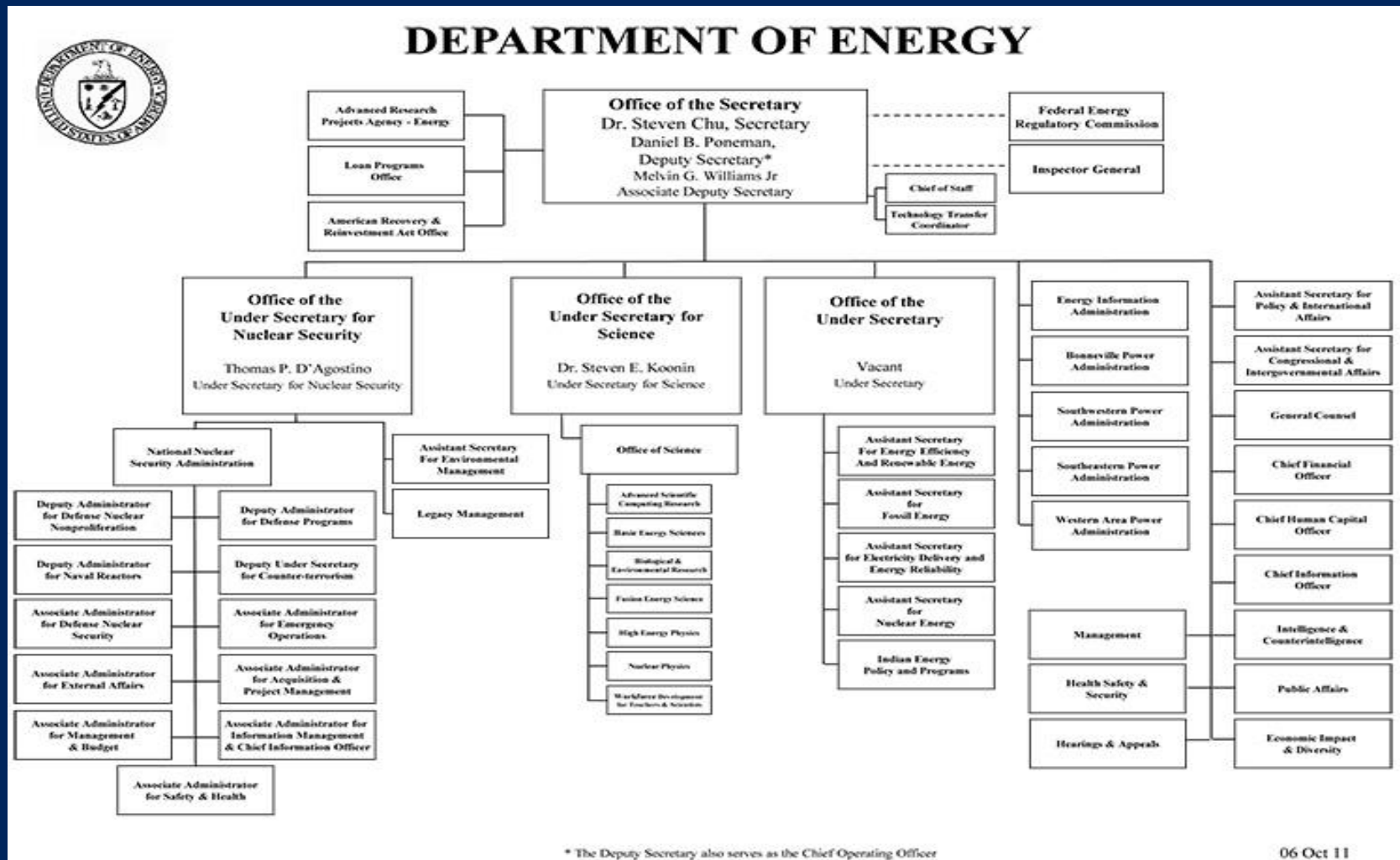
Results from *Accelerators for America's Future Workshop* in 2009

Areas of R&D identified by each working group. All areas are of importance to each working group. Color coding indicates areas with greatest impact.

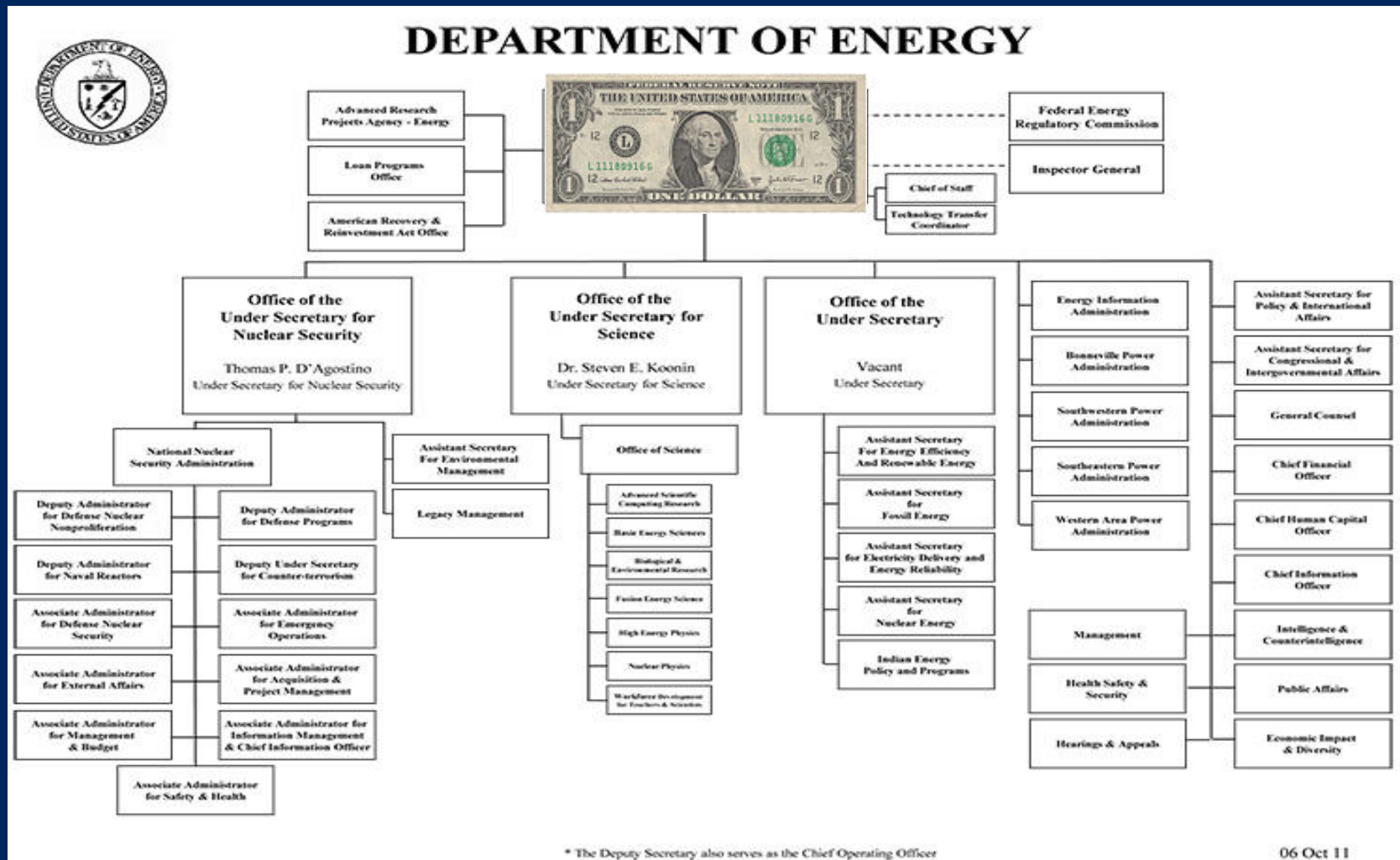


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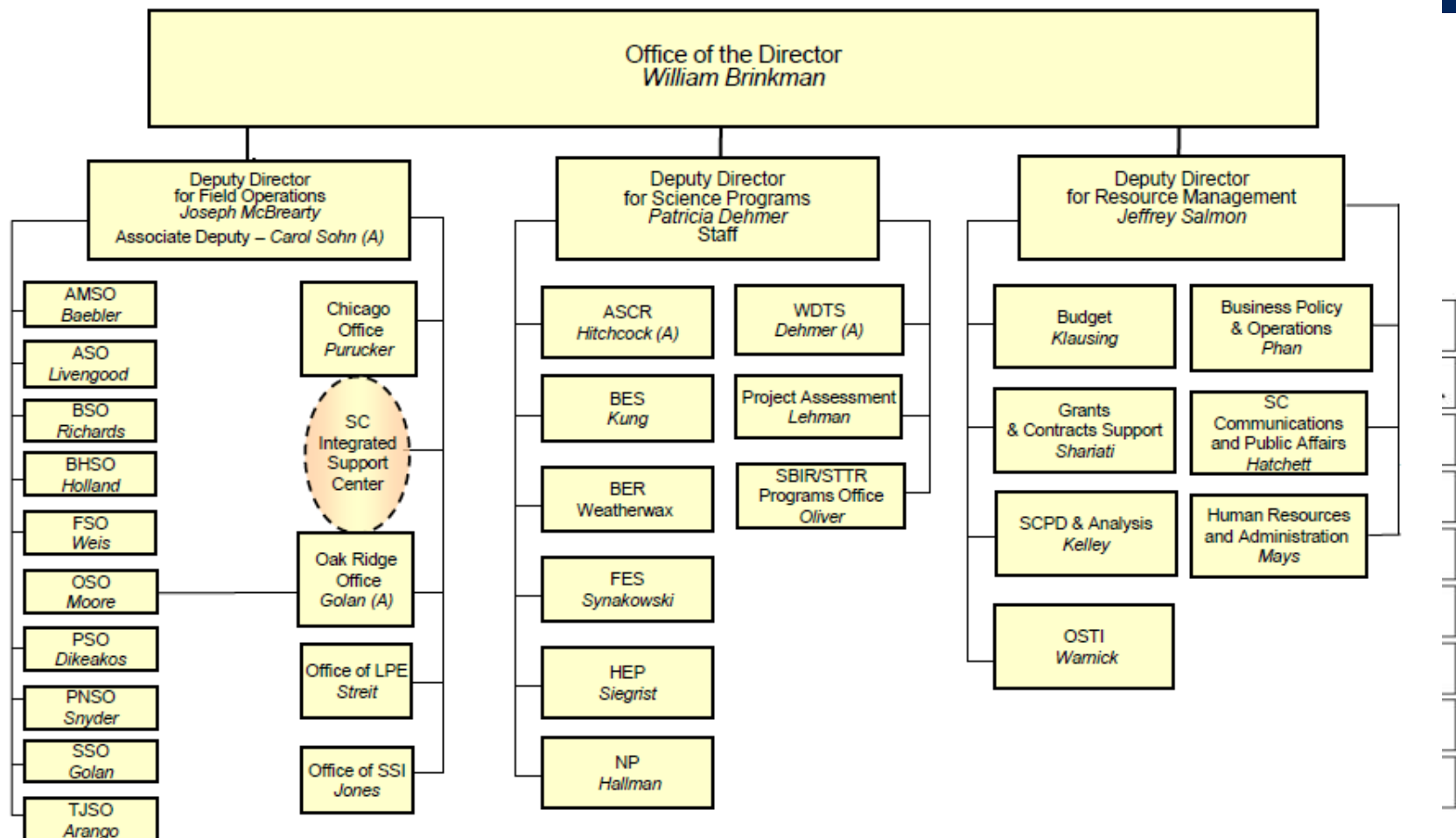
Where does the money come from in DOE?



Where does the money come from in DOE?



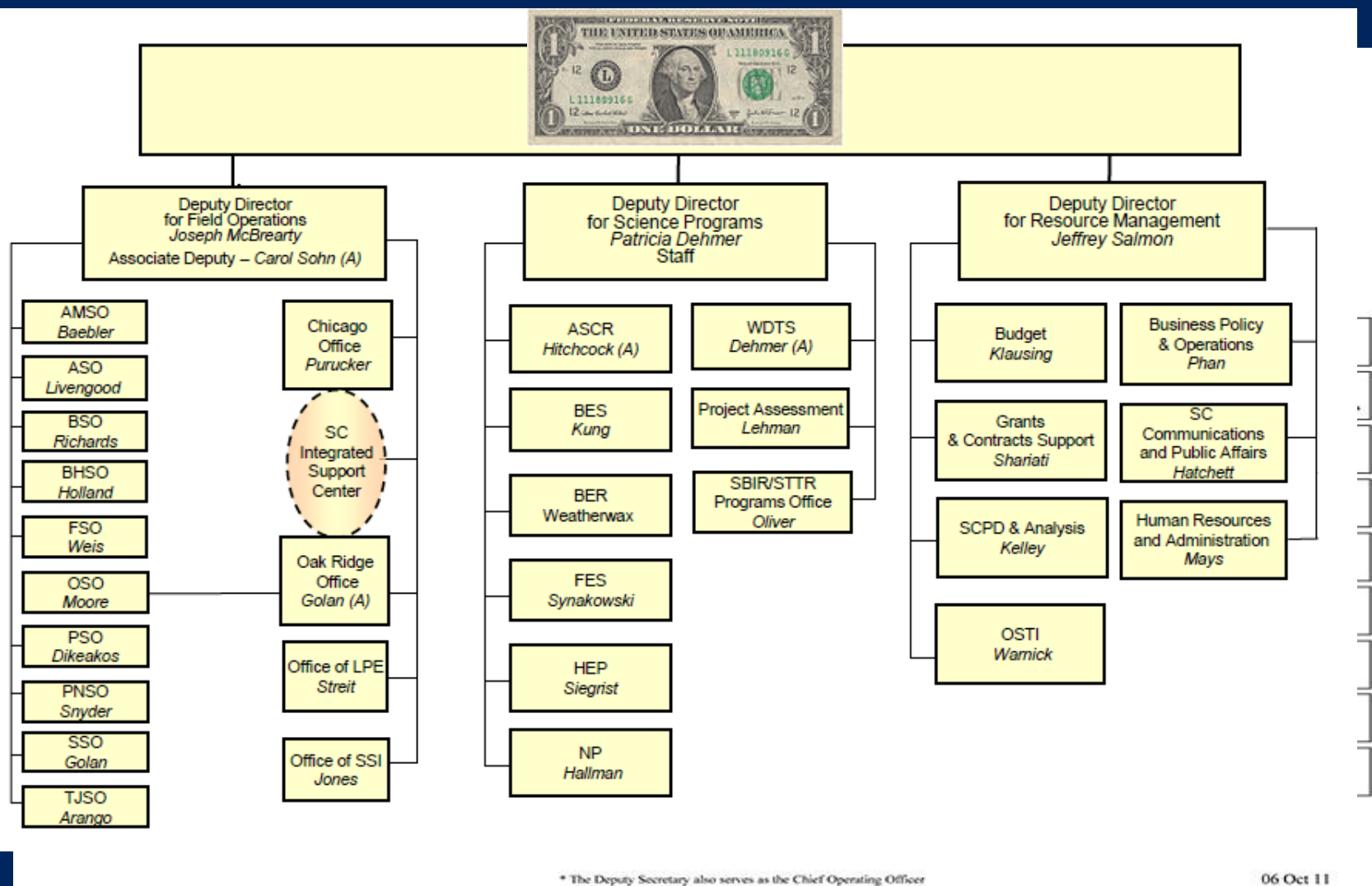
Where does the money come from in DOE?



* The Deputy Secretary also serves as the Chief Operating Officer

06 Oct 11

Where does the money come from in DOE?



06 Oct 11

Hit the road running...

Science Goal “Push”

High Energy

Beam Power

Beam Emittance

High Gradient

New Methods

Brightness
& Coherence

Compact
Accelerators

**DOE R&D
Program Thrust**
Approx \$140M in R&D
with \$42M in Adv R&D

The Seven Grand Challenges
of Accelerator Physics

Superconducting RF

Accelerator, Beam, Computation

Particle Sources

RF Sources

Beam Inst. & Controls

NC High-gradient Acc. Structures

New Accelerator

Superconducting Magnets

Connecting the dots: From Science to Application

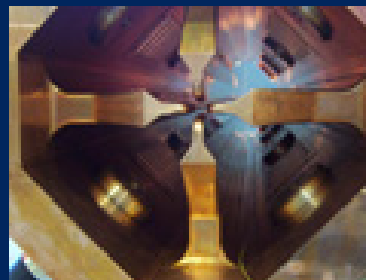
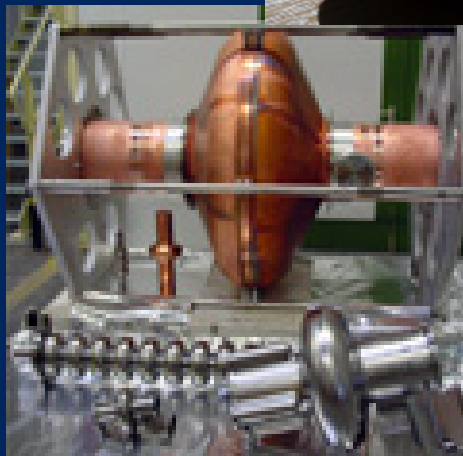
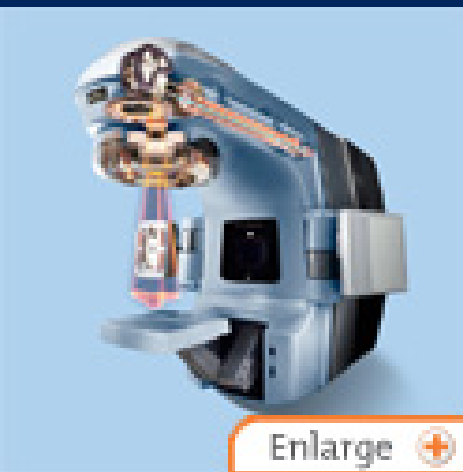
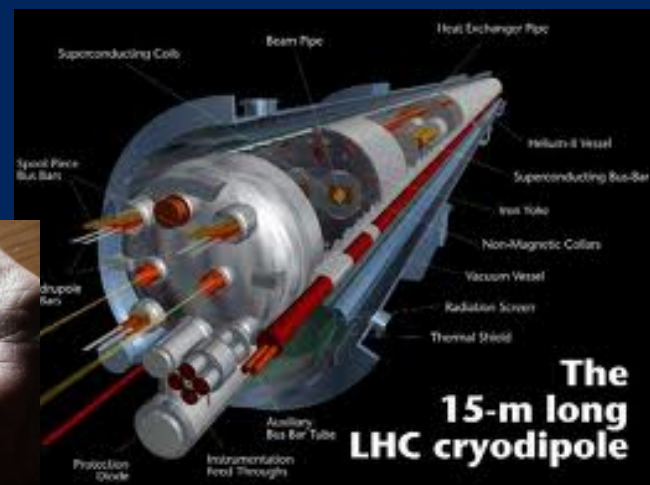
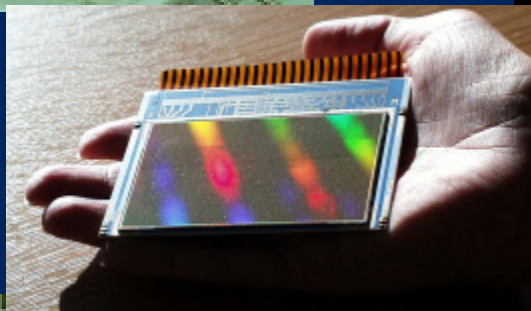
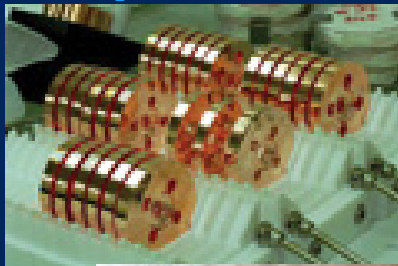
Science Goal "Push"							Application "Pull"				
High Energy	Beam Power	Beam Emittance	High Gradient	New Methods	Brightness & Coherence	Compact Accelerators	DOE R&D Program Thrust ~\$140M				
							Industry	Medicine	Energy and Environment	National Security	Discovery Science
●	●		●			●	●		●		●
●	●	●		●	●		●		●		●
	●	●			●		●		●	●	●
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Connecting the dots: From Science to Application

Science Goal “Push”							Application “Pull”						
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●	●		●			●	Superconducting RF	●		●		●	
●	●	●		●	●		Accelerator, Beam, Computation			●		●	
	●	●			●		Particle Sources	●		●	●	●	
●	●		●				RF Sources	●		●		●	
	●	●			●		Beam Inst. & Controls		●			●	
			●			●	NC High-gradient Acc. Structures	●			●	●	
●						●	New Accelerator		●			●	
●		●					Superconducting Magnets		●			●	

Feedback

Previously successful R&D

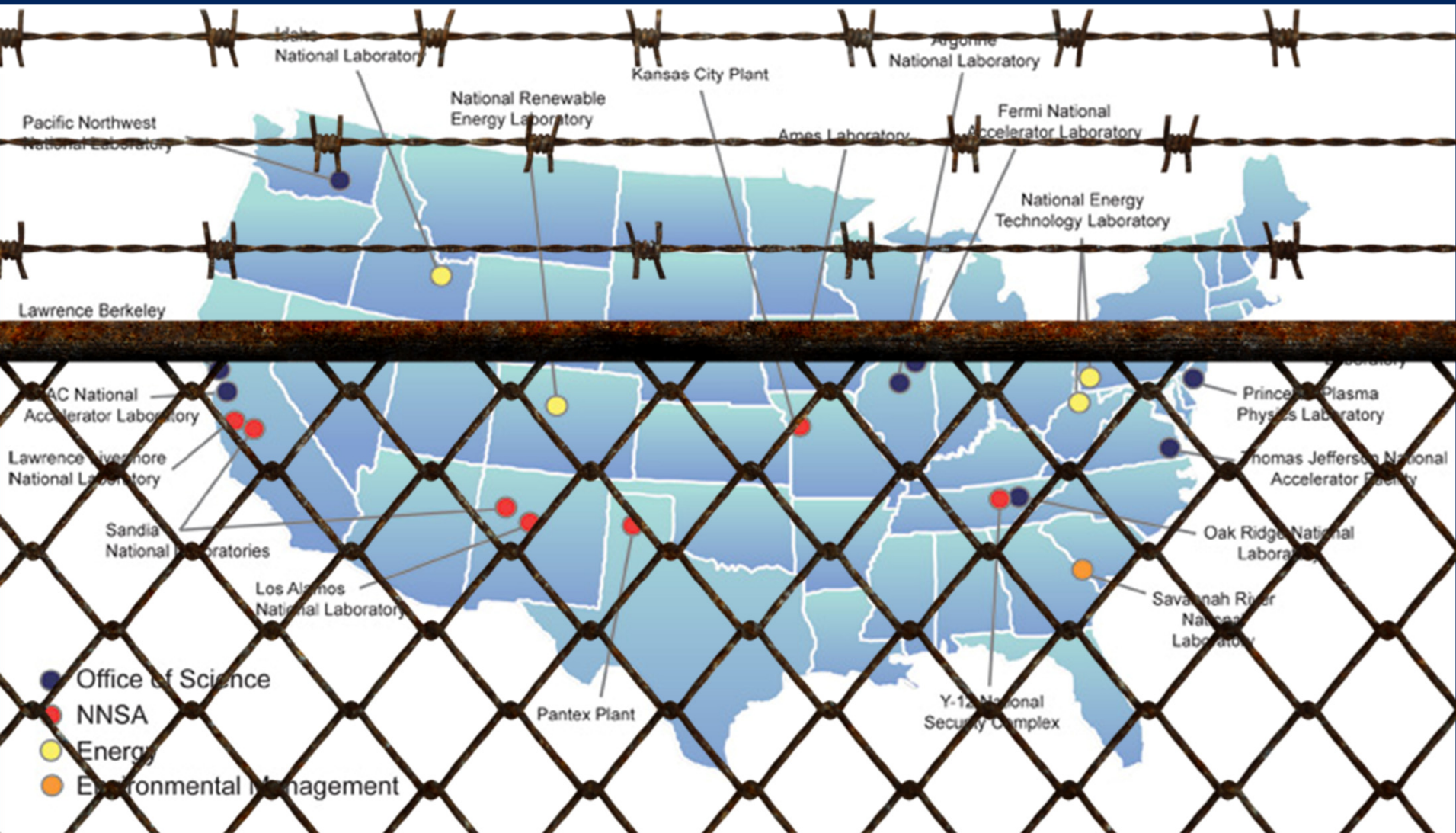


Accelerators in the market place

Courtesy: R. Hamm

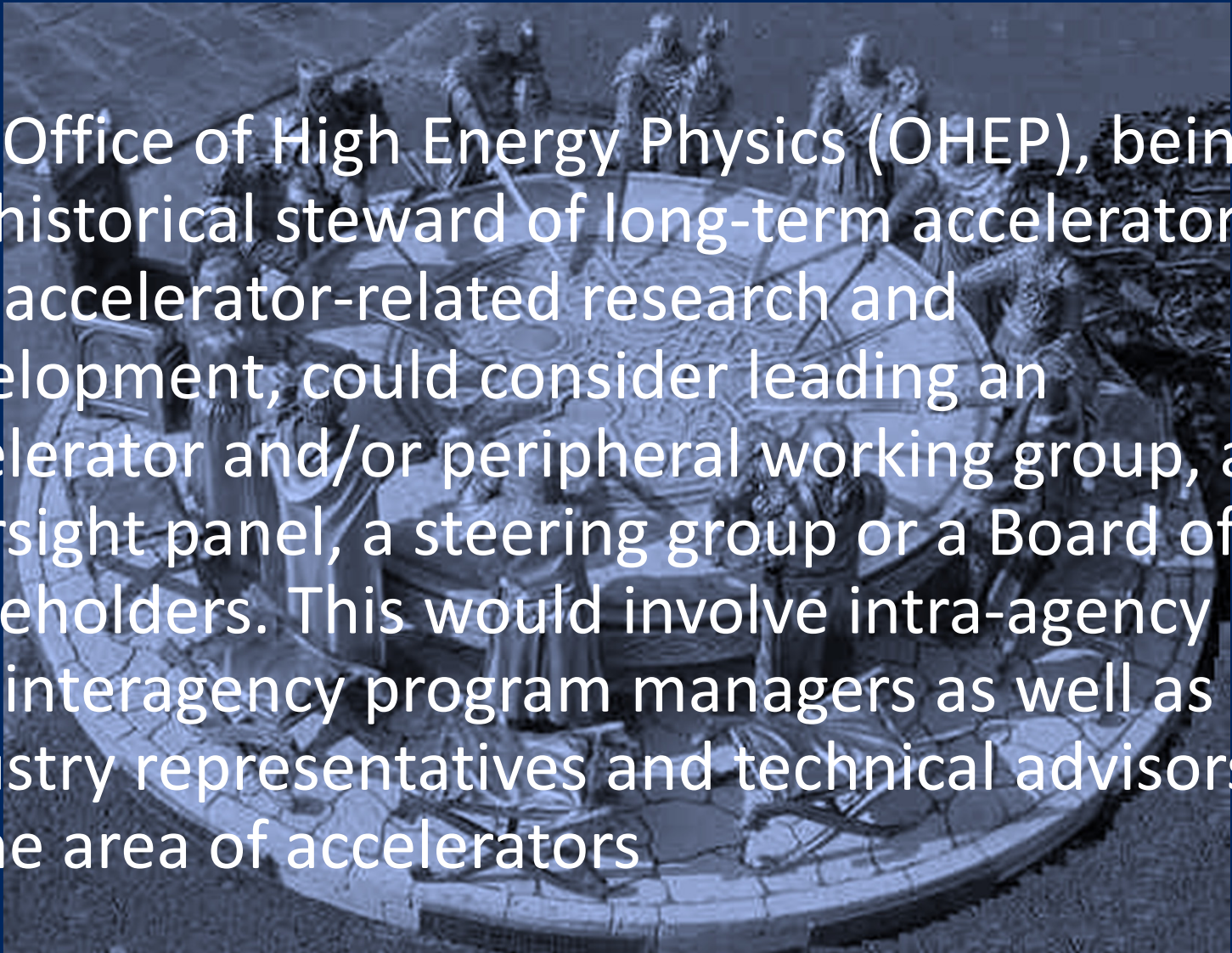
Accelerator business segment	US Vendors	Annual Revenue*	No. of US Employees*	Foreign owned vendors in US
Electron cancer therapy	Varian Medical Corporation	\$2,340M	5200	
Radioisotope production	GE Medical (Sweden)	\$120M	100	Siemens Healthcare, AccSys Technology, Inc.
Ion implantation	Applied Materials Corp.	\$1,200M	1500	
Neutron generators	Thermo Scientific, Adelphi Technology, Inc.	\$25M	150	
MRI systems	Fonar Corporation, GE Healthcare	\$1,500M	2000	
Medical imaging detectors	Ortec, Amptek, Canberra	n/a	n/a	
Ion Beam Analysis	National Electrostatic Corporation	\$20M	100	
Electron beam NDE	Varian Security & Inspection Products, L&W Research Corp., HESCO	\$110M	150	
* Estimates from author		\$5.315B	9200	

...and this is how industry has viewed us.



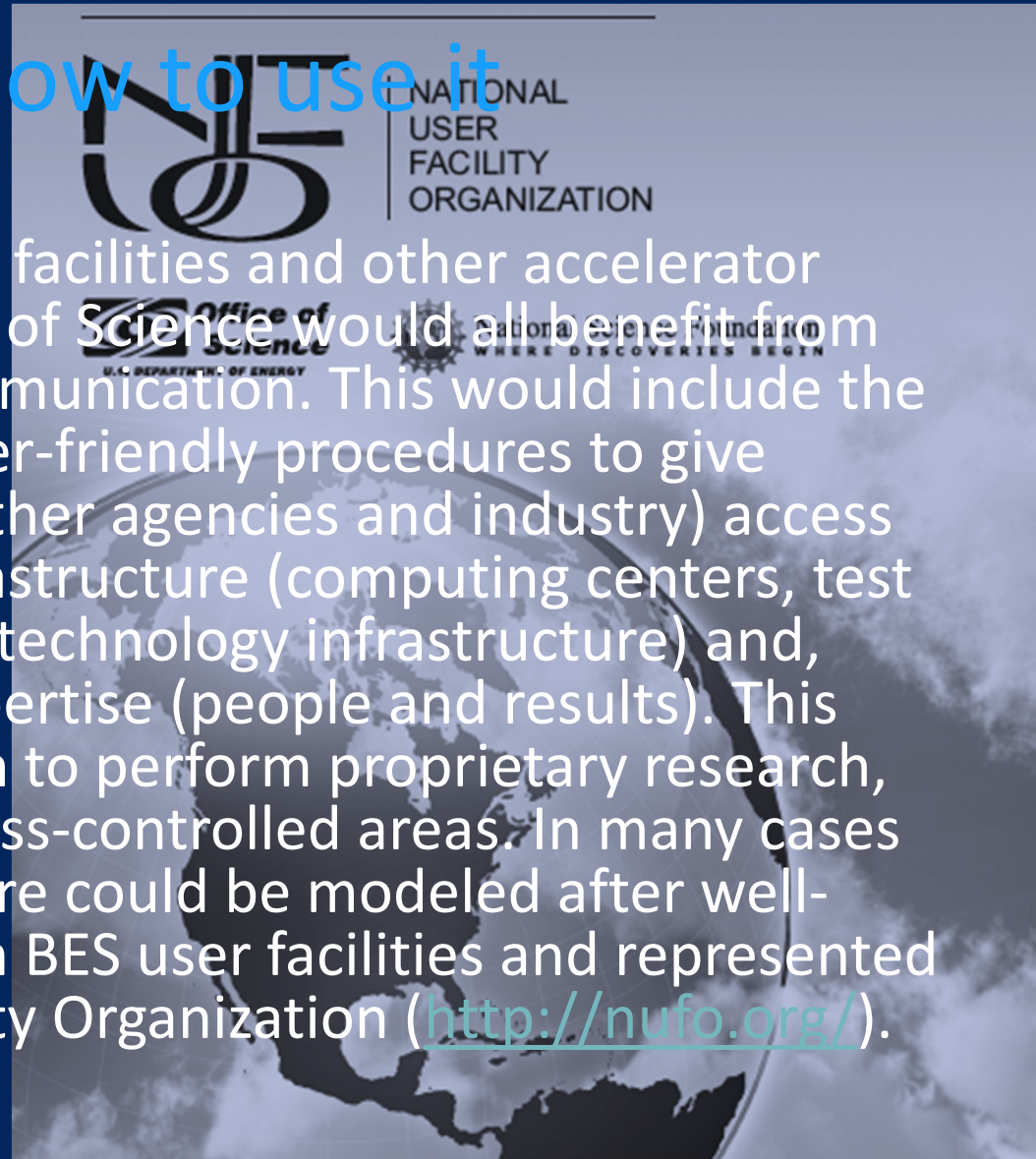
“The Round Table”

The Office of High Energy Physics (OHEP), being the historical steward of long-term accelerator and accelerator-related research and development, could consider leading an accelerator and/or peripheral working group, an oversight panel, a steering group or a Board of Stakeholders. This would involve intra-agency and interagency program managers as well as industry representatives and technical advisors in the area of accelerators



Communicate what is there and how to use it

National laboratories, user facilities and other accelerator R&D facilities of the Office of Science would all benefit from more direct and open communication. This would include the development of simple user-friendly procedures to give customers (for example, other agencies and industry) access to national laboratory infrastructure (computing centers, test facilities, test stations and technology infrastructure) and, equally importantly, to expertise (people and results). This could include the provision to perform proprietary research, or at least research in access-controlled areas. In many cases the use of this infrastructure could be modeled after well-established principles from BES user facilities and represented by the National User Facility Organization (<http://nufo.org/>).



Concerns of our industrial partners

The Office of Science/OHEP can work to identify, understand and resolve the concerns from industry and other agencies regarding protection of incoming and generated intellectual property or information. It would be useful to have, for this purpose and as a basis, a template applicable to all user facilities and infrastructures at Office of Science national laboratories. Such templates could cover all aspects of a contractual arrangement that is typically negotiated every time an arrangement is put in place.



Leveraging where possible

Leveraging the SBIR/STTR funding with a specific focus on energy and environment, medicine, industry and defense and security apart from discovery science could strengthen these parts of the program, providing an easy way to direct some money towards the topic areas identified in the Accelerators for America's Future workshop



Collaborative Accelerator Research Teams

CARTs

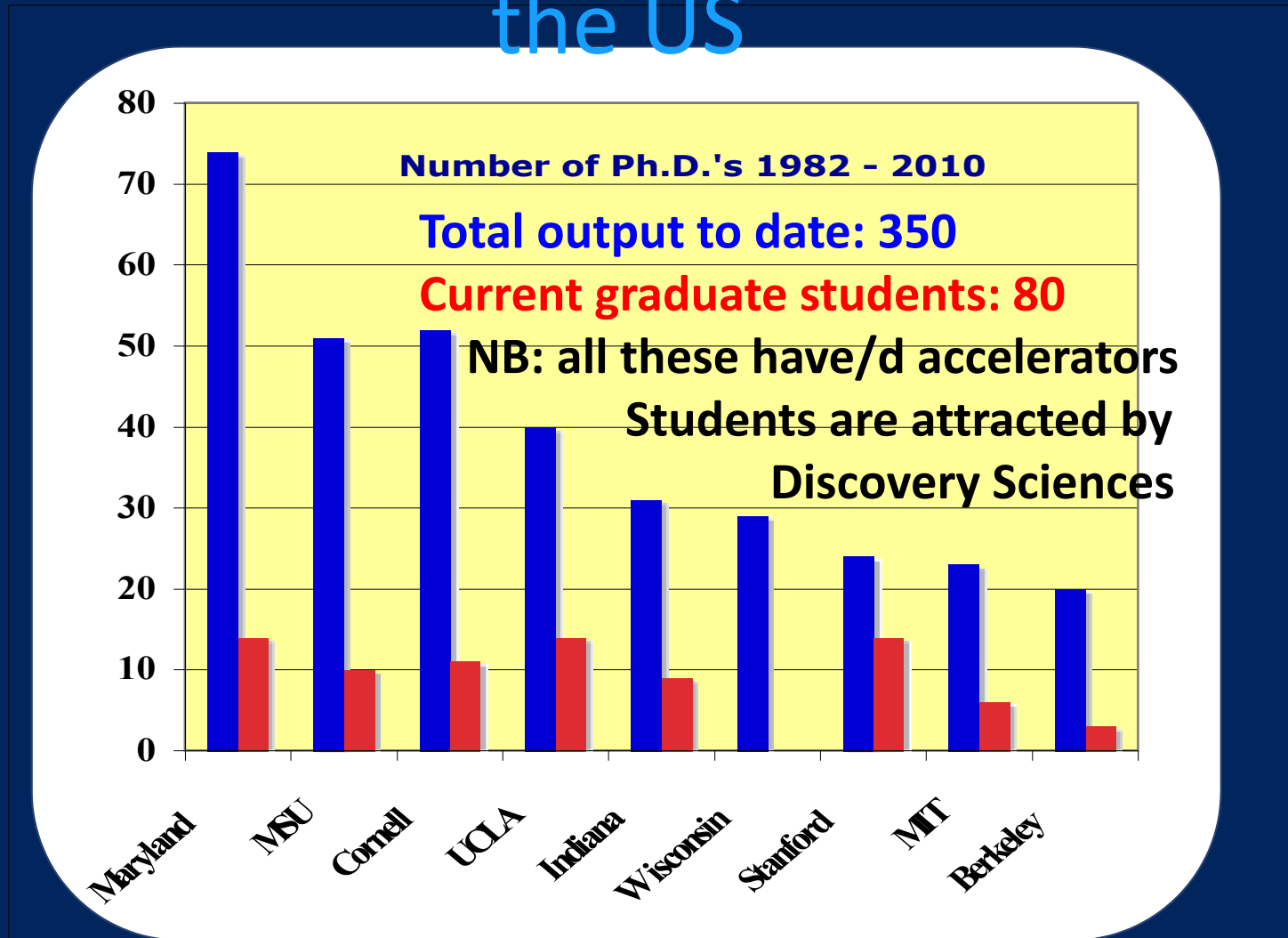
The Office of Science OHEP's wealth of knowledge and vast infrastructure could be channeled to establish Collaborative Accelerator Research Teams (CARTs) focused on specific challenges detailed in the Accelerators for America's Future workshop. OHEP, with its stewardship program as well as the other directorates through its national laboratories, could direct its capabilities towards specific issues in the areas of energy and the environment, medicine, industry, defense and security and discovery science. The interdisciplinary Teams, drawing from national laboratories, other agencies, industry and universities, would have a clear mission, a finite duration and are competitively bid.

A new Program within Advanced Accelerator R&D in OHEP

The Office of Science could establish a program with the purpose of bringing industry, laboratories and universities together to foster the application of accelerator technology in energy and the environment, industry, medicine, defense and security and discovery science.



Education: PhD output for accelerators in the US



Education at operating accelerators with student access and R&D is needed.

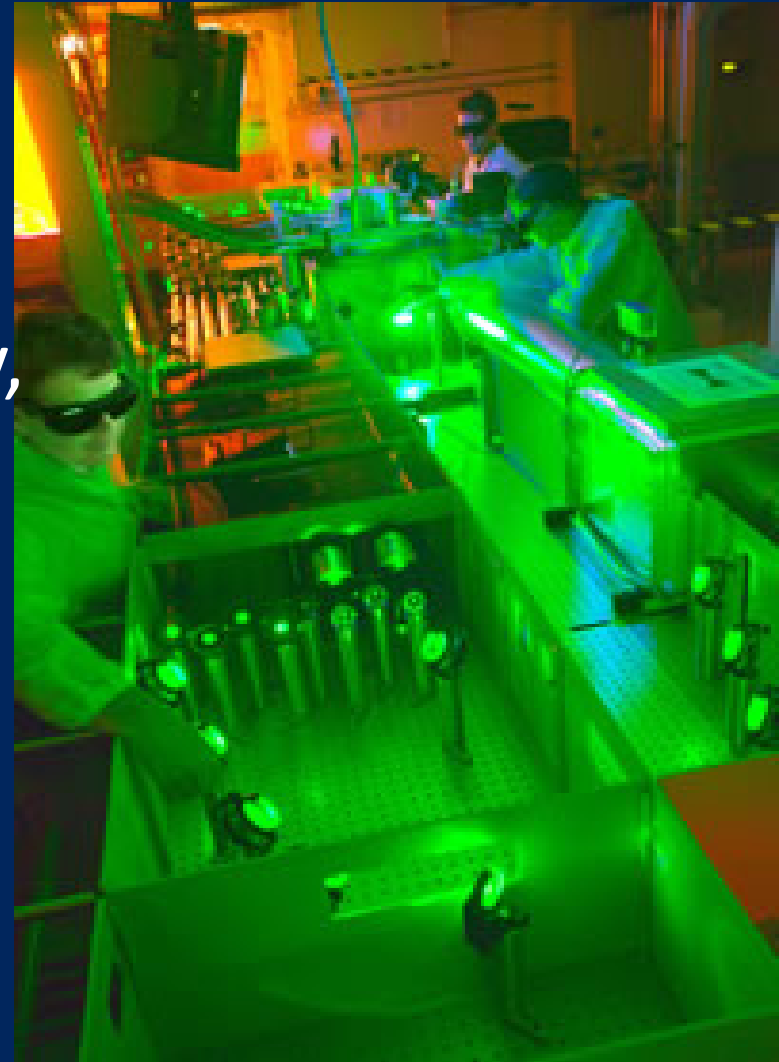
Infrastructure Proposal 1

Scripps Proton Therapy Center, San Diego; Courtesy: VARIAN Medical Systems
confidential

The medical community would benefit from a discussion of how the current R&D program could help on the route to a National Resources for Hadron Beam Medical Facilities. The Office of Science could develop a stepwise implementation plan for providing beams, developing beams and beam delivery systems for a cost-efficient production of such facility.

Infrastructure Proposal 2

The Office of Science could consider providing a home for laser R&D under its auspices. Lasers, an enabling technology, have become an integral part of accelerators and provide tremendous potential for new methods of acceleration, for miniaturization of accelerators and as part of accelerator systems.



It all goes together, but something has to drive...

