

US Department of Energy - OHEP
Accelerator Task Force

Interim Report to NSAC meeting,

Norbert Holtkamp, SLAC
March 9, 2012

The *Accelerators for America's Future* Workshop in 2009

A MESSAGE FROM THE CHAIRS

In October 2009, the Department of Energy's Office of High Energy Physics sponsored a symposium and workshop, "Accelerators for America's Future." Its purpose was to elicit the views and opinions of a wide range of accelerator users on the challenges and opportunities for developing and deploying accelerators to meet national needs.

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W. Henning. C. Shank



Why are we here?

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.”

Who are we – why us?

Sandra Biedron	Colorado State University
Lester Boeh	Varian Medical Systems
James Clayton	Varian Medical Systems
Stephen Gourlay	LBNL
Robert Hamm	R&M Tech. Enterprises, Inc.
Stuart Henderson	FNAL
Georg Hoffstaetter	Cornell
Norbert Holtkamp	SLAC
Lia Meringa	TRIUMF
Stephen Milton	Colorado State University
Satoshi Ozaki	BNL
Fulvia Pilat	JLab
Marion White	ANL
George Zdasiuk	Varian Medical Systems
Michael Zisman	DOE-HEP



Charge from Jim Siegrist, AD

US DOE Office of High Energy Physics

1. Summary of costs and time scales for previous successful accelerator R&D efforts to help us assess future funding profiles;
2. Identification of those research opportunities that might have a strong potential for broad national benefits with relevance to the areas of energy and the environment, medicine, industry, national security and discovery science, along with the reasons why you believe they do;
3. A summary, including an estimate (based on your knowledge and expertise) of the current scope of work, resources invested, and status of the key research and technology areas identified, and;
4. Identification of possible impediments (both technical and otherwise) to achieving successful demonstration; in particular, note as appropriate the underlying fundamental science challenges that need to be addressed, and how these relate to use-inspired and applied R&D.



What did we do? How did we do it?

https://slacportal.slac.stanford.edu/sites/ad_public/committees/Acc_RandD_TF_Blog/default.aspx

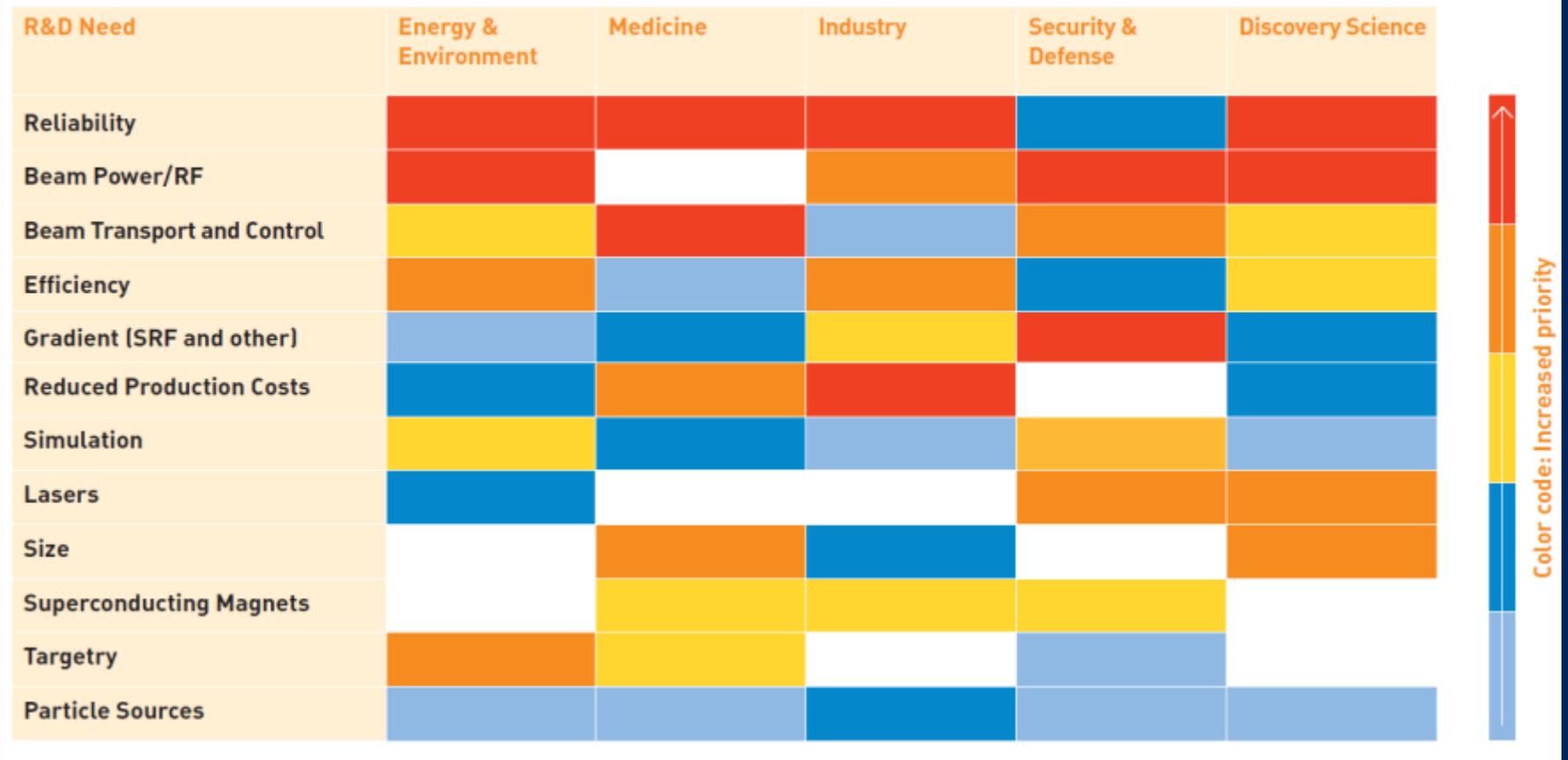


- Looking back: there have been three panels on accelerator R&D with very good recommendations
- Recently: output from *Accelerators for America's Future Workshop*
- Discussed initial draft with ADs in Office of Science on Feb 13th.

Reaching out: “How can we help you?”

Results from Accelerators for America's Future Workshop

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.



Courtesy: W. Henning, C. Shank

The Grand Challenges

1. Extend the energy reach of collider technology to probe fundamental phenomena at the multi-TeV scale → *High Energy*
2. Extend the beam power and intensity reach of hadron accelerator technology to enable next-generation capabilities in fundamental physical sciences and applications in energy → *Beam power*
3. Extend the capability and understanding of performance limits of RF accelerating structures and technology → *High Gradient*
4. Break the “RF Barrier” by developing scalable next-generation acceleration methods in the 10 GeV/meter range → *New Acceleration Methods*
5. Develop tools and technologies for the manipulation of particle beam phase-space and the exploration of limitations to beam emittance → *Beam Emittance*
6. Develop concepts and technologies to extend the brightness, brilliance and coherence of photon sources to meet the challenges of 21st century materials science → *Brightness & Coherence*
7. Develop accelerator systems to serve as compact sources of photons, neutrons, protons and ions → *Compact Accelerators*

Hit the road running...

Science Goal "Push"

High Energy

Beam Power

Beam Emittance

High Gradient

New Methods

Brightness
& Coherence

Compact
Accelerators

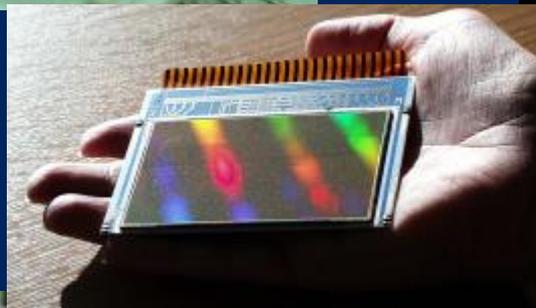
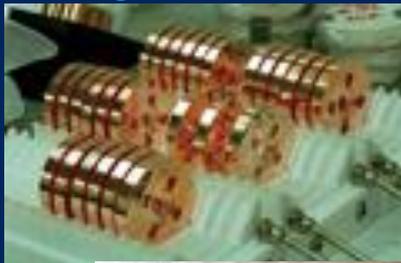
The Seven Grand Challenges
of Accelerator Physics

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			Industry	Medicine	Energy and Environment	National Security	Discovery Science
●	●		●			●	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

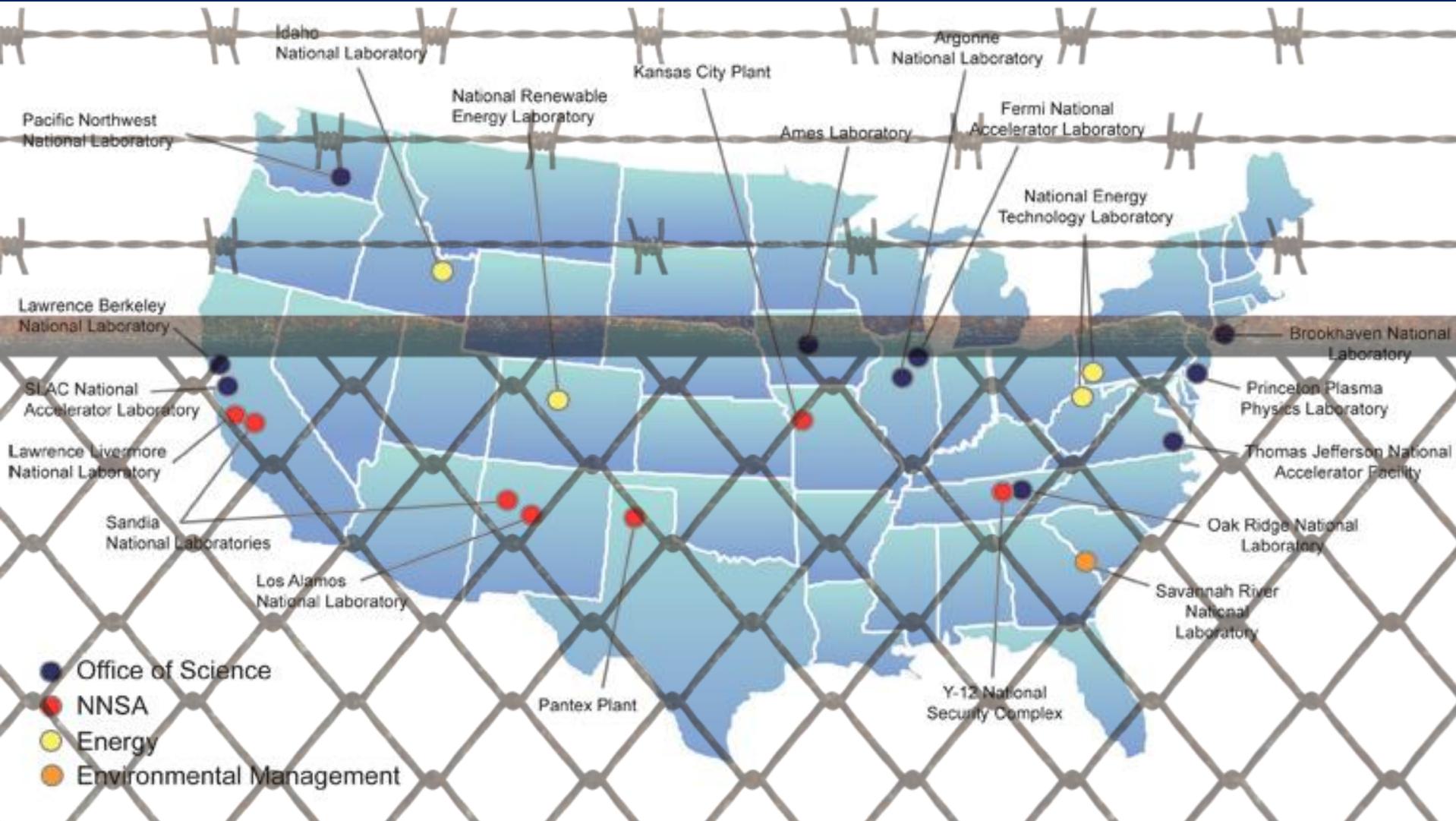
Courtesy: R. Hamm

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	

Historically, this is how the
labs have viewed industry...



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



What do we have so far:

- I will go over a couple of major ideas that a more general and address questions of impediments to success and major programs to look for.
- We have had teams working on:

Discovery Science: G. Hoffstaetter, M. White

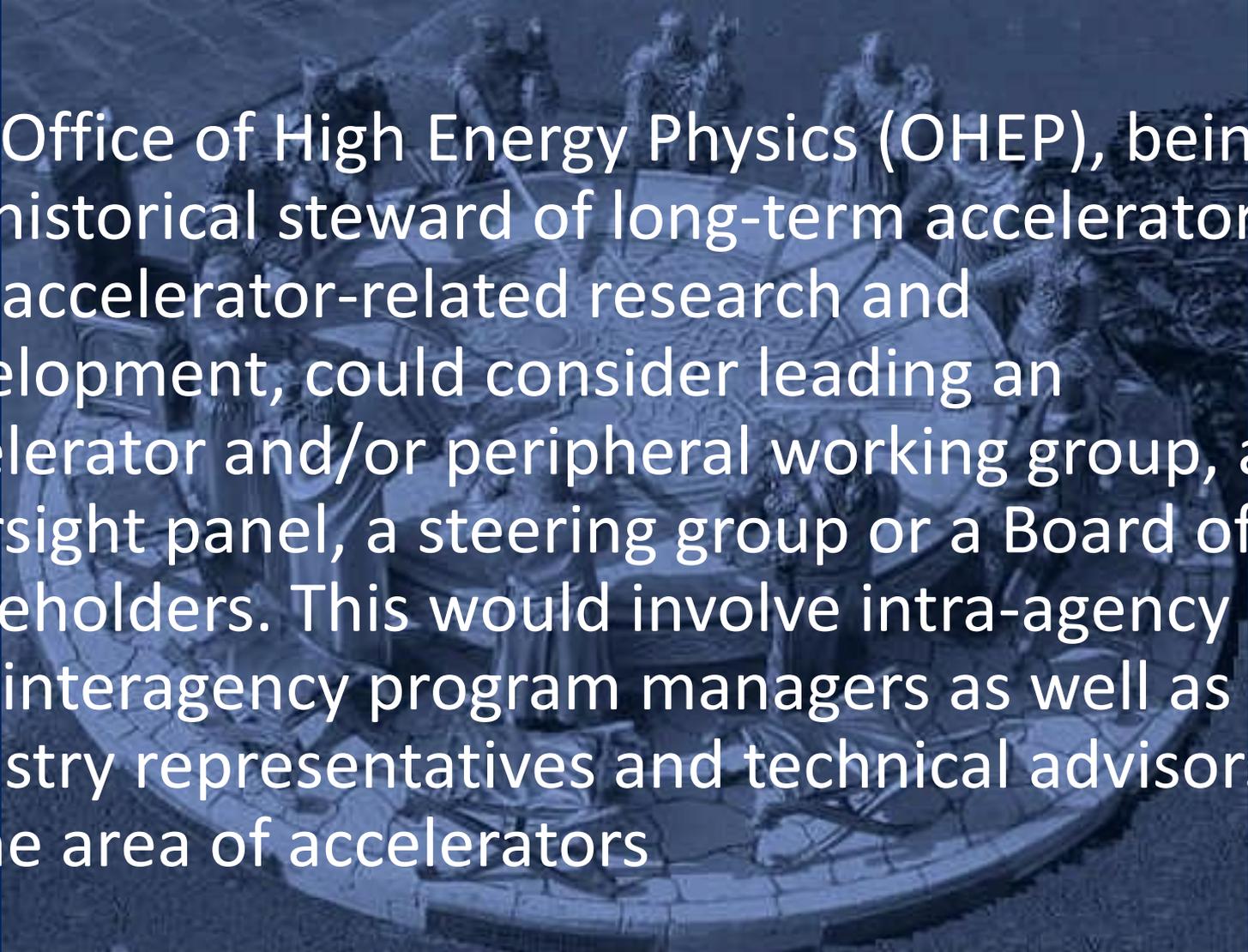
Energy/Environment: S. Henderson, F. Pilat

Medicine: L. Boeh, J. Clayton, S. Gourlay, G. Zdasiuk

Defense: S. Biedron, S. Milton

Industry: R. Hamm, L. Merminga, S. Ozaki,

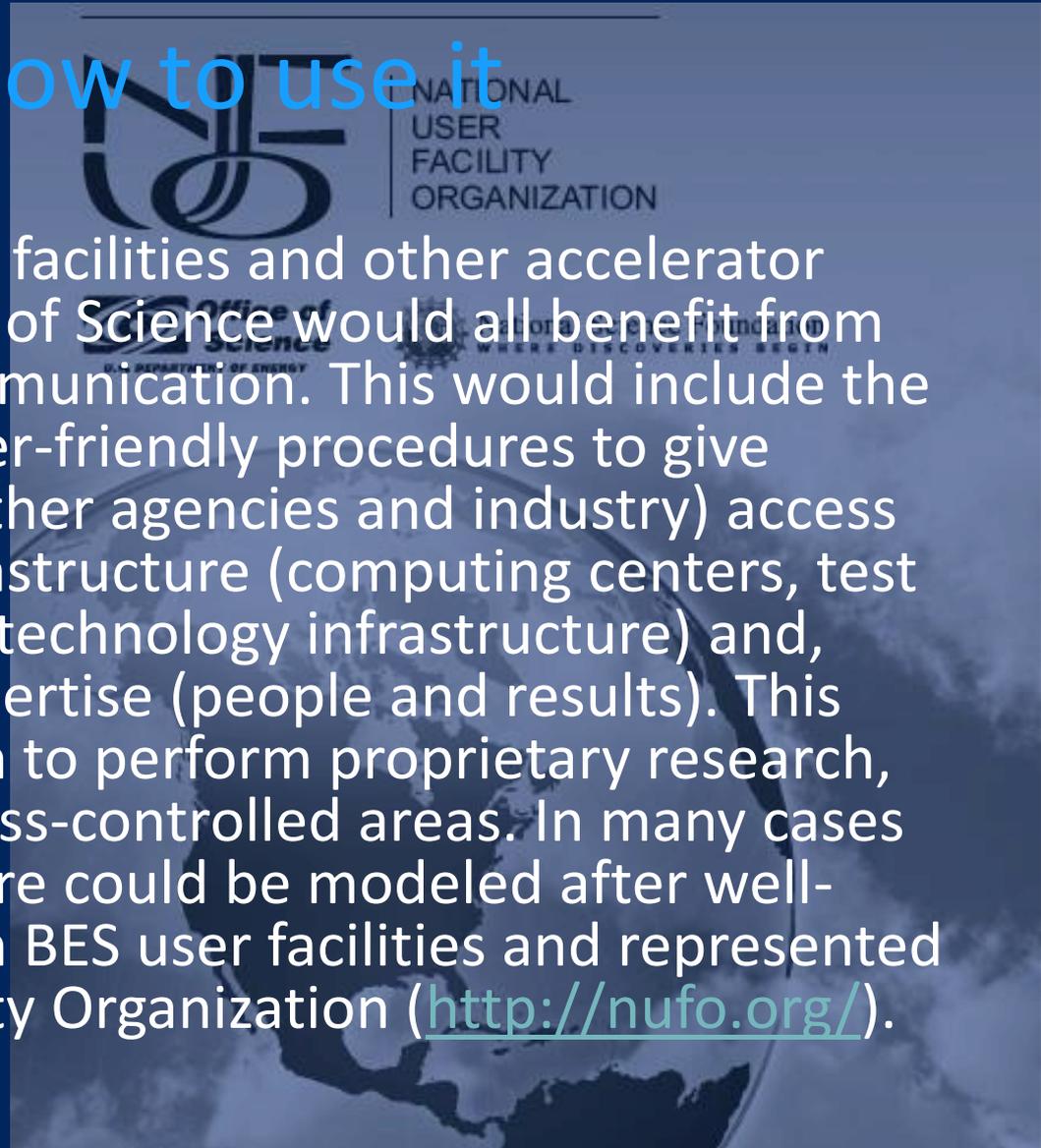
“The Round Table”



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.



Accelerator Education is a must!

The particle accelerator workforce would significantly benefit from an extension and addition to what is currently available in education programs. Workforce development for particle accelerator R&D has traditionally been a major emphasis of the Office of Science, and in particular, the HEP and some of the NSF programs. Though close contacts between universities and national laboratories exist, the Office of Science could help involve more universities in accelerator education programs. It could also facilitate more integration with industry, giving it easier access to these programs.

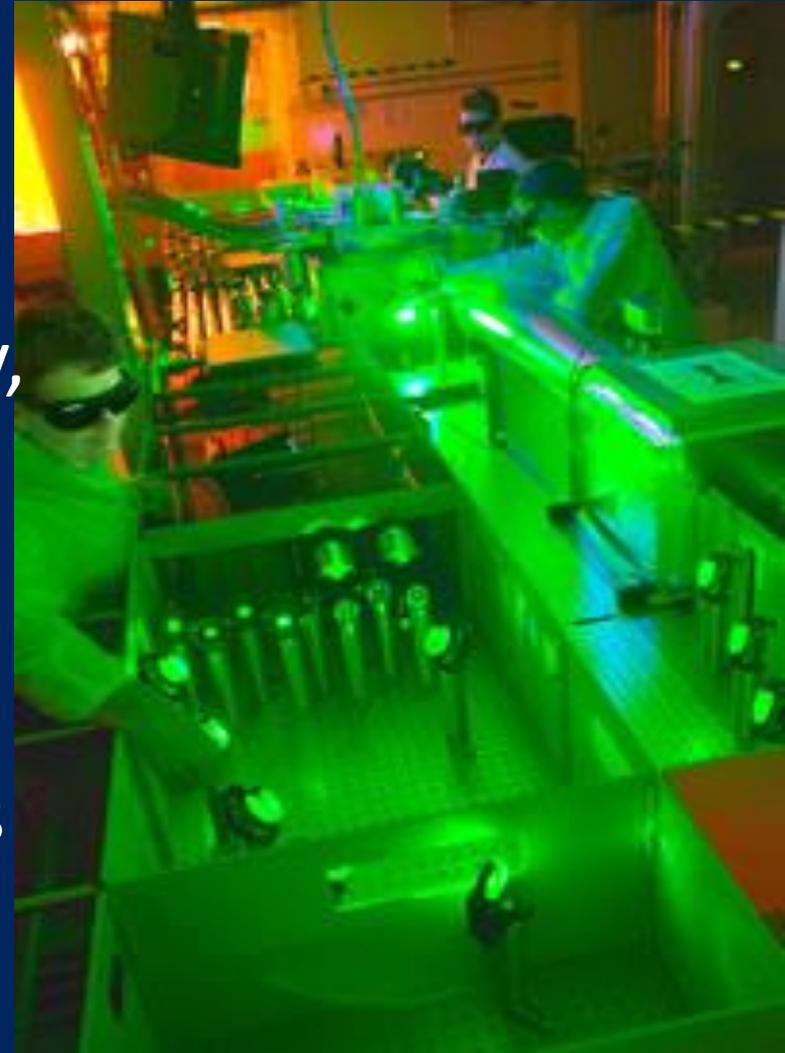
Infrastructure Proposal 1

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.

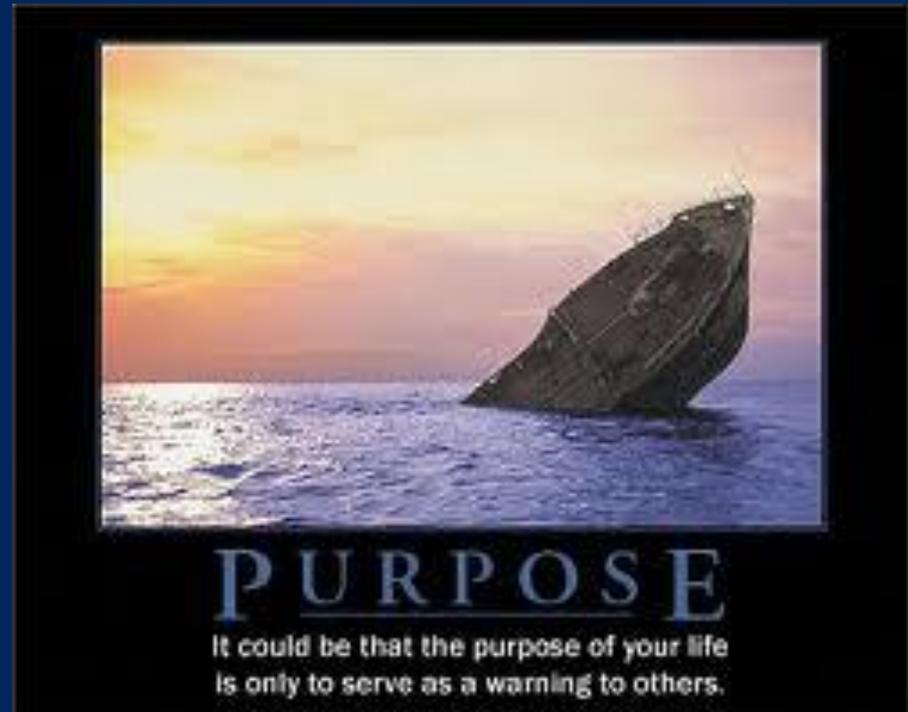
Infrastructure Proposal 2

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.



Summary

- Congress is waiting for an answer and I hope we are helpful
- We need advise on feasibility, appropriateness and content
- Implementing some of the ideas would mean to do business a bit different.
- Of course we hope that our input will last a bit longer and go deeper than some of the other panels. But that needs all/most of OS on board



THANK YOU