What the US is Doing to Meet Its Growing Demand for Rare Earth Materials & Products – an Opportunity for Global Stakeholders

5th International Rare Earths Conference

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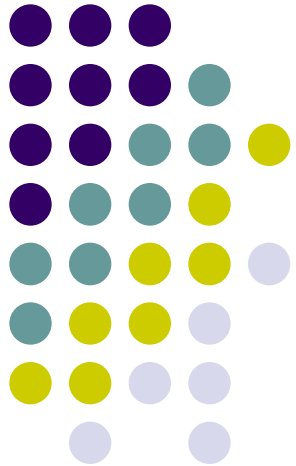
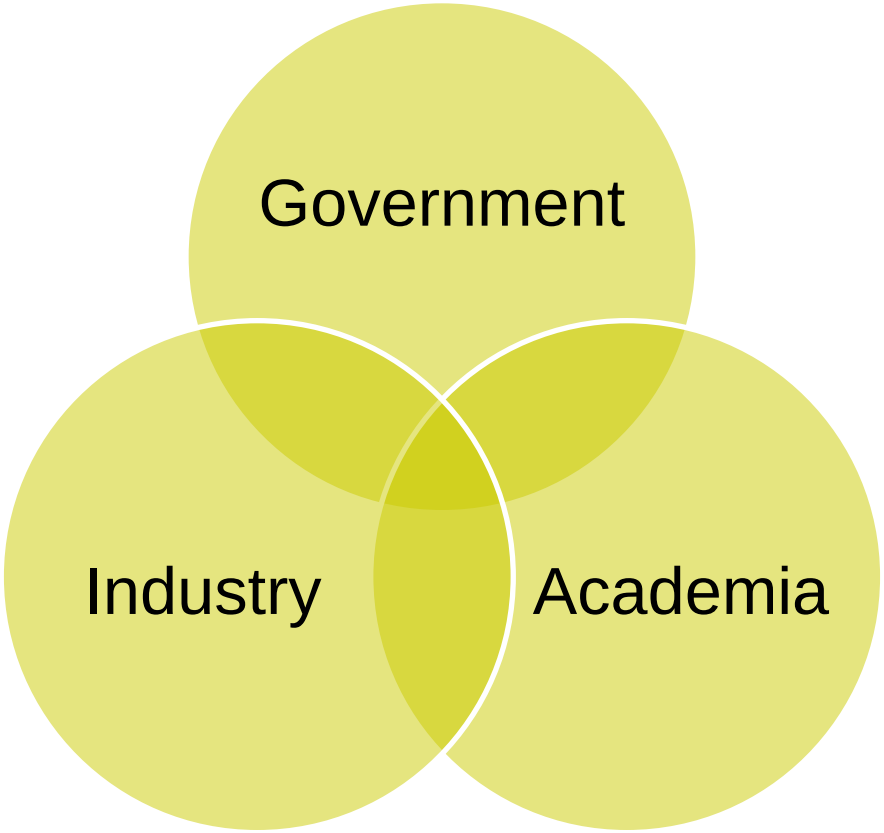
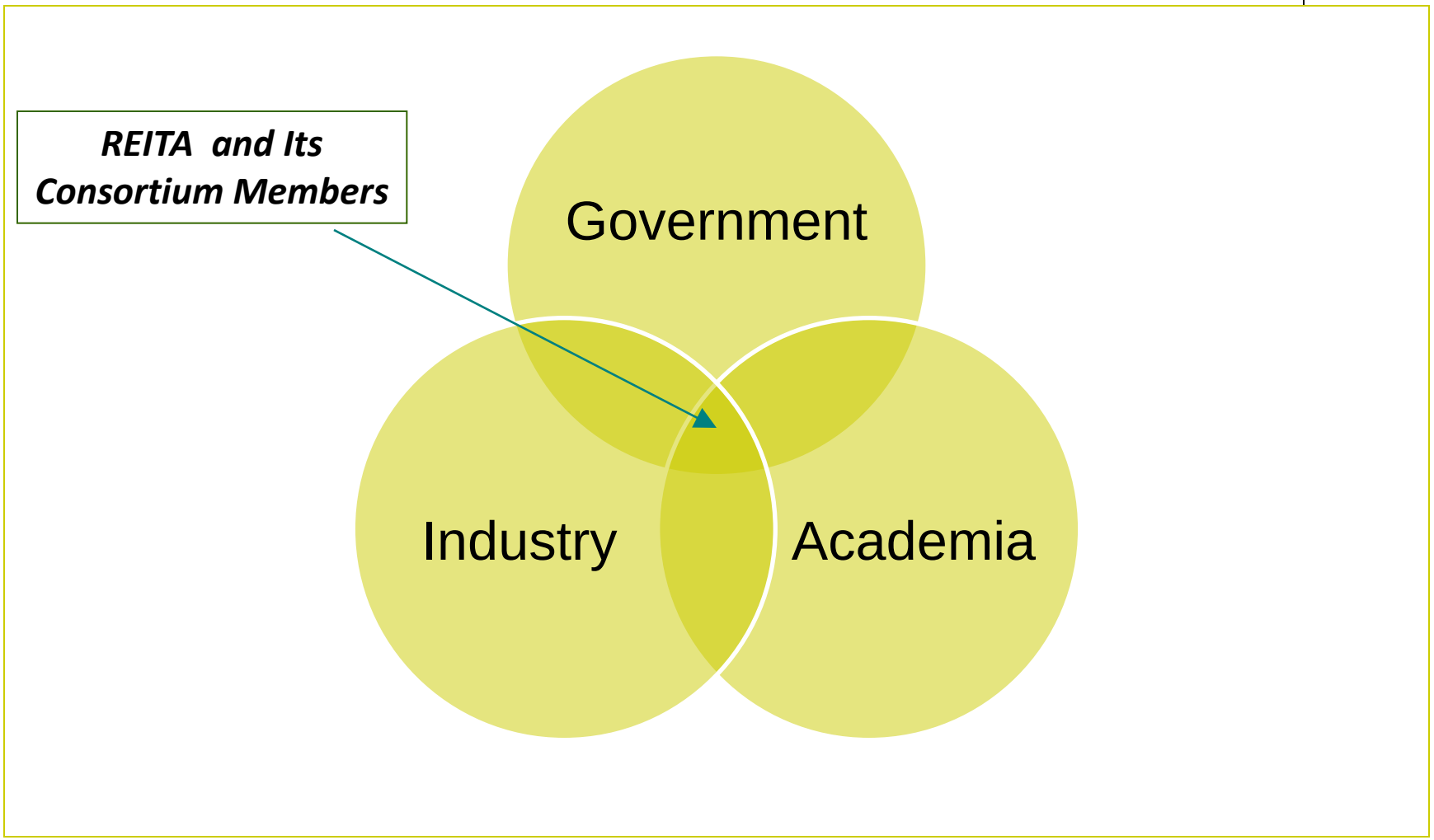
(REITA)



Energy Independence / Green Energy Selected Stakeholder Categorization



At the Nexus: RE Technology Development for Energy Independence / Green Energy



Presentation Outline

The Case for Action

REITA – Its Mission, Process and Outlook

Conclusion

The Case for Action

Disclaimer:

This Case for Action is ***a brief summary of*** the multitude of reports and papers written by many of the people in this room, and other industry experts, over the past few years. No attempt is made to repeat their work, but rather to condense it into ***a few statements of fact upon which (hopefully) most of us can agree.***

The Case for Action

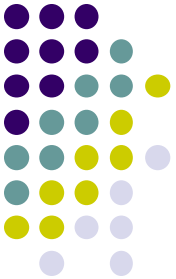
- China's RE reserves are finite
- Chinese internal demand for RE materials and technologies is forecasted to continue growing at double digit rates for the foreseeable future
- These conditions will continue to ***drive Chinese policies to limit RE production and exports to better manage its precious natural resource***

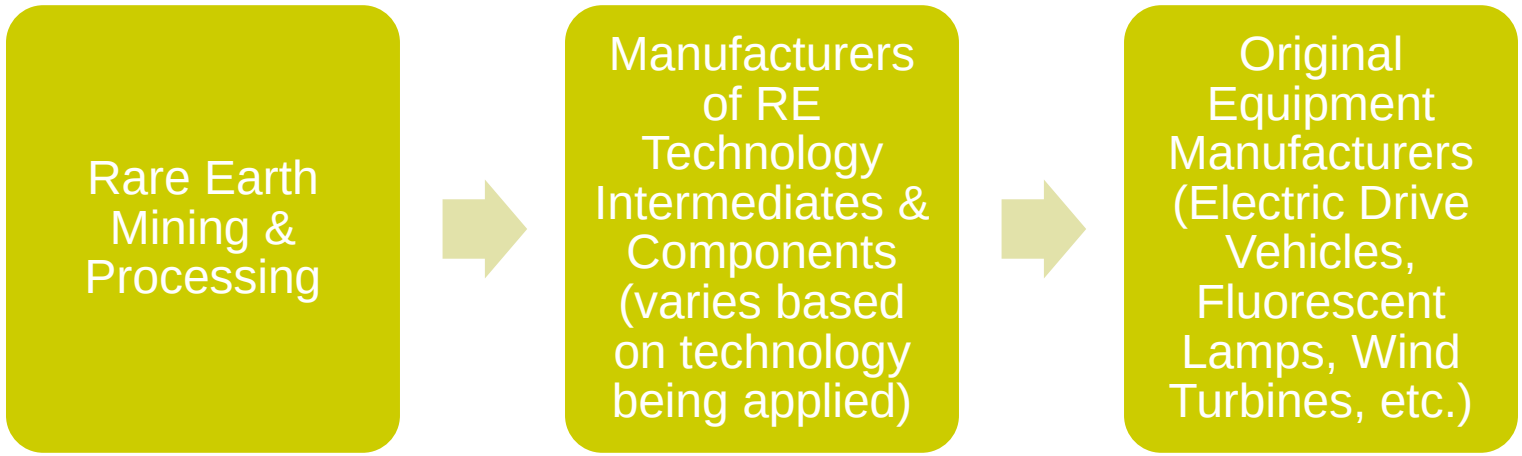
The Case for Action

- For ***diversity and security of supply*** of RE technologies, the “Rest of the World” must take action in light of China’s prudent policies

- Availability of RE raw materials from sources outside of China will not, in and of itself, solve the problem – ***whole supply chains for individual RE technologies need to be created*** to insure secure and diverse sources of RE technologies ***for Original Equipment Manufacturers*** (OEMs) ***and other downstream customers***

RE Industry Stakeholders for Energy Independence / Green Energy





The Case for Action

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Offshoring technology innovation: A case study of rare-earth technology

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Available online 12 March 2007

Abstract

Many US firms are improving their individual competitiveness by offshoring manufacturing operations, services and, increasingly, knowledge work. Although research to date has maintained that these practices are beneficial to the offshoring firm and national economies, by reducing costs and expanding markets, little is known about the longer term effect of offshoring on the rate of innovation of home economies. This paper suggests that offshoring practices have adverse effects on innovation at the national home base. The analysis uses patents in the rare-earth element industry, a high-tech area which is among those that have evolved the furthest towards outsourcing and relocation away from the US and to developing countries. Looking at the rare-earth industry can provide insights in identifying potential long term impacts of offshoring on innovation because many other US industries are likely to adopt similar offshoring strategies.
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The Case for Action

In his paper, Dr. Fifarek and his colleagues conclude:

- **As the manufacturing of technologies employing rare earth elements has moved offshore … "These outcomes *have significantly affected rare-earth innovation processes in the US."***
- **As the relative rate of successful patents by US organizations has decreased "… the likelihood that knowledge generated in the US will be used for such innovative activity is also decreasing."**
- **"… *the need for firms to increasingly plan their innovation within a collaborative supply chain environment*."**
- **"… *the government may need to provide support* to areas subject to market failure *in terms national private R&D investment because of offshoring decisions…*"**

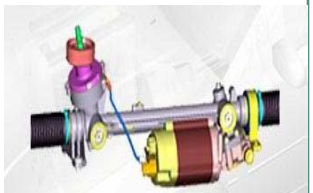
The Case for Action

- Fully dense ***RE permanent magnets and RE phosphors*** - both vital for green energy and energy independence - are excellent cases in point.

- Creation of entirely new supply chains for these technologies ***will require collaboration.***

- ***The urgency to address the issues*** to meet its goals, for energy independence and national security, ***is receiving heightened attention of the US government.*** The next few slides show why.

US Department of Energy Interest in RE Technologies

	Application	Rare Earth (RE) Technology	Enabling Functionality	RE Elements Required
 Toyota Prius	Hybrids, Plug-In and All Electric Vehicles	RE Permanent Magnets	Electric Traction Drives replacing or supplement-ing internal combustion engines	Nd, Pr, Dy, Tb
 Bosch Electric Power Steering System	Electric assist motors in conventional and advanced vehicles	RE Permanent Magnets	Higher MPG by taking significant loads off power trains	Nd, Pr, Dy, Tb
	Integrated Starter / Generator for Improved MPG	RE Permanent Magnets	Shuts off engine when stopped and instant restart when accelerator is pressed	Nd, Pr, Dy, Tb
	Compact and Linear Fluores -cent Lamps	RE Phosphors	Ability to match color and bright-ness of incan-descents with 70% less energy	Y, Eu, Tb

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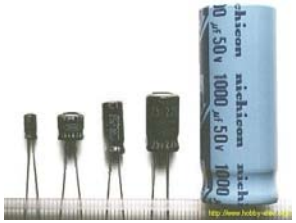
US Department of Energy Interest in RE Technologies

	Application	Rare Earth (RE) Technology	Enabling Functionality	RE Elements Required
 High power Ni-MH Battery from Toyota Prius	Ni Metal Hydride Batteries	Energy Storage	Proven and Cost Effective compared to Li Ion Battery alternatives	La, Ce
	Capacitors with High Energy Density	Rare Earth-doped ceramic , tantalum and other types of capacitors	High Energy Density compared to conventional capacitors	Various
	Wind and Hydro Power Generation	RE Permanent Magnets	Gearless generators for better reliability and online performance	Nd, Pr, Dy, Tb
	LEDs	RE Phosphors	Efficient, compact and intense light source	Y, Eu, Tb

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US Department of Defense Interest in RE Technologies

Rare Earth Elements Used

Nd, Pr
Sm, Dy, Tb

Rare Earth Technology

Compact / Powerful
Permanent Magnets

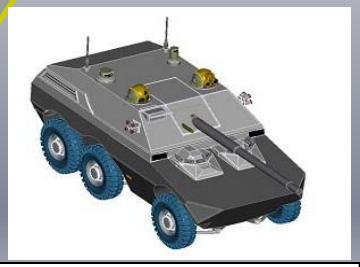
Function / Application

Guidance & Control and Electric Drives

Selected Examples

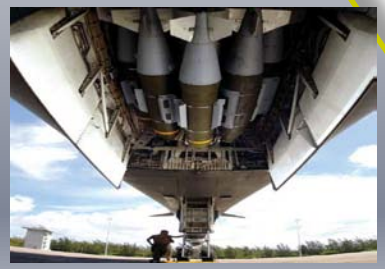
Predator Unmanned Aircraft

Tomahawk Cruise Missile



Future Combat Systems Vehicles

Zumwalt DDX Destroyer



Smart Bombs

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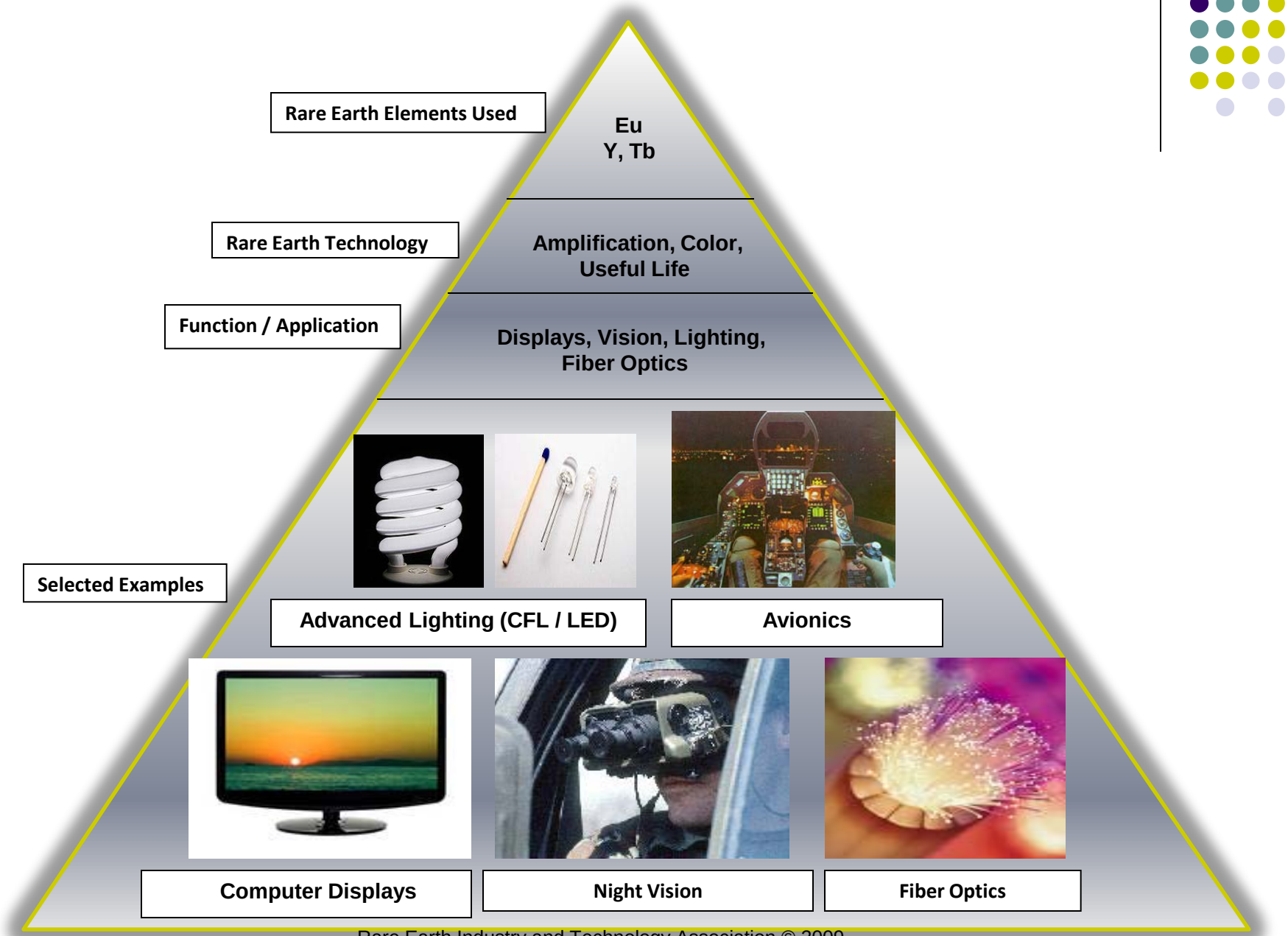
US Department of Defense Interest in RE Technologies



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US Department of Defense Interest in RE Technologies

Rare Earth Elements Used

Nd, Y,
La, Lu, Eu

Rare Earth Technology

Amplification, enhanced resolution of signals

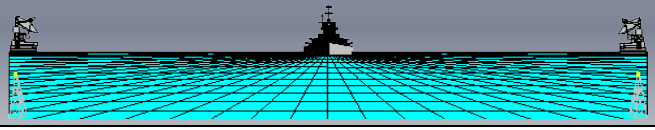
Function / Application

Radar , Sonar, Radiation and Chemical Detection

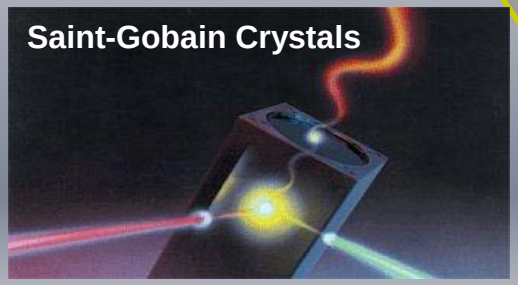
Selected Examples

Radar

Sonar Transducers



Microwave Communications



Enhanced λ Ray Radiation Detection

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REITA Vision and Mission Statement

Vision: To become the premier association of ***industry, government and academic partners*** meeting the global need for Rare Earth materials and products

Mission Statement: ***To facilitate and foster the creation of a commercially sustainable Rare Earth industry and technology base*** to meet the growing global need for Rare Earth materials and products ***for green energy, defense, energy independence applications***

REITA's Values

- Collaboration
- Respect for IP Rights
- Openness - views are transparently expressed
- Trust
- Phase-gated approach to projects
- > Risk = > Rewards

REITA and the Consortium of Members

The Rare Earth Industry and Technology Association (REITA) is a Colorado ***nonprofit corporation*** (Section 501 (c)(4)) ***formed to facilitate the development and commercialization*** of rare earth technologies critical to commercial and national security applications

Those companies and institutions that execute the agreement with REITA become members of the ***Rare Earth Technology Consortium*** (along with REITA who is also a member of the Consortium)

Consortium Funding Possibilities

The ***Consortium*** is designed after the US Department of Defense Science & Technology Division's "Innovation Enterprise Model" ***qualifying REITA to contract directly with DoD*** (on behalf of the Consortium members) ***under extremely favorable funding instruments and terms*** to pay for technology development

Acquiring DoD or other government development funding will be critical to the ***Consortium achieving its mission in an expeditious timeframe*** while mitigating the commercialization risk to the ***Consortium*** members

REITA Membership Qualification

REITA has an ***open membership policy for any global company or institution that is capable of playing a role in REITA's mission*** by way of RE-related technology or market expertise

Whether or not a non-USA company or institution is allowed to participate in a *specific* DoD funded program will depend on ***the nature / sensitivity of the program and the member's eligibility*** under the US Arms Export Control Act (22 U.S.C. 2778), International Traffic in Arms Regulations (***ITAR***), etc.

Current REITA Members

Molycorp Minerals

imagination at work

ARNOLD MAGNETIC TECHNOLOGIES

EEC ELECTRON ENERGY CORPORATION

COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

Jack Lifton LLC

Current REITA Members

Worcester Polytechnic Institute

Rare Element Resources
Targeting Gold and Rare Earth Elements

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Iowa State University operates
The Ames Laboratory
under a contract with the
U.S. Department of Energy

Rare Earth Technology Consortium Technology Development Process

Project Teams are subsets of the Consortium members ***who "self assemble" into and execute the requisite technical and commercial agreements*** amongst themselves in order to initiate a Development Project

When called on by a Project Team, ***REITA will execute a contract with the US government, on behalf of the Project Team***, to fund the Development Project

Concluding Remarks

To meet projected global demand, the world will need every ***economically viable*** RE resource (especially RE heavies) to be developed and brought into production

Because global RE resources are finite and ***extremely expensive to develop***, RE conservation is critical:

- ***High yield processes*** in each and every RE technology supply chain should be utilized
- ***Recycling*** technology for RE scraps, wastes, and spent RE products needs to be developed and practiced whenever possible

Conclusion

Please accept REITA's ***invitation to apply for membership*** *in the Rare Earth Technology Consortium*.

Membership application / agreement can be downloaded at **www.reitausa.org**

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