

Industry Job Hunting for PhD's

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ExxonMobil Research & Engineering Co.
APS Baltimore Meeting – March 15, 2006**

Industrial Research: Questions to Ask

- **How Do Industries Practice R&D?**
 - **Defining Projects**
 - **Research Approaches**
 - **Time Scale for Research Projects**
- **What Career Paths Are Open to PhD Scientists?**
 - **Research**
 - **Development and Deployment**
 - **Management**
- **How Would I Fit In?**
 - **Selecting and Joining a Company**
 - **Engaging in Research**
 - **Career Trajectory**
- **What are the Rewards of an Industrial Career?**

Who Am I?

- **Condensed Matter Scientist**
 - **Magnetic Resonance (NMR & EPR)**
 - **Faculty Member: UC Santa Barbara**
 - **Member of Technical Staff: ExxonMobil Res. & Eng. Co.**
- **Wide Range of Research Experiences: Materials, Catalysis, Geophysics, Geochemistry, Fossil Fuel Science, Molecular Dynamics, ...**
- **Company Roles: Research Scientist, Group Leader, Section Head, Senior Scientific Advisor, ...**
- **ExxonMobil Corporate Recruiter: College of Chemistry, UC Berkeley (~25 Years)**
- **APS Governance - Chair: Education Committee, Committee on Opportunities in Physics, Panel on Public Affairs; APS Fellow**

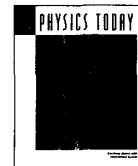
What is Industry?

- Wide Variety of Industries
- Different Objectives, Operating Plans
- Varied and Exciting Opportunities for Physicists

Top Physics Companies

- | | |
|-----------------------|-------------------------|
| 1 IBM | 11 SRI, Int'l |
| 2 SAIC | 12 Ball Aerospace |
| 3 Northrop Grumman | 13 Hewlett-Packard |
| 4 Corning | 14 DuPont |
| 5 General Atomics | 15 Pfizer |
| 6 Exxon-Mobil | 16 General Electric |
| 7 Lucent Technologies | 17 Boeing |
| 8 Lockheed Martin | 18 3M |
| 9 Raytheon | 19 Agilent Technologies |
| 10 Schlumberger | 20 Dow Chemical |

Source: *Physics Today* subscriber list, May 2005.



PHYSICS TODAY

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Angie Matchko
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Dear Angie,
We are delighted to inform you that *Physics Today* magazine is awarding your company with a Top Physics Company award for 2005. *Physics Today* is read each month by 120,000 scientists and engineers in university, government and commercial labs. The award is given each year to the top 20 industrial employers of physicists, as measured by the Statistical Resource Center for the American Institute of Physics. You can look below to see how your company compared in this physics ranking:

Top Physics Companies

- | | |
|-----------------------|-------------------------|
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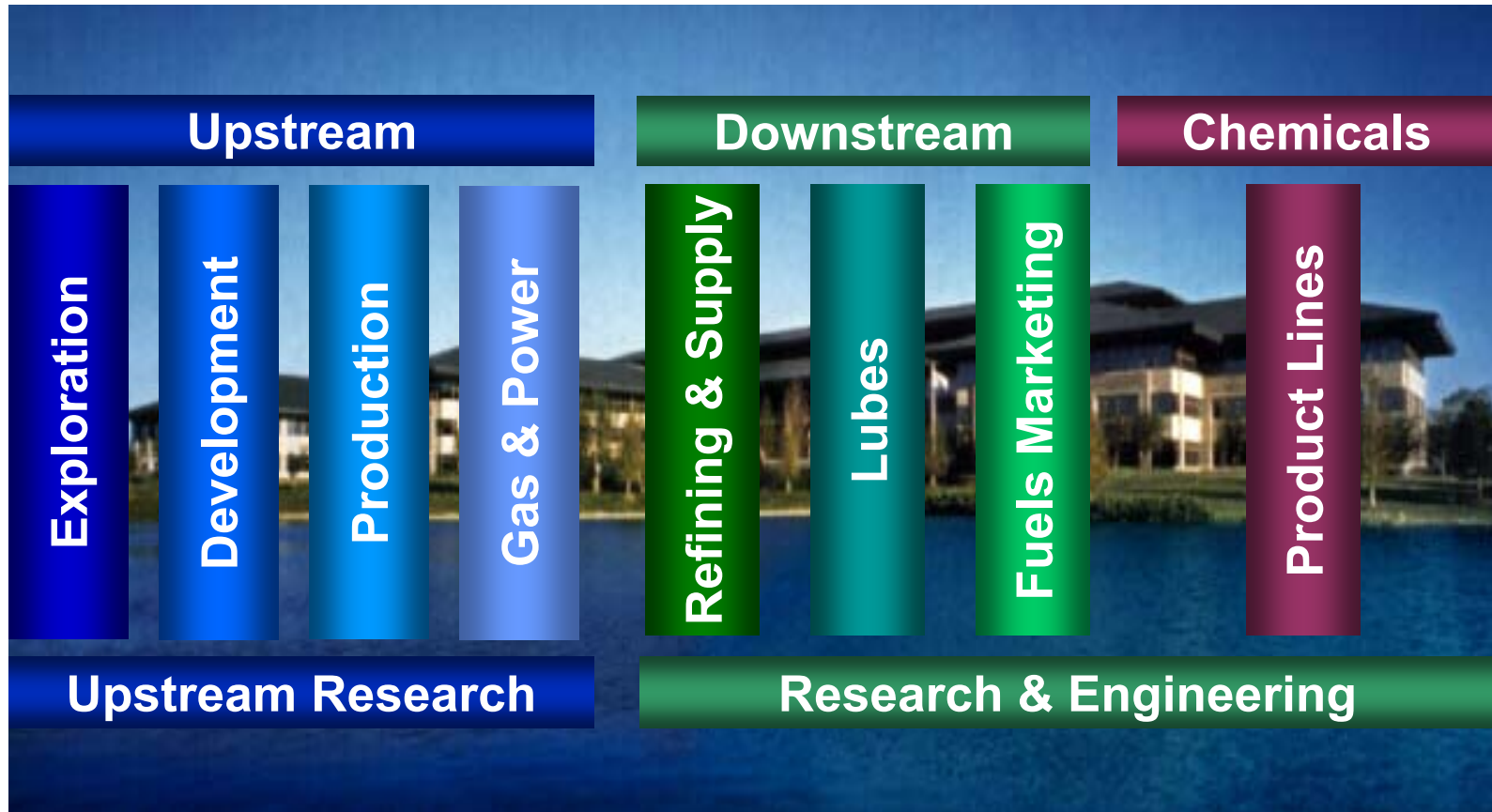
Source: *Physics Today* subscriber list, May 2005.

This award may come as a surprise to you, for you might never have pictured your company as a "physics company." If so, you would not be alone. Most people can name a chemical company (Dupont), electronics company (General Electric), maybe even a biotech company (Pfizer). Even though those companies hire tens and hundreds of physicists, most people in business have never heard of a "physics company." This might even be true for HR professionals, who hire physicists for their company each year, but never think of their companies as a "physics company."

We hope that you will be able to display your award proudly, maybe even explain why you received a "Top Physics Company" award in the first place. And when you're hiring for a position that requires physics training or a physicist in the future, we hope you'll consider using our recruitment services at www.physicstoday.org/jobs, or in print editions of *Physics Today* (classads@aip.org). Who knows, it might help you to nail down another "Top Physics Company" award in 2006!

 Jeff Bebee

ExxonMobil: An Example

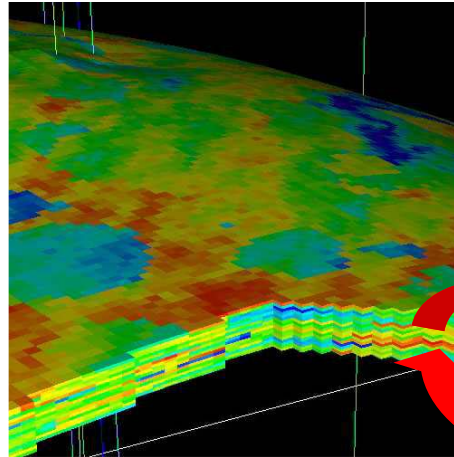


- **85,000 Employees**
- **20,000 Engineers and Scientists**
- **2,000 PhD's**

Upstream Technology

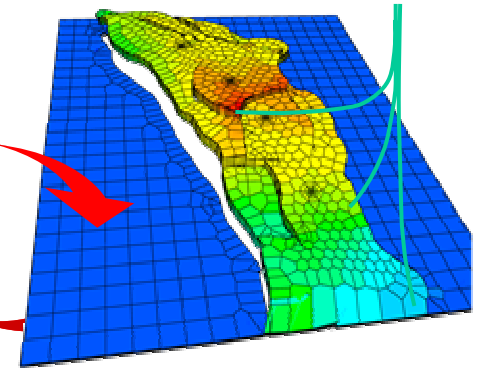
Exploration

- 3D/4D Seismic Data
- Geochemistry
- Geology
- Visualization



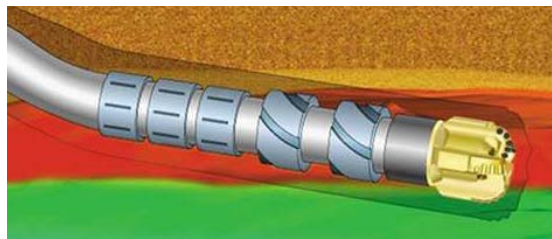
Leading Edge Simulator

“Virtual Drilling”



Development / Production

- Directional Drilling (> 6 mi)
- Deep Water Production (> 5,000 ft)



Extended Directional Drilling



Deepwater Production:
Hoover-Diana (GOM) 4800'

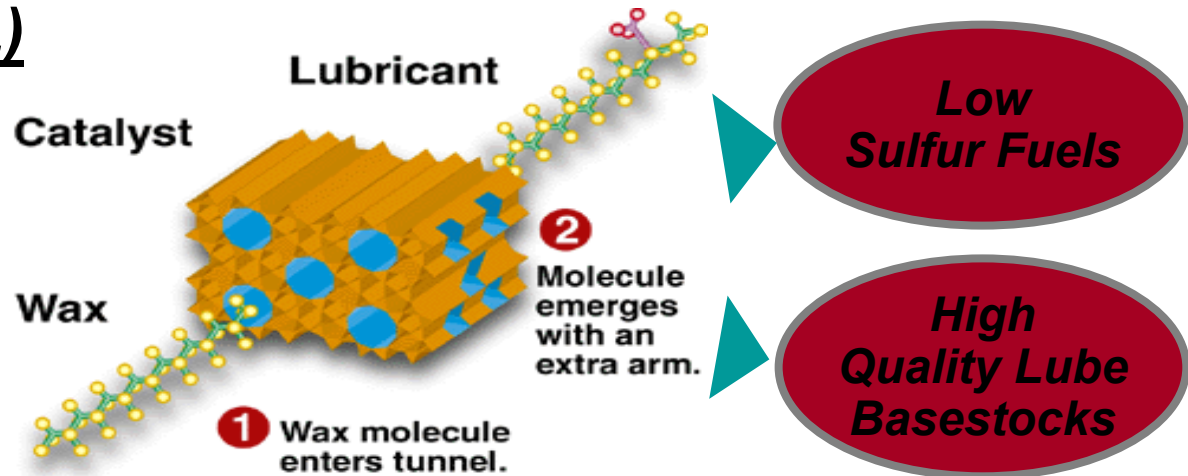
Downstream Technology

Molecule Management

- Tailor the Process to the Crude
- Best Use of Every Molecule
- Used in 45 ExxonMobil Refineries Worldwide

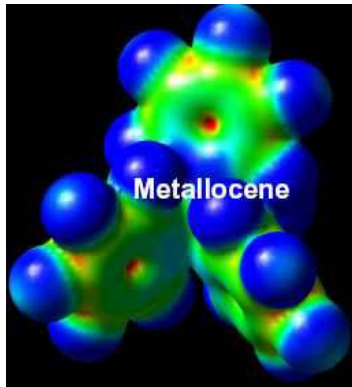


Gas-to-Liquids (GTL)

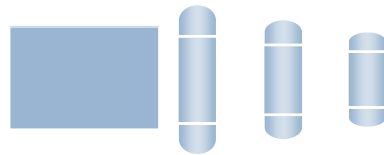


Chemicals Technology

Metallocene Polymers



Catalyst Design



Process Development



Commercial Plant

High-Throughput Experimentation (Chemicals & Downstream)

Alliance with Symyx
July, 2003



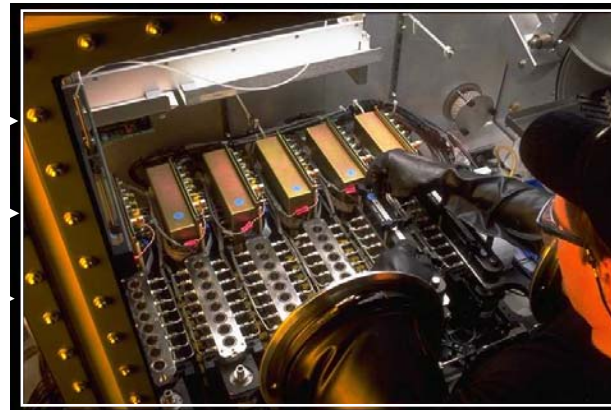
Symyx®

ExxonMobil

Feedstocks

Catalysts

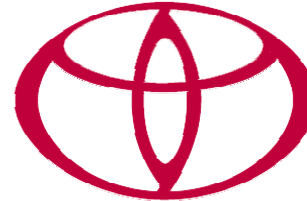
Process
Conditions



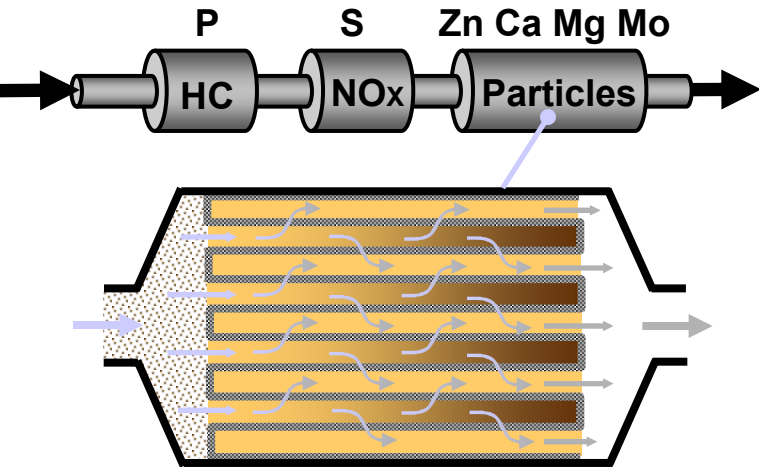
Discovery
of new
Products
and
Processes

Corporate: Advanced Vehicle Technologies

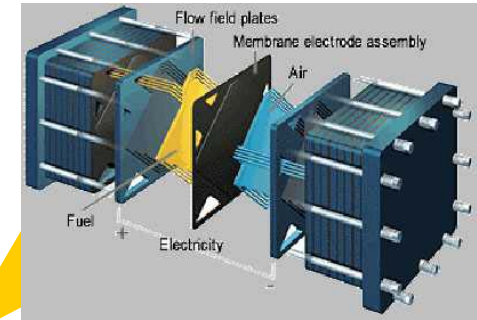
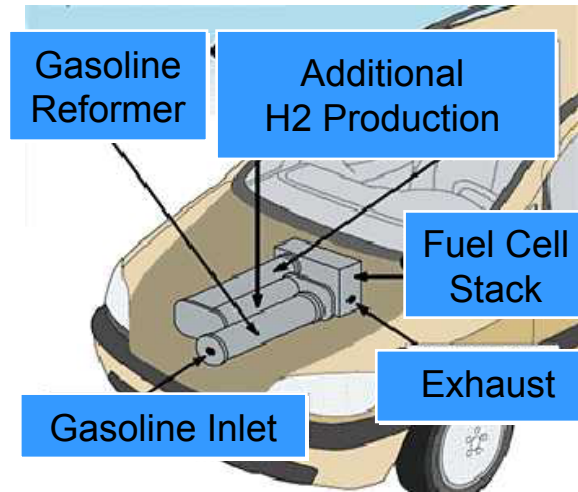
ExxonMobil Strategic Alliances with Auto Companies



Fuel and Lube Effects on Diesel After-Treatment

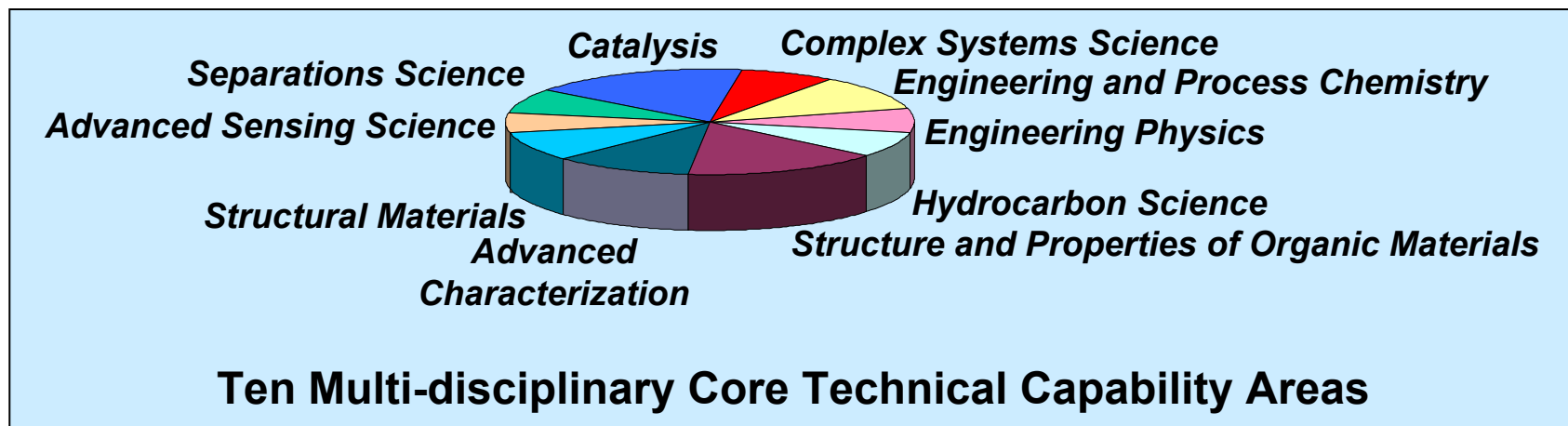
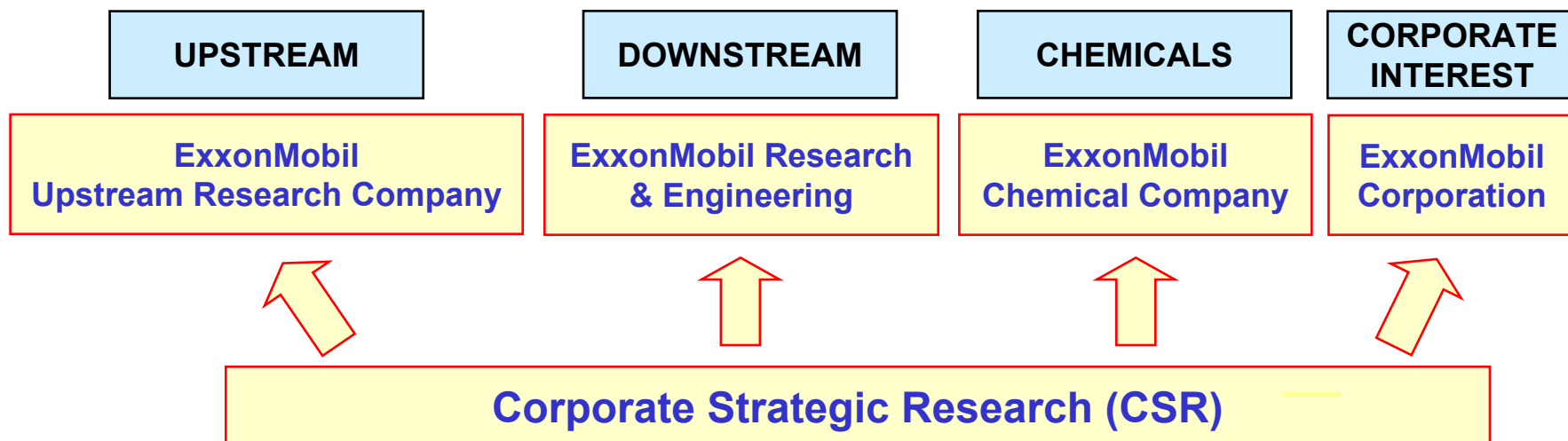


Fuel Cells



- Lower Emissions, Greater Efficiency

Corporate Strategic Research

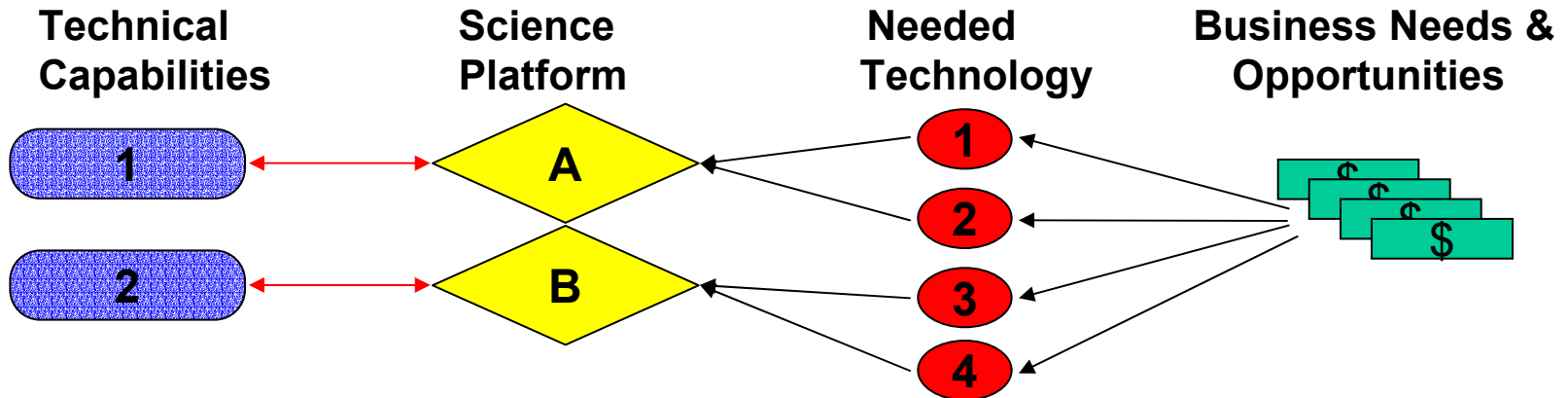


- 145 MTS + ~15 PPhD's
- ~20 % Physicists

How Do Industries Practice R&D?

- **Choose Projects Carefully**
 - Meld ideas, capabilities, needs
 - Value vs. probability of success
 - A good project portfolio will have a mix of value / probability options
- **Complexity of Problems Requires Multidisciplinary Teams (Physicists, Chemists, Engineers, Mathematicians, ...) for Projects**
 - Early involvement of staff from other laboratories
 - Consultation with development and engineering personnel
 - Balance value and probability of success
 - You bring your skills and background to the team
- **Use the Most Advanced Tools**
 - Characterization: Beamline, Non-Linear Optical Spectroscopy, ...
 - Computing: Modeling, Data Mining, Visualization, ...
- **Cast Technology Issues in Scientific Terms**

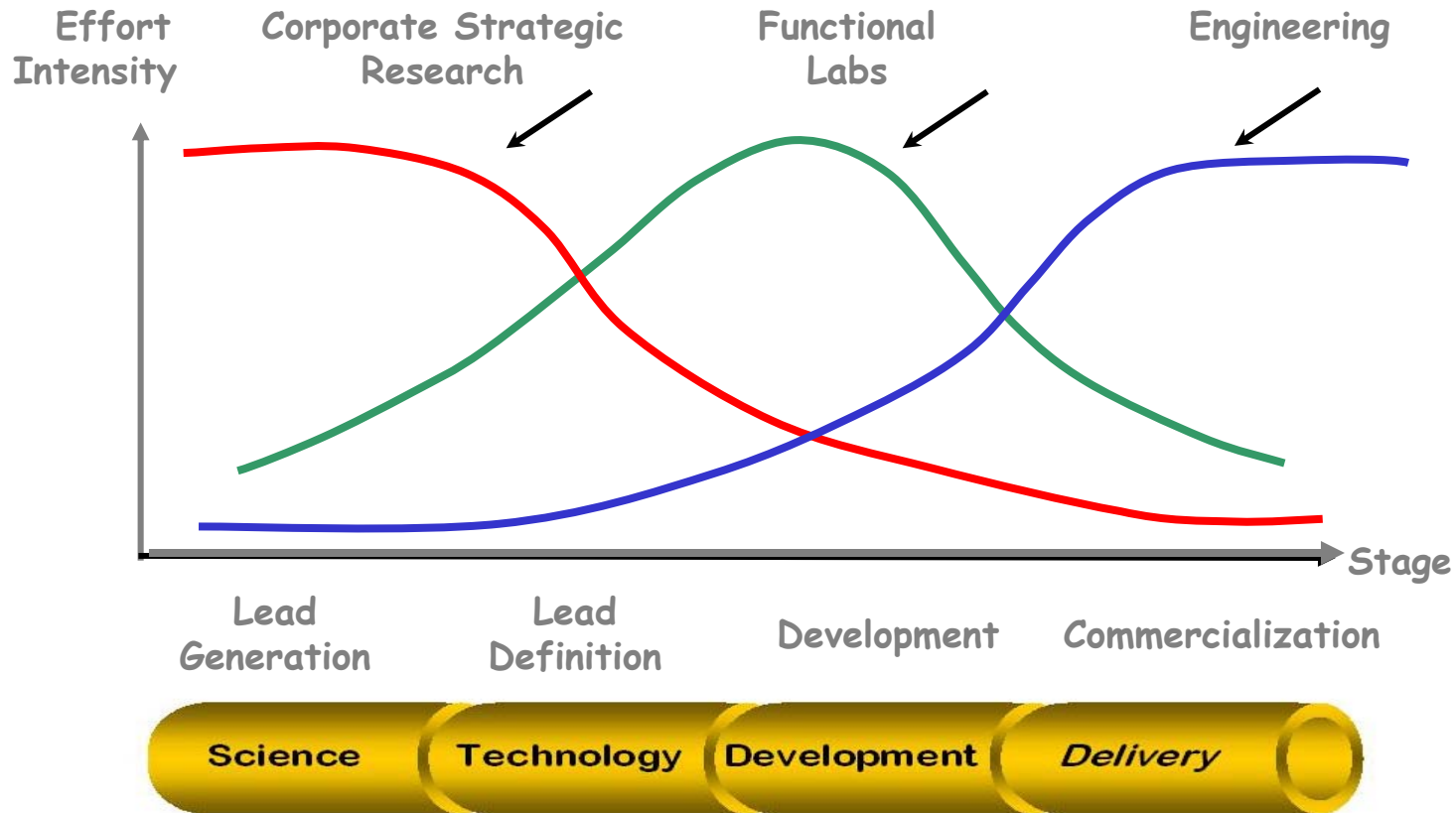
How Are Projects Defined and Selected?



Ongoing Dialogue Involving Business, Technology, and R&D Organizations:

- Strategic Outlook
- Ongoing / Short Term Needs
- Technology Opportunities
- Science Capabilities
- Potential Value of the Project

How Do Projects Progress?



- Use Staged Approach (Lead Generation, ...)
 - Have Gate Reviews at Each Transition Point
 - Ensure Seamless Personnel Handoffs Along Commercialization Path
- ⇒ Typical Lifetime for a Successful Project: ~ 5+ Years

What Industrial Career Paths Are Open to PhD's?

- **Research**
 - Ongoing work in a given scientific area, coupled with deepening experience in company problems ...“Company Expert”
 - Work on different projects, applying basic science to key problems
 - ⇒ Is there a parallel science / management track in the company?
 - **Development, Deployment, and Support**
 - Working in development laboratories, engineering, or business units
 - Closer contact with the business, can be extremely effective
 - ⇒ We hire PhDs into all four areas, moving back and forth encouraged
 - **Management**
 - Participation in leadership roles is encouraged ...another dimension
 - Management ↔ research transitions are encouraged
- ⇒ For Graduates Completing 20+ Years in Academia, It's Not Clear Which of These is Most Attractive ...You May Wish to Try Several!

Job Searching in Industry

- **Preparing the Resume**
 - **Basic academic information (Degrees, Dates, Recognitions / Honors)**
 - **Enumeration of capabilities, especially areas of deep expertise**
 - **Brief description of research activities, significance and novelty of your work**
 - **Other work experiences and leadership activities**
 - **Supporting documentation: undergraduate GPA, publications, ...**
 - **References**

- **Things Industrial Reviewers Are Looking For:**
 - **Analytical ability**
 - **Interpersonal effectiveness ...A Team Player**
 - **Adaptability ...“Peripheral Vision”**
 - **Communication skills**
 - **Demonstrated leadership**
 - **Job / organization / location fit**

Interviews and Early Job Contacts

- **Get an Overview of the Company Before Your Visit (Websites are Useful)**
- **Prepare for a Technical Seminar on Your Research and for Interviews with Members of the Staff**
- **In Your Presentation, Appreciate the Diversity of People's Backgrounds**
 - They may not be familiar with the specific details of the research but will follow the logic and consistency of the arguments
 - Why have you chosen to do this thesis / PPhD ? What is its significance? How does it shed new light on the research area?
 - What possible extensions might it have to the company's business?
- **Interviews are Two-Sided. Interview the Company too!**
 - What are the company's goals and vision?
 - How are the individual researchers involved in realizing the vision?
 - How would my science fit into this environment?
 - What are the career paths? How broad is the opportunity spectrum?

⇒ Don't be afraid to ask many people the same questions!

The Job Offer

- **Job Type**
 - **Post-Doctoral (One Year – Renewable) or Permanent Employee**
- **Salary**
 - **Scales reviewed annually, Experience (PPhD, etc.)**
- **Benefits**
 - **Health, Savings Plan, ...**
 - **Dual career opportunities**
- **Relocation Assistance**
 - **House hunting, moving, ...**
- **Conditions**
 - **Background, Drug test, ...**

What Are The Jobs Like?

In Corporate Strategic Research:

- **Post-Doctoral Fellow**
 - Placement in a capability development project where your background is complementary
 - The tools and laboratory are in place ...immediate research activity
 - Peripheral interactions with other science areas (seminars, workshops, ...)
 - External publication is important
 - ⇒ Significant level of conversions to permanent positions
- **Permanent Hire (Member of Technical Staff – MTS)**
 - Placement in one or two projects where your skills are useful
 - Expand the capability envelope
 - Learn the associated business issues
 - Internal and external publications

Career Trajectory

- **Assimilation Process (First 6 Months)**
 - Safety & Procedures
 - Mentors
 - Explore the laboratory research environment (seminars, ...)
 - **Establish a Technical Base**
 - Participation in research projects
 - Familiarity with affiliate research
 - **Expand Horizons**
 - Develop competency in other technical areas
 - Organizational tasks (lead seminar series, safety, ...)
 - Initial leadership opportunities (sub-teams, special projects, ...)
 - Cross laboratory collaborations
- ⇒ **Explore career paths (Research, Development, Deployment & Support Management). May move between these roles during a career**

Rewards of an Industrial Career

- **A Broad Range of Experiences**
 - You can define your role and manage your career
 - Can move between fields
 - Resources are available
 - Combine practical and applied science
 - Strong interpersonal and intercultural interactions
- **Can Work on Problems with Great Technical and Societal Impact**
 - Providing energy sources
 - Improving the environment
 - Developing new technological options

⇒ See ideas come to fruition



Ultra-low Sulfur Fuels



High Strength Steels for Natural Gas Pipelines



High Performance Products



Methane to Liquids