Industrial Research Labs:  
Neither for the Feint of Heart  
Nor the Short of Sight  
But Vital

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The American Research Landscape:  
Leveraging the Academic/Industry Partnership  
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Outline

- What is Mitsubishi Electric and MERL
- The Future of Corporate Research
- Basic Research in a Corporate Setting
- Technology Transfer
- University Industry Interaction
- IP (Bone of Contention)
- What Government Should Do
- What’s it All About Really
Mitsubishi Electric (Melco)

- $30B in sales
  - 70% in Japan, 10% in US, 10% in EU, 10% in East Asia
- 100,000 people in 35 countries
- Diverse business units
  - Elevators, communications equipment, auto parts, factory automation, semiconductors, TVs, DVD players, satellites, power plant equipment, large systems for government and industry, …
- Primarily a business to business company
- Seeks competitive advantage via technology
  - (as opposed to e.g., price)
  - Every recent president of Melco has been an engineer
  - The current president is the former head of corporate R&D
Mitsubishi Electric Research Labs (MERL)

- The US arm of Melco’s Corporate R&D
  - Computer science and electrical engineering research from algorithms and devices to systems
- MERL’s Mission
  - To generate important intellectual property in areas of value to Melco
  - To locate appropriate Melco organizations and, through partnership with them, significantly impact business
- 65 researchers in Cambridge MA
- Established in 1991
Placing MERL in the Research Lab Spectrum

• Funding
  – 1/3 customer requests, 2/3 central funding

• Research vs advanced development
  – MERL has two sub-labs, one for applied research & one for AD

• Creator versus observer/acquirer
  – MERL seeks to create new technology

• Participation in the research community
  – MERL is open, publishing all its results

• Collaboration with universities
  – MERL does a lot: Student interns, relations with professors, …
The Future of Industrial research

- Recent years have not been glory days
  - Mighty labs have fallen
  - Research is shorter range in most places
  - Some labs have been closed

- Is industrial research on the way out?

- Can basic research continue in industry?
Is Industrial Research on the Way Out?

• I don’t think so
  – Companies need to innovate or die
  – If a company has the PE ratio of Cisco Systems in the late 90s, it can buy up all it needs from innovative startups
    • But for lower fliers, this costs too much
  – Also, companies need research closely tuned to their needs
    • That is not necessarily available from anywhere outside

  – There are many ways to organize research and pendulums swing back and forth, but companies must devote effort to innovation
Can Basic Research Continue at Companies?

• I believe it can
  – But there is almost certainly going to be less of it for a while

• Basic research takes time and money
  – The more basic it is the more time and money it takes
    • The most basic research requires (near) monopoly profits
      – The old AT&T could do it
      – Probably, Microsoft can do it
      – The government can and should do a lot of it
      – Most companies cannot
  – But, patient companies like Melco can benefit from basic research
    • The key is focusing on relevance to the company and
    • Following through all the way to business impact
Basic Research in a Corporate Setting

• First a caveat:
  – In general, basic research in computer science
    • is nowhere near as basic as in physics of biology
  – However, even if only modestly basic,
    • long term research is tricky to achieve in a corporate environment
The Rule of Thirds

• What a lab does needs three key parts:
  – 1/3 had better be benefiting the company now
    • Or else, people will wonder if money is well spent
  – 1/3 laying the groundwork for next year’s immediate benefit
    • Or else, the lab will be in trouble next year
  – 1/3 developing seeds for the future
    • Or else little of real interest is going to happen
    • This is where basic research is possible
      – And in my opinion essential
The Approach to Basic Research Used by MERL

• Basic research requires
  – Exceptional people
  – Stable funding
  – Avoidance of micromanagement from above

• For it to benefit the company
  – The people must do relevant things
  – The people must follow through all the way to impact

• It’s a delicate balancing act,
  – but potentially very productive

• Freedom within moderate constraints
  – Can be very good for research and company impact
Freedom & Focus in Basic Industrial Research

Corporate Needs

Bounded Freedom

Technical Expertise

Researchers
Understand where they can advance science
Understand company needs (far from easy)
Select research directions in the overlap
(Only a few can really do this, others follow)
Create major innovations
Follow through to impact the company
Technology Transfer

• At the center of technological development
  – But far from easy
Technology “Transfer” I - Idea flow

- Not very effective model
  - “Great ideas” move from one step to another
  - Doesn’t work well for universities or corporate labs
    (unless ideas are very simply described as in pharmaceuticals)
    - Communication is difficult
    - Not-invented-here antibodies are virulent!

- Implicitly lurks behind many university-industry models
  - Including (it would seem) the “one-stop IP-shop” model
Technology “Transfer” II - People flow

• Pretty effective model
  – People move with “Great ideas” from one step to another
  – Works fine for universities and within companies because
    • Communication is good
    • Transplantation limits not-invented-here antibodies
  – The outflow of students is a university’s greatest strength
  – But, requires a lot of turnover at the recipients
    • new people with each set of ideas
Technology “Transfer” III - Collaboration of Peers

- Very effective model
  - People with similar abilities collaborate as peers
    - Creating and communicating ideas
  - Works great for universities and within companies because
    - Communication is good
    - True collaboration means everyone feels “it is invented here”
  - People moving useful but not essential
Peer Collaboration Good With Universities Too

Universities

Basic Research

MERL

Basic Research

Advanced Development

Melco

Advanced Development

Product Development
University Industry Interaction

• Universities and industry can work together many ways
  – Some are a lot better than others for one side or the other
Great Kinds of Industry University Collaboration

• Peer collaboration (With or without corporate gifts)
  – Good for all concerned
    • Inexpensive; but company shares IP
  – MERL does this a lot

• Student interns
  – Great for company and students (as long as company is open)
    • Medium expense; Company owns IP
  – MERL does this a great deal (50-60 interns/yr for 65 tech staff)

• Professors consulting to industry
  – Great for company and professors
    • Considerable expense; Company owns IP
  – MERL does this a moderate amount
Not so Great Kinds of Collaboration

- Fully funded research
  - Great for university
    - Extremely expensive; Company owns IP
    - Too expensive for MERL
- Partly funded research
  - OK for both sides
    - Still quite expensive; Company shares IP
  - MERL does this a small amount
- Research Consortia
  - Fine for University, variable value for companies
    - Expensive; complex IP situations
  - MERL hasn’t yet seen a consortia worth the cost
Industrial Affiliate Programs

• Here I can only speak from MERL’s particular perspective
  – IAPs have many goals, but one often cited is “access”
    • This seems to me to be a weak justification at best
  – If a company has competent researchers in a field
    • It has much better access to all universities at once
  – If it does not have such researchers
    • It is difficult for it to take advantage of the access an IAP provides

• In its early days, MERL was a member of several IAPs
  – In part, this was an attempt to make connections
    • Which wasn’t particularly effective
  – In part, it was philanthropy
    • Which in better economic times we would be pleased to continue
IP (Bone of Contention)

• Universities and industry are natural collaborators
  – With few areas of contention
  – Except IP!
Not all IP is the Same

• Some IP is
  – straightforward to transfer, hard to get around, and has high value
    • Pharmaceuticals, plant verities, …
  – Nobody can argue against universities obtaining maximum value
    • Hundreds of millions are at stake

• A lot of other IP is
  – hard to transfer, easy to get around, and of much less value
    Computer algorithms, system things, …
  – It doesn’t make much sense to be fighting over this kind of IP

• University licensing departments
  – Were created because of the former
  – But naturally tend to treat everything the same
  – They can greatly complicate collaboration
A Horror Story

• A few years back
  – MERL was considering joining a university/industry consortium
    • MERL would have paid a considerable sum to the university
    • MERL was asked to sign an IP agreement that
      – Gave the University shared rights to IP developed by MERL by its own people on its own money in its own facility in the area of the consortium
    • MERL never succeeded in negotiating an agreement that
      – Was even equal to no agreement at all
    • No surprise, MERL never joined the consortium

• One cannot help but feel nostalgic for 10 years ago
  – When universities didn’t care much about IP
The Typical Case Isn’t Very Good Either

• US universities are asking way too much for IP
  (Often claiming Bayh Dole made them)
  – Many a proposed IP agreement is of the form
    • Pay now for the right to decide later what it will cost later
  – One doesn’t need to have any agreement
    • To be able to decide later what it will cost later
  – The only kind of agreement MERL will sign is of the form
    • Pay now so you don’t have to pay later
    • But we haven’t had this opportunity with a US university in a while

• All this is a major impediment to collaboration
  – In general, we sign no agreement and
    • Collaborate only in situations where MERL will co-invent
    • At least then, US patent law specifies we don’t have to pay later
What Government Should Do

• Support basic research
  – This is something that really raises all boats

• Grow scientific talent
  – By supporting education

• Promote immigration of the talented and hard working
  – The current difficulties in getting visas of all kinds is a big problem
  – The influx of the talented and hard working
    • Has been the foundation of America
    • Let it continue to be so!
Above all, Let’s Focus on the Fundamental Goal We Share

• Stepping back from the details of IP and the like
  – All in research are involved in the same great enterprise
  – Let’s not let anything petty stop us!
    • (There are enough ways around everything)

• Let’s just collaborate no matter what
  – And through collaboration
    • Make a bigger difference