Research in Corporate Labs

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What is our Mission?

- Structure:
  - 3000 people, ½ PhD, ½ BS + MS
  - 40% Computer Science
  - 2/3 funded by corporate, 1/3 from IBM partners + Gov't + Customers
  - In Almaden CS, theory + "blue-sky" research (25%), new (not current IBM business) large products (25%), 2 – 5 year products (50%)
- Mission (paraphrased):
  - Make a BIG difference to IBM through science and applied research
  - Set corporate strategy, take risks for corporation, provide advanced technology, and provide lustre
- Measurements:
  - Every year-end, we get "evaluations" from partners
  - Strong patenting incentive, but not at expense of publication
  - Researchers expected to maintain strong academic connections
- Research does its own "portfolio" allocation
  - Management is perhaps more business oriented than other labs
  - Continuous Flow between rest of IBM and Research (at least 10 execs/vr)

IBM Research Worldwide

Almaden

Watson

Zurich

Beijing

Austin

Haifa

Delhi

Tokyo

Innovations

1944: Mark 1

1948: SSEC

1956: RAMAC

1957: FORTRAN

Typical mathematical formula:
$$D = B^2 - 4AC$$
Equivalent FORTRAN statement:
$$D = B**2 - 4*A*C$$
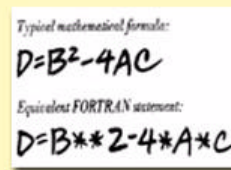
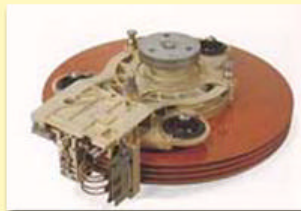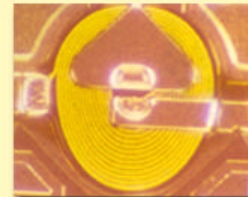1966: One-Device Memory Cell

1967: Fractals

1970: Relational Database
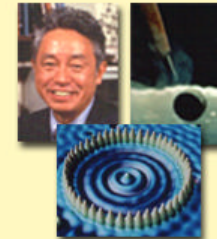
1971: Speech Recognition

1973: Winchester Disk

1979: Thin Film Recording Heads

1980: RISC

Nobel Prizes

1994: SiGe

1993: RS/6000 SP
1996,97: Deep Blue
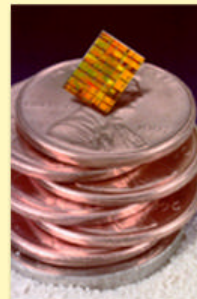
1997: Copper Interconnect Wiring
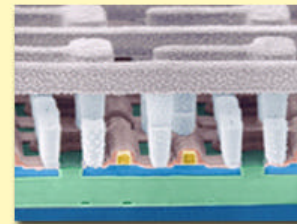
1998: Silicon-on-Insulator

1998: Microdrive

We have always had to re-invent ourselves with changing times

- 1980's: Establishment of Joint Programs
- 1990's: Dealing directly with customers
- 2000's: Starting new businesses for IBM; Getting to work closely with a people-heavy business (IBM Global Services)
- Increased Emphasis on "team" output as opposed to individual output

Case Study of Impact

- 1970: Relational Model invented by Codd @ IBM
- 1979: System R (in parallel with Berkeley Ingres) first relational system
  - Transferred as SQL/VM
- 1980 – 1990: IBM Researcher invented several new relational techniques as part of Starburst; however, Oracle took the lead in UNIX databases
- 1991: Researchers decided enough is enough – "we will do what it takes to win back leadership"; combined with strong partnership
  - In 2002, IBM again #1 in databases
- For "future investment" to pay off, two key ingredients required – ability (and desire) of researchers to work with product divisions, and a strong "partner"

There are different degrees of "immediacy"

- Long-Term:Let us paint a vision of the future: e.g., BlueGene – goal is scientific impact, with a grand challengy focus (there is no IBM business)
- Medium Term:Let us figure out some businesses that IBM is not in: e.g., unstructured data management – let us then build middleware from first principles, and not worry too much if rest of IBM sees it important or not (our current investment is 200 people, way beyond current IBM business)
- Shorter Term:Let us do next gen advanced technologies (e.g. DB2 R+1 around XML and II), investments in line with IBM business
- Like Now: Keep talking to IBM's customers; also solve new division's immediate problems

Try to maintain external focus too (e.g. 2001)

- Publications (out of 130 researchers):
  - 2 Books
  - 3 Chapters
  - 1 Conference Demo
  - 1 Conference Panel
  - 88 Conference Papers
  - 9 Conference Posters
  - 1 Conference Tutorial
  - 3 External Standards Publications
  - 37 Journal or Magazine Articles
  - 21 University Seminars
  - 17 Workshops
  - 9 Other External Publications
- 9 University grants, 2 fellowships

Partner Feedback

- Data Management
  - Delighted with accomplishment and impact, delivery on key products for DB2 and Content Manager ("We would not be here without you"), press briefings, customer consulting, strategy execution, people relationships
- Many others…

Challenges for the Future

- How to do research with services?
- How to establish cross-displinary research centers such as needed in LifeSciences?
- How to get a large number of researchers in front of customers (right now a 80-20 rule)?
- How to prevent researchers from falling into the well of incrementalism?

2001 PIC Key Conference Papers

Algorithms & Theory (STOC, FOCS, SODA)	7
Data Management (SIGMOD/PODS, VLDB, ICDE)	10
Human-Computer Interaction (Interact, CHI)	10
Knowledge Discovery & Data Mining (SIGKDD, ICDM, ICML)	5
User Interface Technologies (ICASSP, PUI)	4
Web (WWW, SIGIR)	8
Others (INFORMS, PODC, MM, ICME)	6
Total	50