

Open Innovation at HP Labs

*Fueling the next
generation of
breakthroughs in
Information Technology*

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Director, Strategy and Open Innovation
5 October 2010



A LONG TRADITION OF INNOVATION



HP's first computer: the HP 2116a



HP Indigo Digital Press



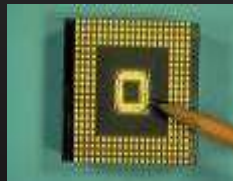
Utility Computing



"SHREK-2" – Flexible Computing



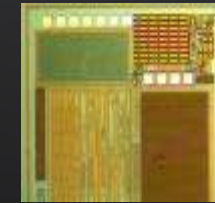
HP first laser printer



RISC Architecture



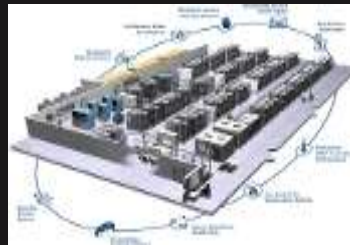
Thermal Inkjet Printing



Memory Spot Chip



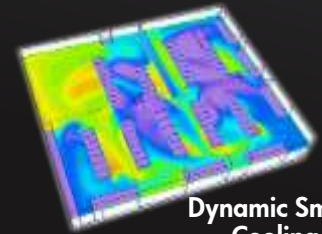
HALO Life Size Collaboration



Adaptive Infrastructure – Model Based Automation



Deterrence methods that could be used in printing currency

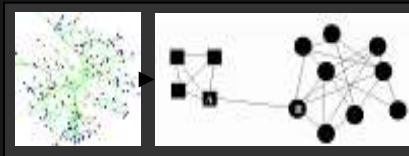


Dynamic Smart Cooling

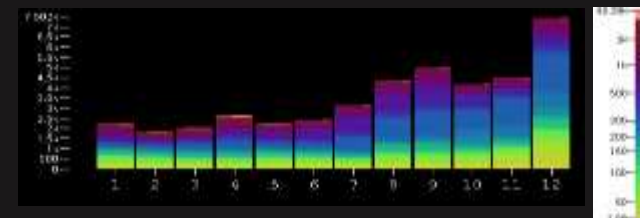


Product Tracking

Data Mining



Social Networking
Email Spectroscopy



Visualization - Pixel bar chart



GOALS FOR HIGH-IMPACT RESEARCH

Business impact

Technology transfers, demonstrators

Advancing the state-of-the-art

Publications and intellectual property

Thought leadership

Media coverage, external awards,
professional reputation

Engaging customers and partners

Making Labs' innovation real



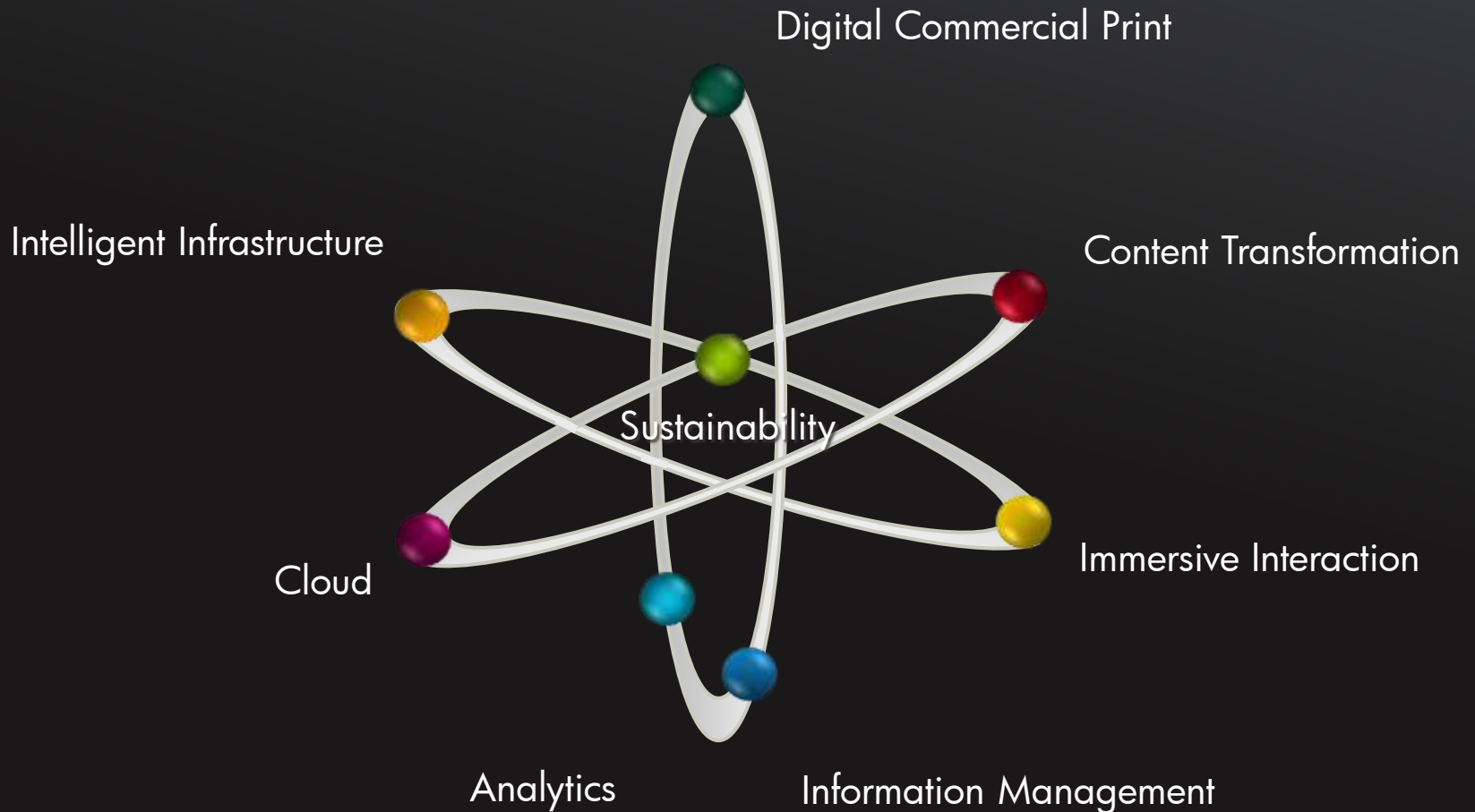
HP LABS AROUND THE WORLD

Global talent, local innovation



HP LABS RESEARCH PORTFOLIO

The next technology challenges and opportunities



Research to business impact

Deliver breakthrough technologies & technology advancements
Create new business opportunities
Invest in fundamental science and technology
Engage with customers and partners

Leading edge research agenda

- Delivering on our big bets

Amplifying investments

- Increasing external funding, talent and ideas for HPL

Demonstrators & customer co-innovation

- Turning our research ideas into reality faster

Tech Transfer

- Delivering value and impact to HP's businesses

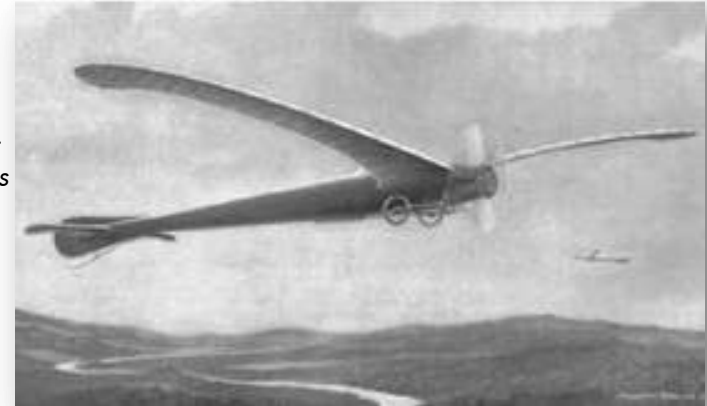
Delivering value to HP

- Business Impact
- Thought Leadership
- Customer Engagement

Breakthrough Innovation

– From this incremental approach in 1910

- *“It is possible to predict the characteristics of an aeroplane of the future which will be built purely for racing purposes. The speed of the aeroplane in straight-away flight has risen from 50 to 75 mph. We think that in view of its sweetness of form, the complete absence of wires, struts and other energy consuming surfaces, and because of the smoothness of the steel surface of its skin, it is conservative to expect from such a machine speeds of 100 to 125 mph.”*
Scientific American, October 1910



SCIENTIFIC AMERICAN, VOL. CIII, NO. 17; OCTOBER 22, 1910

– To this breakthrough approach in 1970s

- The SR-71 was the world's fastest and highest-flying operational manned aircraft throughout its career. On 28 July 1976, an SR-71 broke the world record for its class: an "absolute altitude record" of 85,069 feet (25,929 m). That same day another SR-71 set an absolute speed record of 1,905.81 knots (2,193.2 mph; 3,529.6 km/h).
- The SR-71 also holds the "Speed Over a Recognized Course" record for flying from New York to London distance 5,645 kilometres (3,508 mi), 1,435.587 miles per hour (2,310.353 km/h), and an elapsed time of 1 hour 54 minutes and 56.4 seconds, set on 1 September 1974. For comparison, the best commercial Concorde flight time was 2 hours 52 minutes, and the Boeing 747 averages 6 hours 15 minutes.



Wikipedia

Open innovation framework

Leveraging HP's world-class innovation network to discover and nurture new opportunities to improve business and life

- Assembling experts from around the world to advance thinking and foster discovery
- Leading collaboration on ground breaking programs
- Identifying the next set of technology breakthroughs



Several “obvious” facts regarding Innovation

- All the innovative people in the world do not work for your organization
- Invention does not necessarily lead to innovation
- Financial resources are limited
- Market pressures require ever decreasing cycles of innovation
- Without sufficient profit margins or government funding in the short-term, long-term innovation may not be viable
- Multi-disciplinary approaches more likely to result in significant technology disruptions



Open Innovation Office

strategic investments to amplify and accelerate breakthrough innovations

Innovation Research Program

Customer Co-Innovation Program

Industry University Government Partnerships



Innovation Research Program



HP Labs Innovation Research Program Overview & Characteristics

http://www.hpl.hp.com/open_innovation/irp/index.html

- Open, competitive, global call for proposals
 - NOT a “by invitation only” program – anyone interested can apply
- Annual program
 - Launched in 2008
 - Overall program size (total funded awards) increased in both 2009 and 2010
- Proposals solicited against a specific set of targeted research topics spanning HPL’s research agenda
- Single IP framework for all projects
- Awards range \$50-\$100K per year, up to 3 year projects
 - Designed to support a professor and graduate student



University IRP Research Collaboration Awards 2010

65 awards, 52 universities, 16 countries

EMEA Europe, Middle East & Africa

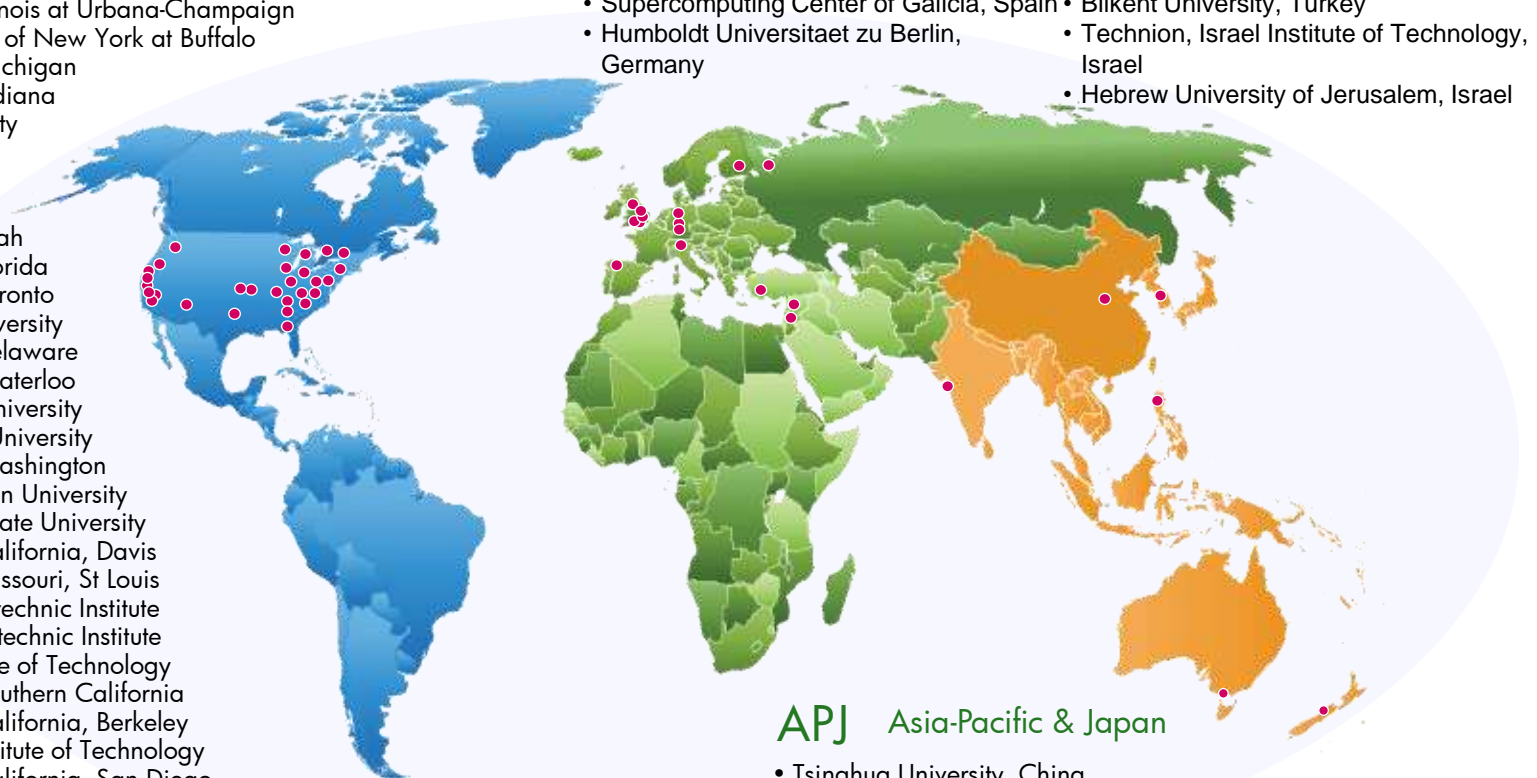
- Imperial College London, England
- University of Bristol, England
- University of Newcastle, England
- University of Surrey, England
- University of Edinburgh, Scotland
- Supercomputing Center of Galicia, Spain
- Humboldt Universitaet zu Berlin, Germany
- Konstanz University, Germany
- Technische Universitaet Berlin, Germany
- University of Geneva, Switzerland
- Russian Academy of Sciences, Russia
- University of Saint-Petersburg, Russia
- Bilkent University, Turkey
- Technion, Israel Institute of Technology, Israel
- Hebrew University of Jerusalem, Israel

Americas

- University of Illinois at Urbana-Champaign
- State University of New York at Buffalo
- University of Michigan
- University of Indiana
- Purdue University
- Virginia Tech
- Rice University
- Duke University
- University of Utah
- University of Florida
- University of Toronto
- Boise State University
- University of Delaware
- University of Waterloo
- Kansas State University
- Arizona State University
- University of Washington
- Carnegie Mellon University
- Pennsylvania State University
- University of California, Davis
- University of Missouri, St Louis
- Worcester Polytechnic Institute
- Rensselaer Polytechnic Institute
- Georgia Institute of Technology
- University of Southern California
- University of California, Berkeley
- New Jersey Institute of Technology
- University of California, San Diego
- University of Wisconsin-Milwaukee
- University of California, Santa Cruz
- University of California, Santa Barbara

APJ Asia-Pacific & Japan

- Tsinghua University, China
- Korea Advanced Institute of Science and Technology, Korea
- National Cheng University of Canterbury, New Zealand
- Monash University, Australia
- Chung University, Taiwan
- Indian Institute of Technology, Bombay, India



IRP in 2010 - 3rd year of program

Key features

- Open competitive CfP
- Aligned to big bets + Labs-wide participation
- Research content led from Lab teams
- Two-stage Call + simplified review process
- Standard CRA

Outcomes to date

- Conference papers published: 74
- Journal papers published: 36
- Publications in preparation: 42
- Post grad students involved: 106
- Number of patents filed: 19
- Proposals Received: 1078
- Proposals Funded: 86

2010 participation

- Received
375 proposals, 202 universities, 36 countries
- Funded
65 awards, 52 universities, 16 countries

Customer Co-Innovation



Customer Co-Innovation in HP Labs

- ❖ *One year project-based shared investment, shared risk co-innovation activity between HP and an industry leading innovative customer*
- ❖ *that harnesses the technical expertise of HP and the domain knowledge of the customer*
- ❖ *to create compelling, first of kind prototypes that demonstrate the value of new technologies and provides insight into the implications of these technologies for business.*

Customer Co-Innovation

Leveraging a partner who is
a technical leader in its
industry



HP/DreamWorks Shrek – using HP Labs Cloud Rendering Service



MAKING DREAMS WORK

- *“We always want more than Moore”*
Katzenberg’s Law
 - *More computation means more iterations and higher quality; it means we can get closer to our creative ambition*
- **HP Cloud Rendering Service**
1000 processor data center at HP Labs Palo Alto
- **Seamless extension** of DW animation IT infrastructure, provided 50% additional capacity for peak production demand on Shrek 2
- Over ½ million frames rendered, consuming > 100 CPU-years



Customer Co-Innovation

Leveraging a unique
technical capability



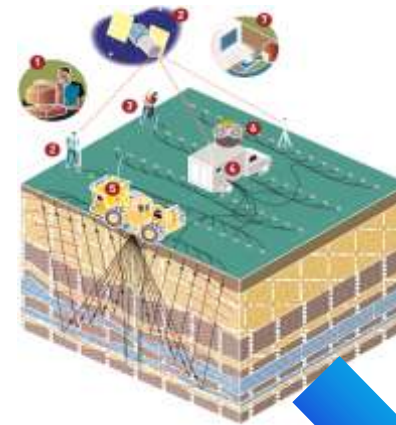
HP and Shell Sensing Solution

<http://www.hp.com/go/sensingsolutions>

HP Accelerometer



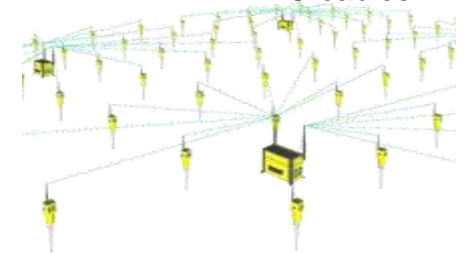
- Exploration survey network
- Up to 1M wireless sensor nodes
 - **New HP seismic sensor technology**
- Complete sensing solution
 - Sensors, network, storage, quality control, deployment/recovery
- Efficiency of extraction – more from existing fields
- Reduced impact to environment
 - fewer new wells, in best locations
 - Less equipment into field, no cables
 - Energy reduction of system



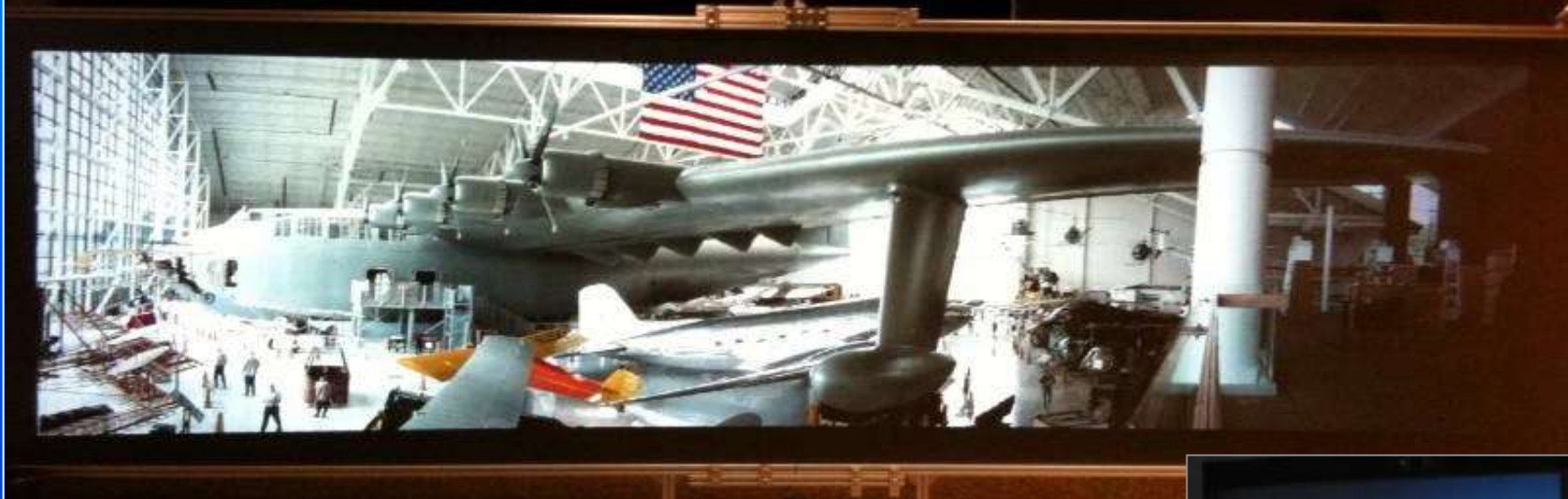
PRESENT
10km x 10km
survey
10,000 nodes
300km cables



FUTURE
10km x 10km
survey
Up to 1,000,000
nodes
NO cables



Courtesy: <http://www.ainc-inac.gc.ca/ai/scr/nt/ntr/pubs/og-eng.asp>



Pluribus (HDx2 @22'x6')



Multi-imager panoramic (HDx3) 3D camera



VIVIENNE



= Immersive 3D Entertainment



Customer Co-Innovation

Leveraging a business model
strength





ELECTRIC



GAS



WATER



GENERATE



WAYS TO SAVE

4

3



Jones Residence

You're Watt-Tastic! Only 4% of users have your level of efficiency.



Home Energy Monitor



HOME



Total usage this month:

\$120.95 ↑ \$10.43 from last month

12^{7 kWh}

Baseline Load vs U.S. Average

Your weekly living room baseline load compared to the average U.S. household's base



- Going beyond the smartgrid
- Managing supply and demand

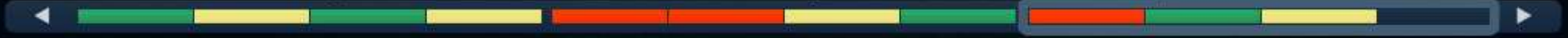


Total Usage: Entire Home [ANALYZE](#)

January

February

March



kWh \$ CO2

Today

Hour

Day

Week

Month

3 Months

Industry-Government Partnerships



Case Study: Post Docs at IQSL



Stan Williams, Senior Fellow and Director of Information and Quantum Systems Lab

Case study: Post-Doctoral Experiences
Information and Quantum Systems Lab
HP Labs



"The really excellent postdocs not only do a great job on the projects assigned to them, but they are the ones who start up a project of their own that winds up being a part of our portfolio. Thus, the postdocs we hire into IQSL create their own jobs."

Stan Williams - Director, Information and Quantum Systems Lab



Job Objective:

Create technologies for a new information ecosystem:

- Photonic interconnect to increase bandwidth 1000X
- Memristor based nano-electronics for memory and logic
- Quantum information for enhanced privacy and security
- Nanoscale sensors and actuators to harvest data

Key outcomes:

- Post-docs since 1995: 42
- At IQSL in 2009: 16
- Number obtaining permanent positions at HP: 9
- Number now research professors: 9 (5 tenured)
- Number starting new company with technology licensed from HP: 1

Publications and Presentations:

- Number of papers in refereed journals co-authored by post-docs: over 250
- Highest number by a single postdoc: 17
- Number of major conference presentations by post-docs: over 100
- Several best paper and best poster awards
- Hundreds of US Patent Applications filed with post-docs as inventors/co-inventors

Open competition:

IQSL's Williams says, "HP is a place where postdocs can learn to succeed in any environment - I have a much better success rate in placing post-docs in Universities here than I did at UCLA." Approximately one-third of IQSL's post-docs join HP as lifetime researchers, another third enter academia as research professors, and the final third go on to successful careers at national laboratories or other corporate research labs.



Outstanding results for HP Labs

Since 1995, HP Senior Fellow Stan Williams has led a cutting-edge team at HP Labs' Information and Quantum Systems Lab (IQSL), applying deep core competence across the disciplines of information theory, quantum mechanics, photonics, nano-electronics, materials and mechanics. Post-docs have made significant contributions to the team's many successes, and have been an integral part of the lab's research.

Postdocs receive a two-year appointment, with an optional one-year extension. Not only are they encouraged to publish, they also contribute to critical HP inventions. As a result, post-docs at HP Labs learn an important skill not usually taught in academia: writing high-quality patent applications.

IQSL has been recognized in recent years for the quality of its IP portfolio, to which postdocs have made significant contributions.

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In 2010, working with NSF and IT industry, started the first IT Industrial Research Postdoc program



Lessons Learned



Lessons [Still Being] Learned from collaborating with Universities



- Developing a legal agreement that everyone (worldwide!) can agree on is a tall order
 - Sometimes having 95% of your audience agree is good enough
 - But...what happens with your most important partners don't agree?
- Surveyed participants from previous year and made improvements in current year based on their inputs
 - IRP Submission system was cumbersome, so we improved it
 - Earlier timeline for awards to secure graduate students early
- Many applicants still want ways to collaborate with HPL, even if we were not able to fund them. What are some ways we can achieve this going forward? (i.e. web 2.0 communities, events, etc.)

Lessons learned from collaborating with external organizations

- Shared risk partnership (it's all about relationships)
- Complementary expertise and experience
- New perspectives from other industries
- Clear requirements and dependencies
- Start small
- Technical papers and not PowerPoint
- Reasonable IP terms
- “Short term” attitude often largest hurdle to innovation



Q & A

