RIDING THE WAVES OF INNOVATION

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Welcome
to the HP Innovation Journal! I am
thrilled to share with you some of our
most exciting stories of innovation and
to help celebrate a few of our many
accomplishments through this quarterly
publication.

As we build a new HP, our vision is to
create technology that makes life better
for everyone, everywhere. Our mission,
in turn, is to engineer experiences that
amaze. We’re committed to a culture
of continuous reinvention—turning
incredible ideas into amazing realities,
repeatedly taking on ambitious
challenges, and relentlessly working
at them until we’ve forged them into
memorable achievements. Once we
deriver, we innovate and reinvent again--
we never stop challenging ourselves.

We have a rich history of innovation
at HP. During the past 76 years, we
have brought disruptive technologies
to market that have fundamentally
changed our industry and the world
around us. These pages will demonstrate
that we remain one of the greatest
innovation organizations in the world!

So please enjoy the first edition of the
Innovation Journal, with featured articles
on the compelling vision that’s driving a
new HP, our innovative approach to new
business incubation, developments that
we’re helping pioneer in robotics, and
much more.

Best Regards,

SHANE WALL
CHIEF TECHNOLOGY OFFICER AND
GLOBAL HEAD OF HP LABS
HP has a storied history of innovation and is led today by a community of inventors and engineers excited to build from that legacy as we create and reinvent the future. The HP Innovation Journal is a celebration of our living culture of invention and innovation—and proof that we have the heart and energy of a startup and the brains and muscle of a Fortune 100 company. Each issue will shine a spotlight on the intersection of our people and their ideas; on the notable new technologies and experiences that we’re developing; and on the key industry trends that we will drive through innovation.

WE WANT TO HEAR FROM YOU! EMAIL HPINNOVATIONJOURNAL@HP.COM TO CONTRIBUTE TO THE NEXT INNOVATION JOURNAL.
As I see it, the new era ahead will make life better for everyone—including our employees.

The new HP can be thought of as a vessel with a powerful engine built from the experience and curiosity of HP’s multidisciplinary employees. Based on that core of talent and knowledge, the leadership team at the helm is steering us to an exciting future of innovation based on a clear and solid vision: We engineer experiences that amaze. Experiences that will make life better for everyone, everywhere—including those of us working at HP.

Support for innovation has always been part of HP’s DNA, and I’ve experienced that support first-hand. As a young engineer, I once found myself lost in a maze of test and measurement instrumentation. I was unclear on the fundamentals the instruments addressed, and unsure of how the instruments and computers came together as a system. Darkness and panic changed to light when someone handed me an HP application note on “Spectrum Analysis Basics” from April 1974. Soon I had an entire binder full of HP app notes that covered every subject necessary for a novice like myself to construct the system I needed.

HP’s support for curiosity, education, and knowledge—the building blocks of innovation—has never lessened during my 28 years here. One thing has changed, however. As the launch date of the new HP approached, I saw a new excitement about our company’s vision. Over the past year, our engine room has been abuzz...
given the ethos of the new HP and the course ahead.

That course is built on an in-depth analysis of the most important social, economic, and ecological megatrends expected to impact the global population over the next 10 years. In light of these megatrends—which include rapid urbanization, changing demographics, hyper globalization, and technology acceleration—we are working to understand the future needs and technologies most relevant to HP and our customers.

Resource constraints, for example, are driving the world to reduce the energy used across the lifetime of a product. Lifetime energy accounts for energy used in the extraction of raw materials, manufacturing, waste-mitigation, transportation, use, and reclamation. This need to reduce “cradle to cradle” lifetime energy will fuel the acceleration of 3D printing. Engineers will envisage and build high strength-to-weight ratio parts to vastly reduce the lifetime energy in physical objects (See photo above). Learn more by visiting HP’s Graphic Arts YouTube page.

Building such objects based on the need will further reduce parts proliferation and waste. For example, it is estimated that roughly 17% of the populace will eventually require a hearing aid. The majority of hearing aids are now produced using 3D print technology. But why stop there? The next step, 4D printing, can allow parts to be printed that change in response to a particular stimulus. What if HP used the attributes of its Multi Jet Fusion™ system to engineer a universal, one-size hearing aid that, in the field, could be shaped precisely to give individual users a custom-fitted hearing aid?

The need to conserve resources and address the quality of life of current and future generations will require the integration of cyber (information) systems and physical systems. Thus, the 21st century will be the cyber-physical age, and innovation will require fundamental, multidisciplinary knowledge of both cyber and physical systems.

This is good news for HP. Our foundational, multi-disciplinary prowess makes us uniquely positioned to deliver value at the intersection of people, profit, and the planet. We are good at asking questions; we are even better at answering them. There’s an exciting future awaiting the new HP and those of us dedicated to asking and answering questions that will change lives for the better.

CHRIS MORGAN, R&D ENGINEERING MANAGER, HP ROBOTICS LAB, BOISE

HP’s pretty, tree-dotted campus in Boise, Idaho, began operations in 1973. Until now, it’s been best known for developing HP’s blockbuster LaserJet printer in 1984. The Boise campus has always been home to the maker spirit. These days that spirit shines most brightly at the HP Robotics Lab, where Chris Morgan leads an amazing team of specialists devoted to innovation.

What does innovation mean to you and your team? To us, innovation is that magic moment when we come together and see what we’ve worked so diligently on come to life. The icing on the cake is watching others get excited about our innovations and then creating their own.

What’s the coolest project you are working on right now? Sid, our autonomous robot. He’s able to perform tasks by himself like move and avoid objects without human control. We’re learning a lot and discovering what we’re doing is highly useful and practical. Robots will enhance our experiences and give us back more time.

When you’re not innovative in the robotics lab, what are you doing? I’m always building. I have my own tinkering center at home. I also love to play and write music.

What inspires you to innovate? I don’t come to work, I come to my playground. I get to work with some of the smartest people in the world. And as the world’s population continues to grow, there’s always going to be a need for quality engineering. As long as that’s the case, my mind is always wandering and looking for the next best thing. Robotics is limitless!

Go to HP CTO’s YouTube page to see Sid in action and learn more about the Robotics Lab.
How labs allocates resources to fuel innovation and profit

The role of HP Labs is to create novel technologies and experiences that define the future of the company. The key question is how to invest to create the greatest impact? Do we invest in making a difference in existing businesses or do we invest in disruptions?

The problem is that a “true disruption is indistinguishable from a distraction in its infancy,” as former HP executive Frank Cloutier once noted. While R&D tends to generate lots of ideas, figuring out which will truly be transformative is difficult. It typically takes seven years to scale a business from nothing to $1B in revenue (or $100M in profit).

HP is impatient for profit and revenue. The advantage of targeting the existing business is that a 2% improvement on a $52B business generates $1B in revenue. We could strive to generate customer delighters that command a premium on our products. But is that where we should make our research bet? To address this dilemma, we use a portfolio approach.

We budget about 10% of HP Labs investment in fundamental research. This has high risk (in time and technology) but if successful will have high return. The work in Surface Enhanced Raman Spectroscopy falls in this camp. This is an unbelievably cool approach to molecule identification; however, we don’t know yet how to keep samples from being contaminated. In addition, we have the business risk of whether HP will enter and pursue the sensor market, which is very exciting.

About 60% of our investment is oriented toward existing business units. This is because the best likelihood for return is through creating differentiation for our existing products/channels. Labs has to make a contribution here beyond what the division can do, otherwise the division resources are way better at meeting customer needs.

The final 30% of our portfolio is in stuff that likely will become a new business (i.e., very unlikely to sell through our existing channel or business units). We don’t usually start here, but many ideas end up here. This part of the portfolio is incubated to decide whether to spin in or spin out the business.

Our research portfolio of projects intersects
with the business wave approach from HP's Dion Weisler. As he describes it, the first business wave is about the current landscape. “In this wave, we move quickly and fight continuously to improve our core businesses, drive profits, and increase cash flow.” Business wave two is about emerging businesses — you can see companies entering but no clear leader (3D print is such an example). Business wave three is about markets that don’t yet exist. This is where breakthrough technology is needed. Technology innovations are key to all three waves, but we generally focus HP Labs resources on waves two and three.

It’s never obvious where a great idea will come from. As such, we don’t plan research like a product roadmap. Instead, we establish areas that we think have longevity, and create checkpoints for deciding to continue investment or shelve the idea. History has shown this approach works well, from new technology for the Indigo digital press, to new materials for 3D print, to security innovations for our devices.

HP Labs is chartered with taking the path less traveled by, to create and identify new technology that opens new business opportunities and creates options for HP that make a difference both to our customers and our bottom line. Yogi Berra once said, “Predictions are difficult, especially when they are about the future.” I prefer Alan Kay’s comment: “The best way to predict the future is to invent it.”

Keith is an HP Fellow and Head of the Print and 3D Lab at HP Labs. His innovations have been shipped in almost every printer from consumer Inkjet, office LaserJet to large Indigo digital presses. He has a deep belief that “it’s easy to predict the future, just difficult to tell what year it will be in.”

### MARKET WATCH

HP’s Ecosystem and Venture Outreach team works with startups, new business accelerators, and VCs on solutions that help drive a market expansion of our platforms, creating a virtuous cycle of innovation for our ecosystems. HP hosts specific startups that work on proof of concepts aligned with our business unit priorities.

Such alliances give us early access to disruptive technologies that, ideally, will be commercialized into new products that will differentiate us in the marketplace. HP’s value add to the startups is mentorship from our technologist and business teams and the ability to scale their technologies into a global arena. Below is a sample of these promising partnerships.

**NEW BUSINESS ACCELERATOR: RIVER**

Founded by San Francisco capital firm Rothenberg Ventures, River is a new business accelerator investing in upstart companies looking to make a difference in virtual reality, robotics, artificial intelligence, nanotech, and other areas aligned with HP’s interests. The bi-annual River program offers a $200,000 investment, office space, and mentorship to early stage startups.

**NEW BUSINESS ACCELERATOR: THE JUNCTION**

Tel Aviv-based The Junction provides seed-stage startups a platform to accelerate and advance their ventures into better products and companies. A six-month intensive program from Genesis partners, The Junction brings the best and brightest new Israeli companies together with industry experts in user experience, business development, and product marketing.

**Kranti Singh:** “Embracing disruption that might blur today’s organizational, economic or cultural boundaries, but creates opportunities for new ways of thinking and creating brand new economic/cultural horizons.”

**Bruce Fleming:** “Looking at new opportunities through a lens without constraints and reinventing what HP means to customers. It’s beyond PCs and printers.”

**Serge Vejvoda:** “It means pushing yourself and your team to find new ways to tackle an existing set of problems or a whole new set of challenges.”

**Steve Simske:** “Instead of thinking where a technology’s trajectory will take it, try to find two independent technologies that, when combined, take it further.”
How HP can avoid the Innovator’s Dilemma, drive disruptive innovation, and create the new businesses of tomorrow

We can learn quite a lot from history. Let’s journey back to the year 1940, when two young engineers were working on the future from their garage. Having outgrown their space and ready for so much more, off they went to Page Mill Road in Palo Alto to create HP’s first office. In the years since, HP has gone from the first startup to one of the world’s largest startups. Today HP ships more than 80 printers and 100 PCs per minute and generates $50 plus billion in revenue annually.

No company reaches this scale and success without being very good at operations, incremental improvement and driving predictable results. Successfully scaled companies are very good at meeting the current needs of existing customers. Yet this very success has a dark side termed the Innovator’s Dilemma. It states that established businesses avoid pursuing disruptive innovations because they require new markets, or new customers, or both. And more often than not existing customers have no immediate need for disruptive innovations. Fundamentally, disruptive innovation is quite different from incremental innovation and requires a different approach for success (See Table A).

The Innovator’s Dilemma is not new to large companies. The average life expectancy of a Fortune 500 company in 1955 was 75 years; today it is less than 15 years. Tomorrow, who knows?

So how do we drive disruptive innovation and still keep established businesses healthy and growing? The answer is reinvention. Create the disruptive new businesses of tomorrow while running, growing and extending the existing businesses. To do this, we need a framework for new ideas and pursuit of disruptive versus incremental innovation.
DISRUPTIVE VS. INCREMENTAL INNOVATION

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SUCCESS IS ITERATIVE, NOT LINEAR. SCALE ONLY AFTER YOU HAVE PROVEN YOUR TECHNOLOGY/PRODUCT OFFERING, WITH A SOLID BUSINESS MODEL, BASED UPON VIVABLE GO-TO-MARKET APPROACHES THAT SUPPORT ATTRACTIVE FINANCIALS. LEARN, ITERATE, ADJUST, AND REPEAT; THE FASTEST PLAYERS WIN.

Building and successfully growing truly new businesses in disruptive new areas is really hard to do. Yet, history shows us if we don’t disrupt ourselves it’s inevitable that others will do it for us and chances are we won’t like the results.

Opportunities. Thankfully, we have learned from Dave and Bill’s original pay-as-you-go philosophy.

Since early 2014, the HP CTO office has been running a new business incubator designed to test, create, and internally incubate potential new businesses. Incubations use the same lean startup methods employed by VC-backed startups. They are only proposed for funding after the people behind them deliver compelling answers to key strategic and fundamental business questions (see Table B). Because new business creation is by its nature highly uncertain, it’s foolish to pretend that we can predict the unpredictable, or plan for scale before we even know we have a "winner." For this reason, Incubations are all about risk mitigation of testing hypotheses in the market against key success milestones.

| PRODUCT: What is the proposed product, service, or solution offering to potential customers? |
| CUSTOMERS: Who are the customers targeted? |
| VALUE: What’s the value proposition for targeted customers and what key assumptions or hypotheses need to be true for the value to prove itself? |
| GTM: How are you going to get to market and reach your targeted customers in a financially viable way? |
| WHAT’S THE PAYOFF: If all the information above is true, what’s the strategic and financial value of this business to HP? Can we extract attractive financials; and, if so, using what business model? |
Movado Bold Motion smartwatch is a HP wearable in disguise
Source: Wareable
Want to learn more? Visit Movado’s YouTube page.

HP, Titan Partner On Smartwatch
Source: InformationWeek

Did you know that the HP audio oscillator helped to make “music for the Mouse” possible?
Source: HP

Fantasia celebrates 75 years—made possible with HP’s very first product

HP Inc. Reinvents Corrugated Packaging Printing in Collaboration With KBA
Source: CNN Money

HP Inc. Is Bringing Its Giant Virtual Reality Display Into The Operating Room
Source: Forbes
THE BREAKTHROUGH SPEED OF HP’S FIRST COMMERCIAL 3D PRINTER WILL BE A BOON TO PATIENTS WHO NEED PROSTHETICS

Medical prosthetic developers have long embraced 3D printing as a transformational technology. HP’s first commercial 3D printer, due for release next year, offers the kind of innovative technology most needed by the medical community: cost-effective, high-quality, and speedy.

3D prosthetics are “having a real, immediate impact on peoples’ lives,” says Paul Benning, Chief Technologist, 3D Printing and Print Engines. “Doctors can help more patients, and they can produce things locally and affordably. If a patient has to travel for a prosthetic appointment, they can work with that patient and make fitting adjustments or print a new limb, on the spot.”

The introduction of HP’s first commercial 3D printer should improve that process and better even more lives. “We have invented a brand-new technology for 3D printing that’s at least a 10X improvement over existing commercial techniques,” says Benning.

These improvements include a lower cost for the machine itself and lower cost per part produced. Moreover, the parts produced by HP’s new 3D printer are higher quality in terms of accuracy, precision, and strength—especially important characteristics for medical devices. Best of all, the new printer is a speed demon compared to traditional 3D printers.

The speed breakthrough was made possible by building the 3D printer around the page-wide print technology of HP’s Multi Jet Fusion™ printer. “Page-wide is fast in the 2D world, and it’s fast in the 3D world,” notes Benning. “Competitive solutions use scanning lasers and a point-by-point approach. Page-wide is a layer-by-layer approach that gives us tremendous speed advantages.”

That speed advantage will help patients who need prosthetic devices. But the advantages of the new printer won’t stop there. Benning notes that HP’s work in 3D printing will create many opportunities in a medical field that’s racing to develop 3D-printed hearts and other body parts.

“The tools of design and the ability to produce things no longer require huge capital outlay,” he says. Thanks to tools like HP’s new 3D printer, “entrepreneurs with good ideas can bring ideas into the physical world and scale from one part to a million parts.”