

INITIATION OF COVERAGE:

HARRIS & HARRIS GROUP: SURVIVE TO THRIVE

[NASDAQ: TINY \$4.36]

Research^{2.0}

Boston | New York | Paris

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HIGHLIGHTS

- Harris & Harris Group is a specialized investment firm that has built an **impressive portfolio** of private company equities in emerging growth areas, including **personalized medicine, high-speed semiconductors, LEDs, next-generation memory technologies, clean fuels, clean water, advanced materials** and **quantum computing**.
- The firm has exploited **core expertise in nanotechnology** to effectively ride the expansion of nanotechnology applications into industries like semiconductors, electronics, transportation, healthcare, energy and even entertainment. In fact, **nanotechnology has undergone a “quiet explosion” of activity in the last decade** with most metrics (patents, commercial R&D centers, industrial uses) **increasing tenfold**. Large portions of industry have come to rely on nanotechnology as a fundamental enabler for advanced new products.
- The portfolio of over 30 companies is full of exciting emerging companies—standout **names include Solazyme (bioenergy), BridgeLux (LEDs), Laser Light Engines (digital projectors) and Mer-sana (cancer therapy)**. These companies are creating quite a stir.
- Recently the capital markets have offered Harris & Harris an **additional opportunity to provide short and medium term financing** to better leverage their large cash position. This allows Harris & Harris to **offset some operating expenses by increasing the returns on their cash**.
- Both the technology **M&A market and the IPO space have been showing sustained health** and are offering more opportunities for H&H to realize liquidity events in their portfolio at valuations in excess of current carrying values.
- In evaluating how much H&H is worth, we can look at the historical price-to-NAV ratio and the potential for increases in NAV over time. In the past several years the P/NAV has ranged from as high as 8.82x to as low as .57x. On an annual basis the averages have been between 1x and 4.9x. We'd say the long-term average is 2x and the current P/NAV is 1x. We estimate that current NAV understates the portfolio value by 50%, **which would imply a fully valued share price of \$12 for TINY**.

BACKGROUND

Harris and Harris Group (hereafter H&H) is one of the world's premier investors in nanotechnology and one of the few publicly traded private investment firms in the U.S. The company has been investing in private deals since 1983. In 2002, under the guidance and vision of founder Charles E. Harris, the firm began focusing its capital and resources on nanotechnology. Nanotechnology is the study of structures measured in nanometers, which are units of measurement in billionths of a meter. Scientists and researchers are probing the atomic level to create innovative products in a wide range of industries from aerospace and cosmetics to electronics, energy, health care and semiconductors. Charlie and his associates were convinced small technology had a big future. Over the past eight years the company has made over thirty investments in companies developing products based on nanotechnology.

The H&H NASDAQ stock listing and corporate structure provide a unique and attractive investment vehicle for institutional and retail investors seeking exposure to nanotechnology in the pre-public markets. The past decade has seen a significant reversal of investor enthusiasm for early-stage investing in general and nanotechnology in particular. Witness the investors clamoring for private shares on SecondMarket and Sharespost, and the recent launch of Xpert Financial, a private company stock exchange, just a few weeks ago. With investor expectations for private capital and nanotech on the rebound, we believe it is a particularly opportune time to assess H&H. In this report, we'll take a closer look at the company, provide an evaluation of its current business and offer some views on the company's prospects.

GROWING BIG ON SMALL TECHNOLOGIES

H&H has been doing venture investing for nearly three decades. The company had its first exposure to nanotechnology in 1994 when it made an investment in Nanophase (NANX). Nanophase went public in 1997 during the dot-com boom. It was during the dot-com bust period that Charlie Harris honed the company's investment strategy to focus on nanotechnology. This shift necessitated adding professionals to the company with the requisite specialized backgrounds to capitalize on an emerging set of investment opportunities in small technology.

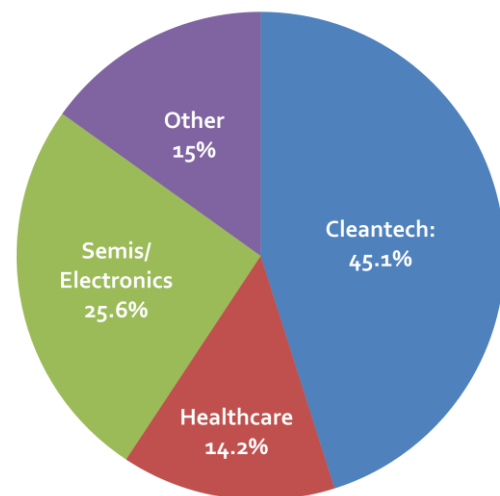
Over the past eight years, H&H has become one of the most active nanotechnology investors in the world. The company has 31 nanotechnology companies in its portfolio today, spanning a wide array of industries and products, including nanoscale-enabled solutions in solid state lighting, emerging memory devices, printable electronics, photovoltaics, battery technologies, thermal and power management, next-generation semiconductor devices and equipment, quantum computing, as well as its use in various life-science applications of nano-structured materials.

Many of the advances in science and technology are occurring on the nanoscale, and many industries are actively involved with nanotechnology research and development (R&D). In healthcare, the areas of drug delivery, vaccines, personalized medicine and molecular diagnostics are actively engaged in nanotechnology R&D. The semiconductor and electronics industries have been actively engaged in this type of R&D for the past decade. Specifically, next generation chip technology, printable electronics, new transparent conductors and thermal management technologies are developing rapidly. In cleantech, the areas of solar, batteries, power management, biofuels and LEDs are all very active.

The H&H venture portfolio can be broken down by broad investment themes and viewing it in such a manner provides a helpful starting point from which to drill down. As of September 30, 2010, there were 12 "Clean Tech" investments that account for 45.1% of the total portfolio. There are eight investments in "Electronics/Semiconductors" that comprise 25.6% of the portfolio and seven investments in "Health Care" that represent a 14.2% share. The remaining 15.1% of the portfolio is classified as "Other" and there are four investments in this category. The thematic breakdown of the H&H portfolio is summarized in the ensuing exhibit.

We can analyze H&H's nanotech portfolio as a diversified pipeline of investments across several themes or sector classifications by various stages of maturity. One way to think about this is akin to how Major League Baseball teams are run. We have the major league team (e.g., The New York Yankees or Mets) and below the major league club there are a series of minor league teams—Triple A, Double A and Single A—the so called "farm clubs." The major league franchise uses its farm clubs to develop promising players with the hope that one day they will be ready to play ball at the major league level.

H&H Portfolio By Sector (9/2010)



H&H has developed a similar approach to investing in nanotech. There is a pipeline of investment maturities in the portfolio, reflecting various stages of company development. In terms of maturity, there are early, mid and late stage investments—these correspond to the Single, Double and Triple A baseball teams. H&H has created a grid that shows where each of their portfolio companies falls within the pipeline of investment maturities and also classifies each investment according to the investment theme.

Over the past eight years, H&H has built a diversified range of investments. As of September 30, 2010, 12 of the 31 H&H portfolio companies are classified as early stage companies while 10 are mid stage and 9 were late stage.

THE OUTLOOK FOR NANOTECH INVESTING

Mike Roco of the National Science Foundation and National Nanotechnology Initiative recently put together an exhibit that shows key nanotechnology indicators for the U.S. and the world. Roco's key nanotech indicators are shown below.¹ Note the significant growth in nanotechnology experienced over the past eight years. The number of people engaged in nanotechnology research, development and commercialization has grown at an average rate of 25% over the last 10 years. We've also seen similar growth in the size of nanotech final product markets, which now exceed \$80 billion in the U.S. and \$200 billion worldwide. At a 25% average annual growth rate, we see a doubling in people and products every three years.

Roco's indicators also reveal substantial growth in scientific research in nanotechnology that fosters future innovation. Nanotechnology has increasingly become a focus of the scientific community as seen by the growth in Science Citation Index papers. The increase in scientific research in nanotech has led a fast pace of patent applications in the area as well as R&D funding, with both private industry and governments engaging in the financing of nanotech R&D.

has provided some projections of how nanotechnology is likely to evolve in terms of people and markets over the next five to ten years. Based on the NSF and NNI projections, the number of people engaged in nanotechnology-related work and activities is expected to increase significantly to 800,000 and 2 million in the U.S. and World, respectively, by 2015 and surge to 2 million and 6 million, respectively, by 2020. Over this time frame, we will likely to see a sharp increase in nanotech final product markets. Roco estimates the value of nanotech-enabled product markets at \$1 trillion by 2015, rising to \$3 trillion in 2020. Such a projection, if realized, would mark a 10x change in the value of final product markets for nanotechnology since the turn of the 21st century.

Technology revolutions and their evolutionary paths typically do not fit neatly into nice calendar periods. However, in the case of nanotechnology, one can neatly view the past decade—from 2001 to 2010—as marking the first foundational phase (Phase 1) and the coming decade as the second foundational phase (Phase 2). H&H began building out its portfolio in the early part of Phase 1 and is well positioned today to continue investing in nanotech during Phase 2.

The first phase of the nanotech evolution saw the creation of the National Nanotechnology Initiative

Nano Technology by the Numbers

	2000		2008		Avg. Growth 2000-08	2015		2020	
	World	US	World	US		World	US	World	US
People - Primary Workforce	60 k	25 k	400 k	150 k	25%	2 m	800 k	6 m	2 m
Final Products Markets	\$30 b	\$13 b	\$200 b	\$80 b	25%	\$ 1 t	\$400 b	\$3 t	\$1 t
Science Citations	18,085	5,342	65,000	15,000	23%				
Patents Applications	1,197	405	12,776	3,729	35%				
R&D Funding	\$1.2 b	\$0.37 b	\$14 b	\$3.7 b	35%				

Source: Mike Roco, NSF and NNI (2010)

Despite the growth in people, products, research, patents and funding over the past decade, nanotechnology is still in an early stage of development. Roco

(NNI) in the United States. The NNI helped foster a global science-centric ecosystem as other governments in Europe and Asia embarked on similar nanotech initiatives. During Phase 1, we've seen the blossoming of an interdisciplinary nanotechnology community that H&H has become a part of and has tapped into while building out its investment portfolio. There are about 150,000 people engaged in nanotechnology-related activity in the U.S. alone, and many more tens of thousands overseas. The past dec-

¹ See, "Nanotechnology Research Directions for Societal Needs in 2020: Retrospective and Outlook," Springer publishing (2010, forthcoming). A draft of the book is available at: <http://www.wtec.org/nano2/>.

ade has witnessed the creation of a flexible research and development infrastructure that today encompasses roughly 100 large nanotechnology-oriented R&D centers and a continually expanding industrial base of about 3,000 companies producing nanotech-enabled products.

While there was a great deal of nanotech activity during Phase 1, most of it was centered on the discovery of new phenomena, properties and functions at the nanoscale, and the improvement of existing products by incorporating basic nanoscale components. Generally speaking, nanotechnology involves a complex value chain that includes regulators (e.g., FDA, EPA), research organizations (e.g., NSF, NIH), emerging and established companies, tool and equipment suppliers, finance and insurance, intermediaries, end users and other stakeholder groups. While nanotech holds great promise as a driver of technological innovation, its evolutionary path can be viewed as being more akin to biotechnology and bearing little resemblance to the dot-com phenomenon that preceded Phase 1.

The dynamics associated with Phase 1 and the longer-term horizon associated with the commercialization of nano-enabled products is well appreciated by H&H and incorporated into their investment process. It would be misguided for investors to look in the rear view mirror to gauge the future evolution of nanotechnology. The second foundational phase of nanotechnology – Phase 2 – will likely see a significant acceleration of nano-enabled product innovation and commercialization.

During the next decade, we are likely to see mass use of nanotechnology and a tenfold increase in the value of nano-enabled products on the market.

In the coming decade, science-based design will deliver a range of new products to the market that are likely to unleash a wave of creative destruction across a wide range of industries and industry verticals. Products enabled with nanotechnology generated an estimated \$254 billion in 2009. During the next decade, we are likely to see mass use of nanotechnology and a 10x increase in the value of nano-enabled products on the market.

Analyzing the H&H portfolio companies today, we can get a glimpse of the key dynamic that will characterize Phase 2—namely, the design and commercialization of innovative nano-enabled products. The ensuing table shows selected H&H

portfolio companies with their corresponding core technologies and products in development and, in some cases, on the market generating revenue and profits today.

Nanotechnology is what economists call a *general purpose technology* or GPT. A far-reaching innovation qualifies as a GPT if it has the potential for pervasive use in a wide range of sectors in ways that drastically change their modes of operation. Examples of GPTs include the printing press, steam engine, electricity and the Internet. GPTs often take decades to fully diffuse through an economy and are the most potent force of creative destruction among all technologies. As a GPT permeates an economy, it reshapes the way societies live, work and play.

As the National Science Foundation noted, nanotechnology has the potential to enhance human performance, to bring sustainable development for materials, water, energy, and food and to protect against unknown bacteria and viruses. Since the year 2000, we've seen a significant ramp up in nano-related activity in all of these sectors. During this time, H&H has been investing and building a portfolio of companies that are utilizing nanotech to create innovative and—in some cases—highly disruptive products in these sectors. In the sections below, we take a closer look at the H&H portfolio by sector.

SELECTED H&H PORTFOLIO COMPANIES: NANO-ENABLED PRODUCTS IN COMMERCIAL DEVELOPMENT

ABSMaterials: Nano-enabled solutions for removing many hydrocarbons, solvents, pesticides, and other persistent organic pollutants from water.

Adesto: Developing Conductive-bridging RAM (CBRAM). The nano-enabled CBRAM technology is the lowest power, lowest cost non-volatile memory for mainstream and embedded applications.

Biovex: Lead product is OncoVEXGM-CSF, a first in class oncolytic vaccine. OncoVEXGM-CSF is currently being evaluated in a Phase 3 multi-national study in metastatic melanoma and a Phase 3 study in head and neck cancer.

Bridgelux: Developing nano-enabled, high-power indium gallium nitride light emitting diodes (LEDs) that will be used for various solid state lighting, mobile appliance, signage, and automotive applications.

Contour Energy Systems: Developing a lithium carbon fluoride battery technology that provides 10x more power than conventional lithium-ion batteries.

Laser Light Engines: Developing solid-state light sources for digital cinema and other large venue projectors that the company expects to consume up to 75% less power than traditional arc lamps.

Mersana Therapeutics: Developing novel cancer therapies based on its nano-enabled biodegradable polymer platform known as Fleximer.

Molecular Imprints: Developing and manufacturing nanoimprint-lithography systems for high resolution and for 3-dimensional pattern replication.

Nantero: Developing **NRAM**, a high-density nonvolatile Random Access Memory. NRAM has the potential to serve as a universal memory technology and replace all existing forms of memory, such as DRAM, SRAM and flash memory.

NeoPhotonics: Designing and manufacturing photonic integrated circuits, or PIC- based modules and subsystems for bandwidth-intensive, high-speed communications networks.

SiOnyx: Developing shallow junction photonic silicon-based optoelectronic products with enhanced light sensing capabilities.

Solazyme: Developing algal biotechnology to renewably produce clean fuels, chemicals, foods and health science products.

SEMICONDUCTORS & ELECTRONICS

The semiconductor industry has become a poster child for nanotechnology, although analysts and investors tend not to think of semiconductor companies as nanotech companies. Since the year 2000, we've seen a migration in the semi industry toward the nanoscale. Whereas prior to 2000 there were few semiconductors with features less than 100 nanometers, today some 60% of semiconductors are manufactured at the nanoscale level.

As scientists scale down toward the molecular level, they see the potential of harnessing quantum effects and creating new and novel chips with increasing functionality that hasn't existed previously. We are beginning to see the emergence of new classes of nano-enabled semiconductors, some of which are being developed by H&H portfolio companies. Chips with novel features account for nearly one-third of the total market today.

The H&H portfolio includes several investments in companies developing novel semiconductor applications. Among these are SiOnyx, Adesto—both classified as early stage investments—and Nantero and Kivio, which are mid-stage.

Perhaps the crown jewel in the H&H portfolio in the semiconductor sector is Nantero. The company is currently the tenth largest holder of nanotechnology patents in the world. Nantero is developing the next

Nantero is using carbon nanotubes to develop a very dense, universal type of memory. They are also the 10th largest holder of nanotechnology patents in the world.

generation of semiconductor devices based on carbon nanotubes. These devices include memory, logic, and other semiconductor products. In the field of memory technology, Nantero is developing a proprietary technology it calls "NRAM."

NRAM is a high-density, nonvolatile Random Access Memory. The company has embarked on an ambitious mission to create a nano-enabled semiconductor that will serve as universal memory and replace all existing forms of memory (e.g., DRAM, SRAM and flash memory).

Molecular Imprints is the only late stage semiconductor/electronics investment currently in the H&H portfolio. The company is developing and manufac-

turing next-generation lithography systems that are used in the production of semiconductors. Molecular Imprints has commercialized a new and unique nano-enabled Step and Flash Imprint Lithography technology (S-FILTM). S-FILTM is a simple step and repeat, room temperature, low pressure nano-imprint process that has demonstrated sub-20 nanometer resolution. The company has established a broad intellectual property portfolio, which includes over 700 global patent filings and over 100 issued patents. The total annual market for Molecular Imprint's lithography-related tools used in chipmaking and disk-drive manufacturing is more than \$7 billion.

Semis & Electronics Investments by Stage		
EARLY: SiOnyx Adesto D-Wave	MID: Nantero Cambrios Kovio GEO Semi	LATE: Molecular Imprints

Now heading into its ninth year of operation, the company is generating sales in excess of \$20 million with revenues expected to rise rapidly during the next several years. The company is working with disk drive manufacturers today who are considering shifting their production at some point in the future to a new process called "patterned media." Several disk drive manufacturers, including Hitachi Global Storage Technologies and Yamagata Fujitsu, have purchased Molecular Imprint's nano-enabled tools and are evaluating them. A move by disk-drive manufacturers to the patterned media process, should it occur, could catapult Molecular Imprints nano-enabled technology into the mainstream. That said, it remains to be seen whether nano-imprint technology will crack into the mainstream in semiconductor fabs.

ENERGY & CLEANTECH

Nanotechnology is also becoming a transformative force in energy and transportation today. We produce over 14 trillion watts of power per day globally. Of that energy, roughly one-third comes from oil, 25% from coal, 20% from gas, 7% from nuclear fission reactors, 15% from biomass and hydroelectric sources, and less than 1% from renewable solar, wind and geothermal technologies. Worldwide energy

needs are estimated to double over the next two decades. The lion's share of the additional energy needed to power our homes, businesses, farms and factories is likely to come from new nanoscale renewable energy technologies as well as from biofuels. Nanotech lies at the heart of the convergence we are seeing today between biotechnology and energy. The true potential of nanotechnology in this realm lies in its ability to transform energy into an information technology whereby we see Moore's law-type effects of ever-greater performance per unit of cost.

Cleantech		
Investments by Stage		
EARLY:	MID:	LATE:
Laser Light Engines	Innovalight	Solazyme
Nextreme	Contour Energy	Bridgelux
Cobalt	ABS Materials	Nanosys
TetraVitae		
Crystal IS		
Siluria		

Over the past decade, we've seen the emergence of a host of new energy technologies that have been labeled "clean." The clean energy technologies today include solar photovoltaics (PV), biofuels, wind power, efficient lighting and battery power. Combined global revenues from cleantech companies in these segments totaled around \$145 billion in 2009, up nearly 16% from the previous year's level. Analysts calculate that cleantech revenues will continue to rise at a brisk pace in the decade ahead and grow to over \$350 billion by 2020.

In the past several years, we've seen increased levels of interest and investment activity from venture capitalists, corporations, and governments in clean technologies. Cleantech accounted for some 12.5% of total venture capital in 2009 and it was notable that the largest IPO of 2009 was A123 Systems (AONE), a manufacturer of nano-enabled lithium ion batteries.²

There have been some recent dislocations in the cleantech market—particularly the PV market where pricing has declined and grid parity is still off in the distance. Furthermore, there are indications today of a shakeout in the venture community as several firms exit the cleantech space. Nevertheless, the general outlook for cleantech is constructive and we expect to see brisk growth in revenues and accelerating nano-enabled innovation in the years ahead.

The H&H portfolio includes a number of cleantech investments spread out over various stages of development. The two late-stage cleantech standouts are Bridgelux and Solazyme.

Bridgelux is an emerging star in the light emitting diode (LED) market. The company develops high-power indium gallium nitride LEDs for use in a range of solid-state lighting, mobile appliances, signage, and automotive applications. Under the new leadership of CEO Bill Watkins, the company is forging new partnerships, releasing new products and expanding its manufacturing capacity. In a market that is expected to expand rapidly in the years ahead, Bridgelux is viewed by some analysts as a credible competitor to CREE, Nichia and the other incumbents.

Solazyme, as a producer of algae-based fuels, can be viewed as a cleantech investment, but in many respects it is an emerging biotechnology company. Indeed, Solazyme illustrates the ongoing convergence of energy- and biology-driven innovation. Advances in molecular biology lie at the heart of future nano-enabled innovations in energy. One of Solazyme's competitors is Synthetic Genomics, founded by Craig Venter, who led the private financed version of the Human Genome Project. Venter's company is backed by Exxon-Mobil and is engaged in using single-celled algae to create fuel, as is Solazyme.

What sets Solazyme apart from its competitors today is the process it uses to create fuel from algae. Unlike its competitors, who grow algae in sunlit ponds, Solazyme's process involves feeding algae sugar in darkness. Solazyme is currently supplying the U.S. Navy with its algae-based oil. Over the next decade,

² For more on A123 Systems, see Research 2.0 reports "A123 Systems: The Good, The Bad, and The Ugly," Sep-

tember 23, 2009, and "A123 Systems: Steady Progress, Better Valuation," June 7, 2010.

the U.S. Navy is targeting renewable sources to supply half of the 1.6 billion gallons of fuel it uses per year.

Solazyme’s technology platform has broad capabilities outside the cleantech space. The company recently announced a joint venture (JV) with global starch and starch-derivatives company Roquette Frères. The two companies are seeking to develop the market for microalgae-derived food ingredients. The purpose of the collaboration is to launch an entirely new category of natural, healthy and functional ingredients based on microalgae. The two companies plan to launch a variety of oil, protein, and fiber-based products aimed at delivering improved performance with a healthier profile compared to ingredients in the market today.

Solazyme continues to gain traction in the various markets it is targeting and is well financed. Earlier this year, Solazyme successfully raised \$52 million in a Series D financing round led by Morgan Stanley that included Braemer Energy Ventures, Chevron Technology Ventures, Lightspeed Venture Partners, The Roda Group, VantagePoint Venture Partners, Zygote Ventures, Unilever, Bunge, and Harris & Harris Group.

The remainder of the H&H cleantech investment portfolio is concentrated in next-generation fuels grounded in molecular biology (Cobalt, Siluria, TetraVita), LEDs (Crystal IS, NanoSys), nano-enabled thermal and power management (Nextreme), solar photovoltaics (Innovalight), and water remediation (ABS Materials). We plan on exploring these investments more in depth in future research updates.

HEALTH CARE

Along with R&D spending, interest and activity in molecular medicine has been on the rise in the pharmaceutical sector. The global pharmaceutical market today is around \$800 billion, growing at a rate of 7 per cent per annum, and is at an interesting juncture. Analysts note that some \$120 billion of pharmaceutical products will be coming off patent over the next several years. The large volume of drugs coming off patent is stimulating the search for new and novel therapies. Many researchers see nanotech as the next frontier of health care, enabling a new era of personalized medicine and powerful treatments for chronic and debilitating diseases.

There is currently an estimated \$2.6 billion in nano-tech-based therapeutics on the market—up from zero

a decade ago. Nano-enabled drugs on the market today include TriCor, Rapamune, Ambisume, Abraxane, Doxil, Emend, Abelcet, Triglide, and Amphotec. Backed by the NSF and NNI, the U.S. National Cancer Institute has been aggressively promoting nanotech in designing and developing new cancer drugs and diagnostics. Some of the most promising therapies in the pipeline are nanoscale designs targeted at major chronic diseases like cancer. The current market opportunity for nanotherapeutics is estimated at \$60 billion currently. This market is expected to roughly double over the next five years and grow to over \$200 billion by 2020.

Healthcare Investments by Stage		
EARLY: Ancora Enumeral Poly-Remedy	MID: Mersana Ensemble	LATE: BioVex Metabolon

The H&H portfolio includes seven companies developing nano-enabled health care products: Ancora, BioVex, Enumeral, Mersana, and Metabolon. BioVex is classified as a late stage investment in the H&H portfolio and is bringing innovative nano-enabled cancer therapies to market in the months ahead. The company is currently in Phase 3 clinical testing with its lead product for metastatic melanoma and head and neck cancer.

Another emerging nano-enabled health care innovator is Mersana. The company has developed a biodegradable polymer platform called “Fleximer” to create innovative medicines that address multiple oncology indications. Mersana’s Fleximer platform is also being employed in partnership with other biopharmaceutical companies to enhance the safety, efficacy, and delivery challenges of other medicines, including nucleic acids, biologics, and small molecules across many therapeutic areas. Recently, Mersana consummated a \$334 million partnership with Teva Pharmaceuticals to develop an anti-angiogenic fumagillin analog that employs Mersana’s Fleximer platform. This partnership was the fourth largest pre-clinical deal over the past decade.

Diagnostics have become a large and fertile area of health care research and development over the past decade. Since the year 2000, we've seen a significant increase in nanotech-related diagnostic R&D with a great deal of this activity focused on cancer. Today, there are over 50 companies in the U.S. developing nanoparticle-based medicines for treating, imaging, and diagnosing cancer. The nanodiagnostics market is relatively small today at around \$5 billion, but it is expected to triple in size during the next five years and become a \$50 billion market by 2020.

A decade ago, nano-enabled therapeutics and diagnostics accounted for zero percent of the total market. Over the next decade, there are expected to represent around 50% of the total market.

OTHER INVESTMENTS

Semiconductors/Electronics, Energy/Cleantech and Healthcare represent the three main areas of focus for H&H today. There is another category of investments generically called "Other" that includes four companies: Polatis, Xradia, Questech and NeoPhotonics. NeoPhotonics has been receiving greater attention in the market having stated its intention to go public and having filed an S-1 earlier

Other Sectors Investments by Stage		
EARLY: none	MID: Polatis	LATE: Xradia NeoPhotonics Questech

this year.

Operationally, the company appears to be faring well. NeoPhotonics reported record third quarter revenue and is generating positive net income.

THE PAST AS PROLOGUE

Many investors have expressed skepticism about the potential of nanotechnology in the marketplace. This is understandable given what has transpired over the past decade. There was good reason to be skeptical about the expectations investors had for nanotech-

nology in the short term. The behavior we saw in nanotech-related stocks was reminiscent of what we observed with dot-coms in the 1990s. In the aftermath of the dot-com bust, investors were searching for the next big thing. Nanotechnology was receiving a great deal of attention by researchers, corporations, analysts and investors. The creation of the National Nanotechnology Initiative in the United States stirred a great deal of excitement and enthusiasm across the



nation and overseas.

Inflated investment return expectations are the norm for emerging general-purpose technologies on Wall Street, and nanotech was no exception. Heightened investor expectation associated with an emerging technology generates a great deal of enthusiasm in the equity markets, which over time pushes valuations past underlying company fundamentals. As reality sinks in, valuations are compressed as investor enthusiasm for the emerging technology diminishes. During the period when hype is dissipating on Wall Street, we often see a weeding out of the weaker companies and industry consolidation.

It is important to understand the investor expectation cycle that plays out with emerging technologies on Wall Street. It is equally important to understand that R&D and product commercialization often continues after investor enthusiasm has waned. With the passage of time, an improvement in the underlying fundamentals sets the stage for renewed investor interest. A beautiful illustration of this process can be seen in the behavior of Amazon.com's stock price over the past 12 years (see chart above). Amazon.com's stock price greatly exceeds its price during the period of excessive dot-com hype—the so-called Internet bubble years.

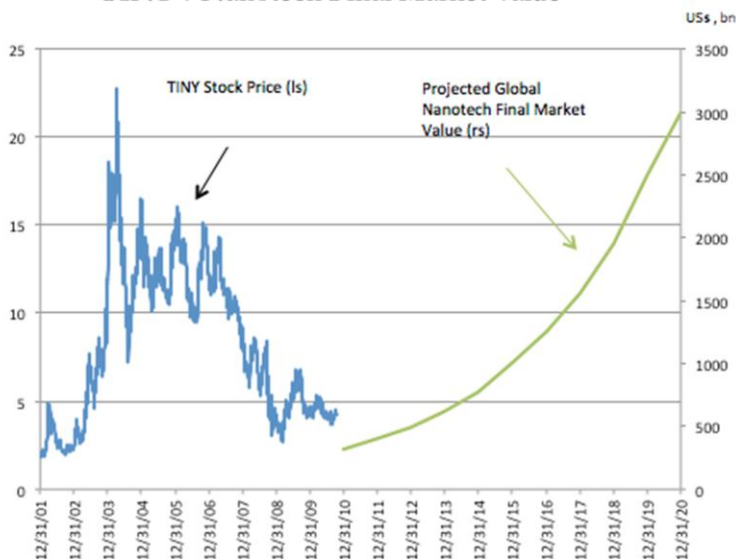
When we assess the evolution of nanotechnology on Wall Street, we can see the typical investor expectation cycle reflected in the behavior of H&H's stock price (see TINY stock chart).

In the early 2000s, H&H's stock price traded in a fairly narrow range between \$2.5 and \$5.0 per share. As time passed and nanotechnology hype increased, H&H took off, rising from \$5 in the summer of 2003 to almost \$25 in the spring of 2004.

As the hype in nanotech subsided (this coincided with Nanosys pulling their IPO from the market in late summer 2004), H&H's stock price fell sharply. During the period 2005 to 2007, the stock again traded in a relatively narrow range between \$10 and \$15. During the financial crisis of 2008-09, H&H's stock price declined back to levels seen in the early part of the decade. The stock has rebounded from the lows seen during the financial crisis, but remains well below the peak years of 2004.

Based on the performance of H&H's stock price over the past decade, we believe that we are well through the hype cycle for nanotech. The current end market conditions support a move into a more fundamentally driven pattern of stock appreciation for the shares.

TINY v Nanotech Final Market Value



Source: Bloomberg, NSF/NNI, Research 2.0

It's been a rough decade for investors in venture capital, which is among the riskiest of asset classes. According to the latest data compiled by Cambridge Associates, venture capital returned a negative 4.15% after fees, expenses and carried interest. The past year has seen a bounce in returns on venture capital, with one-year returns through June 30, 2010, at 6.38%. While in positive territory, the returns on venture capital in the U.S. over the past year trailed those in the broader public equity markets. By comparison, the Russell 2000 index was up 26.57% over the same period, while the Nasdaq and S&P 500 returned 14.94% and 14.43%, respectively.

While investment returns to venture capital in the U.S. have been depressed over the past decade, the longer-term picture is much more constructive. The Cambridge Associates data shows that over the past fifteen years, venture capital has returned 38.09%, and over the 20-year period through June 30, 2010, 24.29%.

We often see regression to the mean of investment returns in financial markets, so one would expect returns on venture capital over the decade to increase—perhaps sharply in light of the fact that recent returns have been significantly below longer-term historical returns.

Over the past decade, there has been heightened interest on the part of venture capitalists in nanotechnology in the U.S. and around the world. Data compiled by Mike Roco at the National Science

Nano Technology VC US\$, billions					
2000	171	23	0	12	206
2001	145	34	48	27	254
2002	318	37	0	11	366
2003	301	25	0	44	370
2004	366	78	16	16	476
2005	566	69	6	19	660
2006	654	73	10	50	787
2007	683	54	2	35	774
2008	1159	144	0	58	1361
2009	668	108	5	12	793

Source: Roco, NSF, NNI

We are about to enter a period of mass use of nanotechnology and if the parallels of the dot-com experience prove to be relevant, one can convincingly argue that the prospects for a company like H &H have never been better than they are today.

That's not to say it will be smooth sailing from here for H&H or other nanotech venture capital investors.

Foundation and National Nanotechnology Initiative show that venture capital investment activity has averaged 30% growth over the past decade. In the year 2000, there was approximately \$170 million invested in nanotechnology in the U.S. and \$210 million globally. In 2008, venture investing in nanotechnology totaled close to \$1.2 billion in the U.S. and approximately \$1.7 billion worldwide.

Recent activity in nanotechnology venture capital has been on the soft side following the effects of the severe financial crisis and recessionary economic conditions. Data compiled by Lux Research showed total VC nanotech investments of \$792 million in 2009. The largest share of funding went to Healthcare and Life Sciences (51%), followed by energy and environment (23%) and electronics and IT (17%). This funding was spread across 91 deals, with an average deal size of \$8.6 million. Two of H&H's portfolio companies—Bridgelux and Solazyme—participated in large funding rounds recently, raising some \$120 million.

We expect that nanotech investing activity will pick up in the quarters ahead due in no small part to much-improved capital markets and an uptick in corporate M&A. The past two years have been the equivalent of an Ice Age in terms of capital market activity, especially with respect to IPO activity. During 2008, the number of IPOs fell sharply to 36 from 254 in 2007, and IPO deal volume remained lackluster in 2009 with 63 deals completed.³

Over the past year, we have seen an increase in IPO deals flow in the U.S. as economic and financial market conditions stabilize and recover. With over 154 IPOs completed in the U.S., 2010 represents the best year in terms of the number of deals since 2007 and

³ Source: Professor Jay Ritter, University of Florida, <http://bear.warrington.ufl.edu/ritter/ipodata.htm>

we expect a steady flow of IPO deals to continue in 2011. A more robust IPO market environment will work to diminish the reluctance of VCs to invest in nanotechnology due to a perceived lack of an exit. Signs that the capital market Ice Age is coming to an end abound, and this is welcome news for venture capitalists and companies seeking to commercialize nanotech-enabled products through funding provided by the public capital markets.

VALUING HARRIS & HARRIS

Valuing a company like H&H is more about finding the right range than a point estimate. We can start by saying that the \$25 price achieved in the past (at over 8x NAV!) was clearly “too high” and will show that the current price of \$4-5 is conversely “too low.”

There are two basic arguments for the current price being too low. First, the stock has historically traded at closer to a 2x multiple of NAV versus the current 1x. Secondly, the NAV understates the market value of the investment portfolio by at least 50% in our estimation. Accepting one-half the argument suggests a \$6 stock, and taking both points together support a \$12 stock at full valuation.

Harris and Harris Group Top Ten Investments By Value

Company	Sector	Value as of 9/30/10	Cumulative % of NAV
Solazyme	Cleantech	\$20,403,708	21%
Xradia	Other/Tools	\$7,365,794	29%
NeoPhotonics	Other/Comm.	\$6,745,442	36%
SiOnyx	Semis/Elect.	\$6,529,342	42%
Laser Light Engines	Cleantech	\$5,619,610	48%
Bridgelux	Cleantech	\$4,873,591	53%
Adesto	Semis/Elect.	\$4,620,000	58%
Contour Energy	Cleantech	\$4,122,378	62%
D-Wave Systems	Semis/Elect.	\$4,053,843	66%
Molecular Imprints	Semis/Elect.	\$3,944,875	71%

As the accompanying table shows, 71% of the H&H portfolio is concentrated in 10 of the 31 companies currently included, and half of these are late stage maturities (Solazyme, Xradia, NeoPhotonics, Bridgelux and Molecular Imprints). It's too soon to know precisely how much additional value

beyond current carrying value these companies will bring, but having a meaningful portion of the portfolio in the later stages of maturity is a positive.

For example, NeoPhotonics has filed an S-1 and is expected to conduct an IPO sometime in 2011. Our intrinsic valuation work on NeoPhotonics puts the projected IPO valuation at approximately 50% above the current carrying value for H&H. As liquidity events occur, we will update and publish adjustments to our valuation estimates for H&H.

Among the mid- and late-stage companies in the portfolio, those with potential to exceed one billion dollars in market capitalizations include BioVex, Solazyme, Bridgelux, Contour Energy, ABS Materials, and Nantero.

Beyond the basics, however, H&H has a hard-to-replicate position in a key emerging technology area coupled with an effective private investment process and what we expect will be improving returns on capital. While we wouldn't suggest that H&H be treated as a growth or product company, they have created some valuable but intangible value beyond the equity stakes and cash they hold on their balance sheet.

EXPANDING THE MODEL

H&H's investment strategy is geared toward providing investors with an increasing frequency of exits and greater predictability of returns. The structural changes seen in the marketplace for both private and public investing over the past decade have created opportunities for the company to expand its investment strategy. The core focus will be providing venture capital for private, nanotechnology-enabled companies. In addition to the core strategy, H&H will make investments in publicly traded, micro-cap nanotechnology companies with market capitalizations below \$100 million and preferably around \$50 million.

H&H will also engage in providing debt to nanotechnology-enabled companies, as they did recently with GEO Semiconductor. Many nanotechnology-enabled companies are currently producing revenue and some have positive net income. H&H sees opportunities to secure favorable terms on debt for companies they know well or work with through their venture investing activities. In addition to fees and monthly principal and interest payments, H&H may receive warrants in these investments.

Investing in publicly traded micro-cap nanotech companies and nanotech venture debt deals should provide H&H with an opportunity to realize more frequent returns. The time from investment to exit is expected to be significantly shorter—12-24 months versus 7-10 years for some of the private investments the company has made in the past.

SURVIVE TO THRIVE

Harris & Harris Group founder Charlie Harris passed away on Sept 30, 2010. Mr. Harris was well respected in the investment community, and his vision and guidance created a strong foundation for H&H upon which to succeed. Based on forty-two years of business experience, one of the important lessons Charlie shared with his colleagues that remains alive and well at H&H today is the notion of surviving to thrive. As Charlie put it:

“Survive to thrive – try to anticipate and prepare for the hard times as they are a normal part of the business cycle and life. Remain in the game and when conditions start to improve, you will be on the ground floor, and it is amazing how quickly you will prosper.”⁴

H&H survived the Great Recession and is in a position to thrive in coming years. The company emerged from the recession with over \$40 million in cash on its balance sheet. Operating expenses remain under control with the company burning around \$6 million in cash per year. There is scope for some reduction in the burn rate in the future, and the company's venture debt deals will generate cash to offset a portion of H&H's annual operating expenses.

Our conclusion is that H&H offers investors a very attractive vehicle to participate in a broad range of very important emerging technologies that cut across multiple industries. Having a listed security is the best vehicle for most investors. Currently the shares are trading at the lower end of the historical price to NAV ratio, and future liquidity events will transform much higher Intrinsic Value into NAV.

⁴ See, Charlie E. Harris, “Some Lessons Learned in 42 Years of Business,” *Journal of Investment Management*, pp. 4-10, 2010.

ABOUT RESEARCH 2.0

Good research finds the truth about the future that makes better decisions. It eschews information that is unimportant (noise), untrue (marketing) or based more on opinion than fact.

We are engrossed in discovering and refining the truths about emerging technologies for businesses and consumers. The effort involves multiple disciplines and a large network of resources. Our goal is to reach conclusions that can be used by investors to make the right decisions.

Successful technology investing is all about looking BEYOND THE QUARTER. Our process is based on a long-term view and includes financial projections and valuation analysis. However we do not focus on the futility of the short-term game of estimating quarters and forward-looking statements.

Emerging technology and equity investing are highly specialized domains with their own thought processes, modes of expression, subject matter, expertise and even unique vocabulary. The real value often comes from being able to apply information and processes from these two worlds simultaneously. A good technology company story without a valuation context is useless for an investor. A detailed financial and valuation analysis is irrelevant without understanding the market and company dynamics.

As a business, we make all our work broadly available and only charge certain fees for enhanced access. We also work directly for companies that are seeking external private or public capital to provide accurate coverage and powerful distribution to both institutional and individual investor markets.

There's an active and important community around Research 2.0 because we realize that everything we do is based on an interaction—not just with facts and data but also insights, actions, and information from our network. Today we have hundreds of highly engaged members in our core network and tens of thousands of readers and followers. We are eager to learn more about your interests and help where we can.

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