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A Hyperfine Time for Essex

The same computational and communications challenges attracting the military to Essex will eventually draw commercial clients in droves.

Inside:

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What's going on at **Essex Corporation** (KEYW)? *Three acquisitions in 10 months … 15 times the market cap of four years ago when we put the company on our list … a lurking $100 million shelf registration poised to dilute shares by over one-fifth … a dogged antiwar CEO who has the military eating out of his hands.* Are they sending us a secret message? Is Essex still an optical oasis and opportunity, or has it become a market mirage?

To contemplate these questions, George sent me to Essex's new headquarters in Columbia, Maryland, down the road from Chief Scientist Terry Turpin's old stomping grounds at the National Security Agency (NSA). Turpin's fortes are passive optical devices and exotic signal processing, of the sort he used to perform for the spooks at NSA. Turpin is an amazingly open and genial host, but for him stealth mode is a necessity. Would I discover the cipher key to the prospects of Essex before the sun burns out? According to Turpin's estimates, that's about how long it would take an adversary to decipher Essex's new encryptions based on the company's radical invention of Hyperfine technology. The enemy won't be able to read your message until long after it—and he—have become irrelevant.

The reason we put Essex on the list in 2001 was Turpin and his Hyperfine multiplexer-demultiplexer (mux/demux). Terry and Hyperfine remain central to the future of Essex.

The pivot of the wavelength division multiplexed (WDM) network, a mux-demux takes several colors of light, each bearing a separate bitstream, and "muxes" or fuses them on a single fiber. At the other end it "demuxes" or separates them again to be sent to their destinations. Hyperfine's simple pair of crystal lenses use the natural aliasing of harmonic frequencies (think of how the spokes of a wheel seem to slow down into fixed positions as they are filmed by a camera). Turpin exploits an analogous effect to create a nearly unlimited span of fixed carrier channels. According to Turpin, Heisenberg uncertainty in position and velocity actually reflects certain reciprocal relationships summed up in Fourier transform mathematics. Fourier showed that any oscillatory pattern repeating in time translates into a sum of sine waves, such as pure colors or musical tones. A complex 10 gigabit per second (OC-192) signal spread out in time converts to a series of docile narrowband signals running at lower power. The wavelengths bounce across the Hyperfine crystals and come out the other side in perfect order. This system, according to Turpin, will allow the creation of channels separated by as little as a few Hertz or picometers (10^{-12})compared to the billions of hertz and nanometers (10^{-9}) of other mux/demux technologies. Turpin can now reduce the spacing between lambdas (wavelengths) to 1 megahertz. (Wavelengths and frequencies are two ways of defining electromagnetic waves, such as radio, microwaves, or light.) In WDM, 1 megahertz resolution means some 500 *thousand* channels in a spectrum space that could hold fewer than 50 OC-192 10-gigabit streams.

Yes, Hyperfine resolves frequencies thousands of times finer than do ordinary mux/demux technologies. As other components in the optical system advance—

lasers, optical phase-lock-loops, optical amplifiers—the Hyperfine technology will enable the fulfillment of the promise of WDM not only as a bandwidth expander but as a connectivity solution giving a wavelength to every user of an all-optical network.

Broadwing still has decisively the best optical network, but might be caught by a Hyperfine deployment.

For the future of WDM optical networks, Terry Turpin's great discovery was that *as wavelengths move closer together in spectrum space, they line up and behave better. They are cooler, more stable, and more reliable*. This discovery defied the regnant expertise at Bell Labs and other centers of optical research where George was regaled with authoritative explanations on its impossibility. Even today most of the industry has failed to come to terms with this Turpin insight. To Terry's embarrassment, we call it Turpin's law, as an optical counterpart to Moore's law, which shows similar effects from the miniaturization of transistors. Turpin demonstrates that as wavelengths are multiplied they use a fraction of the power, keep their shape, shun tricky polarization effects, suffer less crosstalk or four-wave mixing, and can be added or dropped or combined as desired with passive optics rather than by opto-electronic supercomputing.

In this coherent realm, virtually noiseless amplifiers can be developed to replace today's EDFAs (erbium doped fiber amplifiers) and Raman amplifiers. Banishing today's terabit routers with their racks on racks of power-gorging lasers, amplifiers, transponders, muxes, demuxes and remuxes, mazes of electronic microchips and buses and cross-connect switch fabrics, Turpin's all-optical solutions ride passively on wavelengths of light. They can be self-aligned, merged, and separated down the fiber with passive arrays of lenses, mirrors, and prisms that use no power at all. Millions of lambdas on thousands of fibers across the country offer the promise of myriad connectivity—wavelengths and groups of wavelengths that will be routed from point-to-point and create virtual fibers that will be created and dissolved as needed.

Broadwing (BWNG) still has decisively the best optical network, but might be caught by someone who aggressively deployed Terry's Hyperfine gear. However, don't hold your breath. Still enthralling the industry is the image of a few fat lambdas undulating at a rate of more than 40 billion vibrations per second. This is the dream of OC-768 (40 gigabits per second). And with telecom providers still digging out from the rubble of the crash, no one's buying anyway. For another 15-bagger at Essex, don't look for an early Hyperfine deal with a major network.

The high-resolution of Hyperfine's wavelengths for communications, however, translates into high-resolution radar and other remote imaging uses for national security. During Turpin's two-decade span at NSA, he served as chief of the Advanced Processing Technology Division. There he used Hyperfine precursors as optical analog processors for broadband DSP (digital signal processing), separating incoming warheads from chaff for the Strategic Defense Initiative. Now he has taken these optical technologies, both for high-resolution imaging and for real-time digital signal processing, to unparalleled new heights of performance.

Cruising through the crash

As my plane begins to descend toward BWI for my visit to Essex, I feel apprehensive. Even for a physicist like myself, it is a daunting challenge to grasp the intricacies of these futuristic devices, which do data processing using the natural speed and intrinsic parallelism of light and image. One way of measuring the performance of Turpin's passive optical processors is to compare them to the electronic supercomputers that Ray Kurzweil projects in his new book *The Singularity is Near*, sometimes debunked as wildly optimistic. For a wide array of specialized applications in imaging, searching, correlating, and digital signal processing, Turpin's low-power, shoebox-sized machines already work at the 100-petaflop (floating-point operations per second) speeds Kurzweil projects to be achieved in 2017 by room-sized, cutting-edge supercomputers.

As the plane landed, I also was having more prosaic fears. Days earlier, I had accepted Terry's kind offer to pick me up at the airport. Now my hands begin to sweat as I remember that he rides a Harley to work. Would my inaugural motorcycle ride have me winging my way to Essex clinging for dear life to the back of a black leather jacket? Taking small comfort that I'm traveling with just a backpack, I trudge toward "ground transportation."

"Hey, Charlie, over here!" Ah … the gracious voice of Ann, Terry's wife and swing-dance companion (championship level) of 36 years. Certainly *three* people couldn't fit on a Harley? It was the turning point in what proved to be an exhilarating day and a half. Even liberal CEO Len Moodispaw boasted that Essex is saving lives in Iraq and helping to capture the "bad guys." (After all, the wretchedness of war isn't Essex's fault.) Gracious enough to avoid topics such as George W., Moodispaw was at the edge of his seat when it came to recounting his own exploits. Look, this guy's got an ego, no doubt, but take my word for it, he's no fool. And his stone-wall confidence has been a boon for investors as he takes over as Chairman of the company as well.

After a two-year stint as president and COO of Essex, Moodispaw became CEO in August 2000 and jumped immediately on an ambitious program to take Hyperfine

from concept to product while making a profit. Remember, this was during the Telecosm Crash. But it was also mostly post-9/11, a natural opportunity for a company teeming with NSA veterans and over thirty years of government contracting experience. Len did a PIPE (private investment in public equity) financing in the fall of 2000, bringing in two investors: Global Environment Fund and an angel named John Harmon. Over the following three years Essex garnered $6.4 million in tranches from the PIPE. Then in 2003, Essex hit the Amex with a primary offering of 4.6 million shares, attracting institutional investors and the first two sell-side analysts.

From June 2003 to November 2004, Moodispaw doubled the stock float and raised over $100 million. Each new offering nudged the stock price *up* as Wall Street came to expect accretive acquisitions based on the government's fattening counter-terrorism budget and Essex's astounding optical processing capabilities. The bulk of Essex's revenue comes through sole source defense contracts, meaning that the denizens on the dark side need Terry's inventions as fast as he can concoct them.

Hyperfine still resonates

In the realm of data processing, the word *unique* takes on new meaning with Essex. Once presented with an optical processing problem that the gurus in special-purpose digital machines offered to solve in 50 thousand years, Terry said he could solve the problem in about 7 months. Optical processors typically give you about 50 thousand times the compute capability of an electronic unit of the same cost. You get the advantages of size, weight, and power and depending on what you want to do you can achieve very high accuracy. Translated to the digital domain, the optical processors that Turpin uses for 3-D imaging have achieved 40-bit accuracy. (By contrast, the leading edge analog-to-digital converters that define the performance of most digital solutions struggle to achieve more than 12 bits of accuracy—these are the *exponentials* of two that add up to the many thousand-fold greater performance.)

Since images are inherently analog, it's no surprise that the ultimate light computer is an analog machine, working with interference, refraction, and diffraction among intersecting colors of light with different phases and amplitudes. Digital is great if you don't know what you are doing and need to program it later. But if you know what you are doing—identifying a preset pattern, face in the crowd, code in a congested cell, missile in a crowded sky, or WDM array of closely packed channels—analog optics is far faster and more capacious. If you can use the image as a program to process other images, you can do massively parallel processing in real-time. By overlaying one image on another, you can cancel all the redundant information and leave only the desired deltas or deviations.

In radar signal processing, the resolution of Turpin Hyperfine machines permits reading not only the terrestrial topography from a satellite but also the subsurface location of mines, pipes, bombs, concealed laboratories, and other underground points of interest. The supercomputing power fits in a small package suitable for a missile, a UAV (unmanned aerial vehicle), and onboard spacecraft, if the function matches the functions that optical processors do well—signal processing, image processing, and analysis of huge databases. For finding the proverbial needle in a haystack, Turpin machines are thousands of times better than digital "Turing machines."

After wasting hundreds of millions on large defense contractors, the military finally went to Essex.

Turpin processes images in real-time that take 20 engineers 6 months to process at **Raytheon** (RTN) or **Lockheed** (LMT). And he does it in a device about the size of a shoebox rather than on a room-sized supercomputer. A shoebox fits on a plane or missile. Until Essex, all radar imagery processed in real-time was done in 2-D, with 3-D left to the domain of science fiction writers. It certainly looks like science fiction on Turpin's LCD. Only it's real. The difference is eye-popping. To my untrained eyes, a 2-D radar picture of a tank looked like, well, lines. Tell me I was looking at a building or a school bus and I'd agree. Now, rotate the image in 3-D and it not only looks like a tank, it looks as if an artist drew it. After wasting hundreds of millions on large defense contractors, the military finally went to Terry and now has 3-D radar working operationally, "saving lives" and "taking the junk out of the sky to find the missile," as the feisty Moodispaw puts it. With the surface penetrating technology of SAR (synthetic aperture radar), Terry can find bombs inside of buildings and caves.

Radar technology currently used in warfare operates in a single waveform because it is easy to process. Unfortunately, it is also easy to jam. Terry is taking care of that with his advanced optical processor for missile defense. Testing on the device was being completed even as I walked through the lab; the processor will go to MIT for further testing sometime in this month. I saw it and can vouch that it's another shoebox that can process a full GHz of bandwidth, which shrinks the target resolution down to 6 inches so you can lock onto objects such as, say, shoes. More importantly, this Florsheim of processors handles arbitrary waveforms that change in flight; the enemy can't jam it because he doesn't know what wave's going to hit him next.

The only problem is that no one builds a software

TELECOSM TECHNOLOGIES

Advanced Micro Devices	(AMD)
Agilent	(A)
Altera	(ALTR)
Analog Devices	(ADI)
Broadcom	(BRCM)
Broadwing	(BWNG)
Cepheid	(CPHD)
Corning	(GLW)
Equinix	(EQIX)
Essex	(KEYW)
EZchip	(LNOP)
Flextronics	(FLEX)
Intel	(INTC)
JDS Uniphase	(JDSU)
Microvision	(MVIS)
National Semiconductor	(NSM)
NetLogic	(NETL)
Power-One	(PWER)
Qualcomm	(QCOM)
Semiconductor Manufacturing International	(SMI)
SK Telecom	(SKM)
Sprint Nextel	(S)
Synaptics	(SYNA)
Taiwan Semiconductor	(TSM)
Texas Instruments	(TXN)
Wind River Systems	(WIND)
Xilinx	(XLNX)
Zoran	(ZRAN)

Note: The Telecosm Technologies list featured in the Gilder Technology Report is not a model portfolio. It is a list of technologies that lead in their respective application. Companies appear on this list based on technical leadership, without consideration of current share price or investment timing. The presence of a company on the list is not a recommendation to buy shares at the current price. George Gilder and Gilder Technology Report staff may hold positions in some or all of the stocks listed.

Altera (ALTR)

PARADIGM PLAY: SOFTENING HARDWARE, HARDENING SOFTWARE

NOVEMBER 9: 17.22; 52-WEEK RANGE: 15.96 – 24.26; MARKET CAP: 6.42B

Trading near its new 52-week low set on 28 October, Altera stock presents an attractive buying opportunity. The paradigm predicts rapidly expanding markets for programmable logic, used wherever fast adaptation of new demands is more desirable than the utmost in chip density and performance. According to Arun Iyengar, senior director of Altera's wireless unit, FPGAs are displacing DSPs in wireless networks because they allow customers to address changing product requirements by simply altering the software code rather than redesigning the chips. These nimble customers lop three months off development budgets and avoid the onerous design costs of ASICs that can run as high as $30m at 90 nm geometries.

Our chip expert, Nick Tredennick opines: "Both Altera and Xilinx will grow rapidly during the next few years as their market encroaches on the current ASIC market ($30b). I like Altera's chip strategy better than Xilinx's. Altera has soft microprocessor cores and two generic lines of SRAM-based FPGAs (Stratix and Cyclone). Xilinx has both soft and hard microprocessor cores and it has two lines of SRAM-based FPGAs (Virtex and Spartan), but it is splitting its Virtex line into four application areas, which fragments production and increases costs."

Worrying investors is the slip in gross margin from a high of 69.9% in 2Q04 to 66.5% in 3Q05, due in part to a slowing of low-volume high-end business and relatively weak wireless sales. But while gross margin is simply trending toward the long-term mean of 66%, precisely what Altera's been projecting all along, revenue increased 2% sequentially in the third quarter as sales of new products grew 23%, with each new product family gaining and Altera succeeding in its down market move with Cyclone. Sales for 2005 are expected to increase 11.5% over 2004, and new products should continue to fuel growth in 2006. The stock trades at 23.2x management's EPS estimate for 2005. *– CB*

Broadwing (BWNG)

PARADIGM PLAY: THE PARAMOUNT ALL-OPTICAL COMPANY

NOVEMBER 9: 6.41; 52-WEEK RANGE: 3.46 – 9.79; MARKET CAP: 472.47M

Not rain nor wind, flood nor mud could stop Broadwing's all-optical network. During the Katrina hurricane that was more than one could say for the U.S. mail or for the optoelectronic rivals. BWNG's lightwaves undulated flawlessly, much to the relief of the severed carriers who hitchhiked on the Corvis-built, Raman-amplified Broadwing backbone that they once disdained.

Broadwing helped its rivals restore service to customers; installed phone banks and provided free telephone links to evacuees; deployed voice and data communications to support FEMA, the Red Cross, and law enforcement; and installed HDTV transport capacity in Baton Rouge to support the media.

This adds up to rock solid reliability and rapid response under catastrophic conditions. Fortune 500, are you listening? It was a good quarter for Broadwing, but the carrier needs to increase the traffic over its long-haul fiber to benefit from the high operating margins of up to 90% that set it apart from its struggling optoklugic rivals. Making slight progress as it continues to buck the industry downdraft, Broadwing's combined revenue from data and broadband services once again eked upward, 2% sequentially and 17% over last year.

As expected, with wholesale long-distance traffic dropping off in response to rate increases and a planned up-market focus, voice revenue declined 5% sequentially and combined communications revenue fell 1.4%. Yet gross margin improved from 33.5% to 34.3%, pushing loss in EBITDA down to $3.4m. With a strong recovery back to more typical growth in September carrying through October, Broadwing's converged services offerings are attracting new customers, such as Healthcare Management Systems, and increasing business from existing ones.

Boasting the largest VPN in North America, serving 40 cities with high-speed transport of real-time, studio quality video, Broadwing signed a 3-year agreement with Fortune 200 insurance company Unum Provident to design, build, and manage their multi-site network for data, VoIP, and video. The time consuming installation and testing of such complex VPN and converged services networks will push out initial sales to the first half of next year. Look for some upside surprises in 2006.

Broadwing remains the rare carrier sporting positive net cash. The company delighted investors by agreeing to pay the November tranche on its convertible debt in cash, leaving one remaining payment of $33m due in February. Meanwhile, CFO Lynn Anderson entered into a 3-year revolving credit facility with the potential to borrow up to $75m from a group of lenders, providing a welcome liquidity cushion. Through the first three quarters of the year, Broadwing consumed only $19m in net cash for operations as the current ratio increased to 1.7x and the quick ratio held steady near a comfortable 1.3x. At $6.41, the stock is trading at a subdued enterprise value of about half of annualized sales. To value Broadwing at a still conservative full year of revenue, the stock would need to rise above $12 based on today's balance sheet.

Before it does so, however, Broadwing may need to demonstrate that it can become *free-cash-flow (FCF) positive,* meaning that it is earning enough cash

MEAD'S ANALOG REVOLUTION

NATIONAL SEMICONDUCTOR (NSM)
SYNAPTICS (SYNA)
SONIC INNOVATIONS (SNCI)
FOVEON
IMPINJ
AUDIENCE INC.
DIGITALPERSONA

COMPANIES TO WATCH

ADAPTIX
AMEDIA (AANI.OB)
ATHEROS
ATI TECHNOLGOIES (ATYT)
BLUEARC
COX (COX)
ENDWAVE (ENWV)
FIBERXON
LINEAR (LLTC)
LUMERA (LMRA)
ISILON
LENOVO
MEMORYLOGIX
NOVELLUS (NVLS)
POWERWAVE (PWAV)
SAMSUNG
SEMITOOL (SMTL)
SIRF
SOMA NETWORKS
STRETCH INC.
SYNOPSYS (SNPS)
TEKNOVUS
TENSILICA
VIA TECHNOLOGIES
XAN3D

above EBITDA breakeven to cover routine maintenance expenditures on its network. Anderson expects maintenance capex to fall within the industry average 5% of annualized revenue. Thus, based on today's overhead rates, Broadwing will need to boost gross margin to almost 41% before it becomes self-sustaining. That feat will likely require a significant increase in traffic volume. *– CB*

Corning (GLW)

PARADIGM PLAY: FIBER TO THE EXTENSION

NOVEMBER 9: 19.57; 52-WEEK RANGE: 10.61 – 21.95; MARKET CAP: 29.82B

Once again, in the 3rd quarter, Corning surprised on the upside, dumbfounding analysts expecting a profit of $0.21 per share. Excluding one-time items, Corning earned $0.26. Anyone who believed iSuppli's forecast back in September would not have been so astonished. The market prognosticator reported that sales of LCD TVs were accelerating above already high expectations thanks to plummeting prices and proficient panel production. Globally, the year's shipments are expected to almost double over 2004 to 17.1m sets. In particular, the average retail price of 30- to 34-inch models is expected to fall 22.5% to $1,548, down from $1,997 in January, thanks to a rapid increase in production of the larger panels.

Making most of the glass substrates used for those larger panels, Corning is even more optimistic, predicting 19m LCD sets will be sold this year. LCD monitors are also continuing their ascent, garnering 69% of monitor sales in the third quarter compared to 67% in the previous quarter. All very good news for Corning, whose LCD revenues account for about 85% of the bottom line on 44% of total product sales.

Corning's telecom sales, which include fiber, cable, and attendant installation hardware, declined for the second consecutive quarter to just over a third of total product sales. The company blames the dip on an inventory correction at Verizon, which is expected to start spending on its FTTH project again in the fourth quarter.

Free cash flow is on track to exceed $350m as Corning's post–Telecom Crash balance sheet continues to improve, with net long-term debt decreasing 44% over the past year, from $1.8b to $1.0b. According to management's outlook, EPS for 2005 should nearly double over 2004 on a 20% rise in sales, easily supporting the PE of 23 based on today's share price of $19.57. The jump in gross margin so far this year, from 40.9% in March to 45.9% in September, probably reflects more efficient processing of the larger generations of glass, which are rapidly increasing in demand. Thus, look for further margin improvements as glass substrates continue to increase in size with each generation. – CB

EZchip (LNOP)

PARADIGM PLAY: A GENERATION AHEAD IN NETWORK PROCESSORS

NOVEMBER 9: 5.08; 52-WEEK RANGE: 4.56 – 15.17; MARKET CAP: 53.98M

With 14 NP-1c customers in production and with 20 additional design wins for this current generation network processor, EZ's third quarter revenues plummeted sequentially to $0.7m from $2.0m because of low sales of NP-1c–based products. Sans sales, EZship will sink to the bottom of a sea of design wins. Of supreme importance for the Israeli company, therefore, are the prospects for 10 gigabit Ethernet, the ascendant industry standard for which EZ has the only full-featured chip. EZ's next generation NP-2 device must succeed in that market.

The company has ample time to leverage its 32 NP2 design wins into sales. Over the first nine months of this year, EZ's short-term net cash position dribbled down only to $19.9m from $23.8m, or $1.3m per quarter. At that austere burn rate, they have 15 more quarters before they need to reenter the financial markets. At about $5 per share, the market is appraising the company at an enterprise value of $76m after accounting for the 60.4% LNOP ownership.

Is that a fair valuation? Say NP-2's prospects are 10x NP-1's as the company estimates. With NP-1 sales of $6.3m over the past year, that would mean $63m for NP-2 in 2007 when the product is in full production. Today's enterprise value is 1.2x that guesstimate. A doubling of the share price to $10 would bring the enterprise value to 2.7x sales. But the market may be much larger (if they win Cisco or Huawei and ZTE breaks through in China). A rapid growth rate could spur investors to value EZ at a higher multiple. Then again, $63m in sales could easily translate to earnings of over $2 per share at a 60% gross margin, or $50 per share at a PE of 25. *– CB*

Power-One (PWER)

PARADIGM PLAY: DIGITAL POWER MANAGEMENT CHIPS

NOVEMBER 9: 5.93; 52-WEEK RANGE: 4.08 – 10.29; MARKET CAP: 506.58M

Just as Moore's law advances made the cell phone industry's conversion to digital inevitable, so will it precipitate a digital revolution in power management. Shrinking semiconductor geometries increase currents and lower voltages, aggravating the toil of regulating power on circuit boards. Narrowing linewidths allows you to use more and more transistors in the same or smaller space, enhancing learning curve advances over analog.

Analog architectures typically require one hard wire per function. If you have 30 power-related functions, you often have 30 wires, a lot of interface, a lot of complicated circuitry. With digital technology, added functions are often free. Engineers can design power modules in 10% of the time with 90% fewer components. Digital can save 50% on board real estate. Changes can be made on the fly with a graphic user interface, avoiding lengthy and costly reengineering and re-layout.

Analog isn't dead. And neither is Linear, with its world-beating group of scarce analog engineers led by industry pioneer Robert Dobkin. In addition to the ever-present analog-to-digital converters, many applications will continue for numerous years for analog in consumer devices and Linear will continue to lead the charge.

But for medium and complex circuit boards, Power-One understood the digital trend early on and remains the only company with a complete digital-power solution. Restructuring completed, the company turned profitable in September for the first time since March 2001. With the traditional product lines picking up steam ahead of the digital avalanche, with no long-term debt, and net cash of $80m, the current market cap of $511m or 1.9x annualized revenues looks conservative. With no new sales, a return the historic ratio of 2.75x revenue would increase the stock price to $8.57. If Power-One outperforms all other companies in digital power and grows to dominate a market expected to reach billions in sales, the stock could become a 5- or 10-bagger by the end of the decade. *– CB*

Xilinx (XLNX)

PARADIGM PLAY: PIONEER OF PROGRAMMABLE LOGIC

NOVEMBER 9: 24.35; 52-WEEK RANGE: 21.25 – 33.39; MARKET CAP: 8.51B

Xilinx's gross margin increased 150 basis points sequentially last quarter as sales from 90-nm products doubled while seeing significant yield improvements. By comparison, rival Altera's gross margin slid 180 basis points sequentially. Xilinx was also a bit more positive on the trend for the current quarter, forecasting revenue to increase about 3% while Altera projects a flat quarter. But by many other crucial measures Altera remains significantly superior to Xilinx: Sales rose 2% compared to a 1.6% drop for Xilinx … operating income increased 4.2% while Xilinx's operating income fell 5.5% … net income was up 15% for Altera compared to 11% for Xilinx … and gross margin remains superior at 66.5% versus 61.4%. Crucially, combined revenue from Xilinx's new products garnered 10% of total sales whereas Altera's new products ascended to 48% of total revenue, meaning Altera has less exposure to mainstream products that are no longer seeing revenue growth. This is perhaps an early indication of the truth of Nick Tredennick's assertion that Xilinx is pursing an inferior chip strategy to Altera, though he still believes both companies will grow rapidly during the next few years. Apparently transfixed by trends in gross margin and quarterly sales blips, however, investors are valuing Xilinx at a premium to Altera with an estimated forward PE of 27.4 through December. *– CB*

radar that changes waveform. They wouldn't sell, since no one can process the data. No problem for Essex, just another opportunity, which was revealed to me in the next lab room, where Essex was in the throes of building its own software radar from the gutted insides of about six different radar models currently in operation. They've already shown they can do it, although the shoebox size has definitely been breached. Think of shoes for Goliath.

Garnering gurus and geniuses

Essex once had a serious competitor in signal processing. It was SDL (Sensys Development Labs), and Terry acquired them in March of 2003. The combo broadened and deepened both companies' expertise, enabling them to win the "Thunder" contract with NSA in 2004 and boosting revenue from $16.3 million in 2003 to $70.5 million in 2004. In case you're wondering what in thunder Thunder refers to, so does everybody else.

Optical processing is virtually magical in its niches, and Essex claims the field to itself.

What we do know is that as a result of Thunder, Essex has leased and secured a 50,000 square foot facility near NSA in Annapolis Junction, turning it into a SCIF—special compartmental information facility. Which means you and I can't get in to distract the government spooks and 250 contractor personnel (managed by Essex) busy using Essex and SDL signal technology to snag thugs such as drug dealers and terrorists.

Wait. Who's this on the phone? It's NSA: "We've got the dope on a dealer, but we have to pin him down in his Columbian hideout, right now." Throwing his jacket on with one foot out the door, Terry's off to Annapolis Junction to configure a customized signal system for the capture. And don't be surprised if he uses the GIS (geographic information system) technology developed by Performance Group Incorporated (PGI), the Fredericksburg, Maryland company Essex acquired in June. GIS is a match with Essex's 3-D image processing, enabling Turpin to overlay a map on his radar pictures. When Terry acquired PGI, they were already doing site information and maintenance for U.S. military bases, locating and mapping buried utility lines, roads, and buildings, and identifying repair points. The same capability will work wonders in a target scenario, creating a see-through, holographic panorama of enemy complexes and mountain hideouts, located with pinpoint accuracy.

In addition to tightening Essex's hold on defense technology, several of the recent acquisitions were designed to help hoist Essex to commercial heights. In a general way, *all* of Essex's acquisitions aid the commercial quest by helping to fund research. In government contracting, a percentage of revenue can be moved to overhead, a valid piece of which is R&D. Thus the government pays a certain percentage of your research, and the larger you get the more it pays in absolute dollars. There are drawbacks. You don't have the level of autonomy you do in self-funded research, and as you grow, your research must become more focused. R&D done for the government is not accounted for in Essex's R&D budget. But of the $15 million of Hyperfine R&D to date, less than 20 percent has been Essex money.

Essex's latest acquisition, Windermere, which closed on 28 February, gives Essex a secure manufacturing capability. Windermere takes Ricoh commercial faxes and morphs them into secure faxes for the government, storing them in a protected warehouse until needed. This capability could be critical to a number of Essex's potential products, beginning with the optical encryptor, which will require secure manufacturing for both government and industry. Technologically, Windermere is a signals-focused firm, but on the microelectronics side, it complements Terry's optics. Also of interest to Terry is Windermere's RF technology, antennas, and information-assurance software now being incorporated into Essex hardware. And Windermere brings commercial customers with them.

Turpin has lately been hiring the best of the other boffins in stealth technologies. Up from Melbourne, Florida, during my visit was Monte Hancock of Computer Science Innovations (CSI), acquired by Essex a year and half ago. An artificial intelligence (AI) guru and data-mining pioneer, Hancock and his equally impressive CSI cohort, John Day, are helping Terry achieve an unbeatable position in cyber warfare and information security and authentication.

Currently developing software that monitors networks for intrusion, Hancock smacks of a character from a film noir flick from the fifties. Is your network behaving oddly—and you don't even know it? Hancock can tell you, *without opening the packets and compromising your privacy.* He uses pattern recognition to monitor changes in network behavior and flag abnormalities simply by looking at the flow of bits. *Abnormalities* mean someone is trying to get into your network and do something bad. Hancock has developed a multi-model approach using existing techniques such as neural networks. The principle is that each analytic paradigm has its own strengths and weaknesses, depending on the circumstances, and he weighs each model accordingly using his adjudication engine.

Using just four multi-component models, Hancock

already has the spooks excited, detecting attacks that NSA has never seen before, behavior of "national interest," so they've whispered. The models are *not* network specific, and he plans to incorporate some thousands of them into his system to be adjudicated, meaning he plans to live long or he's got a pretty steep genius learning curve. Monte Hancock is happy to be hanging around Turpin, because he desperately needs his processing power.

As for Day, while other data-mining experts grapple with grammar, Day has dug even deeper to resolve textual *meaning* and *context*. He's already solving the ambiguity problem, caused by words generally having more than one meaning. For instance, in the highly specialized area of medical methodology reports, Day is doing linguistically sensitive classifying—searches based on concepts rather than the actual phrases. (Google, are you listening?) He also analyzes international cargo receipts, which include, among other challenges, mixtures of languages and misspelled words. Very messy. And not very informative, until Day began uncovering and tracking suspicious cargo using data mining pattern recognition. Hey, that's one way to get rid of the dogs.

The product that's probably closest to commercialization right now did not grow out of an acquisition. It was developed by a team of 20 technologists led by Mark Koontz and Jerry Wood. The group jumped over to Essex from **Harris Corporation** (HRS) because their work targets $100 million markets, shy of the billion dollar markets that interest Harris. Terry knew Koontz at NSA, of all places. Since the second quarter, the Koontz-Wood team has set up an optical products lab for Essex, received an initial order for its "novel" transceiver now in production, and is readying two more unnamed products for field-testing. For Essex, *novel* means 20 GHz bandwidth microwave remoting over optical fiber, resulting in superior signal quality when compared to the coax cable used today. Of interest to the navy for transmitting radar signals from the antenna mast into the battleship, anyone putting microwave dishes on the roof could benefit from this technology, such as wireless broadband startup **GigaBeam** (GGBM.OB). Aimed to solve the last 100-meter problem in congested cities where fiber is hard to install, Doug Lockie's WiFiber startup operates in the 71 to 76, 81 to 86, and 92 to 95 gigahertz spectrum kin to Turpin's microwaves and early in November raised a further $19 in a private placement.

At Essex, Mark Koontz is a good "productizer." During his Harris days, Essex had often demonstrated ideas in the lab but had to go to Koontz to make the product saleable. For instance, the mechanical layout of the encryptor was designed by Koontz, who understands **Telcordia** testing for commercial communications parts, a critical expertise which Essex lacked.

Profiting from patience

Product breakthroughs are brewing. But Essex must first jump the hurdles that routinely challenge companies attempting to bring products from lab to market, including packaging, manufacturing, pricing, and marketing. One scenario for Essex has Turpin calling on air and seaports to sell them surface penetration, signal-processing, and pattern recognition systems for 3-D images of every container or all luggage entering the country. The images would *have* to be interpreted by cognitive engines, flagging areas of interest where a digital processor or and human being can intervene and look at what's going on. Convincing air and seaports to gut and replace the current convoluted infrastructure would be a task likely outside of Essex's current abilities, involving the understanding and acceptance of a new paradigm.

Wireless broadband startup Gigabeam could benefit from Essex's novel transceiver.

To help Turpin master and eventually morph these new markets, Moodispaw will continue to acquire accretive companies with the requisite geniuses, technology, customers, manufacturing capabilities, and product potential. In July Essex completed a shelf-registration allowing them to issue up to $100 million in common stock, over 5 million shares at today's price, to raise cash for more acquisitions or for a potential earn-out portion of the Windermere acquisition. To the extent that Windmere's earnings before interest, taxes, depreciation, and amortization (EBITDA) exceed $5.5 million during the year beginning March 2005, Essex will owe an additional purchase price of up to $30 million next May. That would be good news, because an earn-out payment would mean Windmere is working, as hinted at by the recent doubling of its "Woodstock" contract to $205 million for signals technology work for defense and intelligence through 2009.

Essex will also be cultivating development and marketing partnerships, such as the memo of understanding recently signed with a large and as yet unnamed communications systems house with manufacturing capabilities—the potential "**Cisco** (CSCO) connection" the market is anticipating. The purpose of the nonbinding agreement is to explore a more serious relationship to market Terry's all-optical encryptor.

Encryption is based on an unsolved mathematical problem, such as factoring large numbers, requiring billions of years to crack the code. Though secure, it can be challenging for commercial customers to implement, such as a credit card companies that need to back up petabytes (10^{15}) of data each evening to multiple sites a hundred miles or

more apart. The most sophisticated encryptors, yet to reach the market, will be constrained by their electronics to one data stream (wavelength) of 10 Gbps in a particular protocol. If you want to encrypt two streams or different protocols, you need a different engine for each one.

Using Hyperfine, Turpin shifts the phases of up to 100 frequencies within the data stream, making the optical transmission look like a noisy mess to an intruder. Similar to other systems, cracking the code (in this case, realigning the frequencies) would take billions of years. Turpin's advance is to make life a lot easier and less expensive for the networker because his analog encryptor works an order of magnitude faster than its closest competitor, is protocol agnostic, and works over a wide swath of bandwidth. If you transmit data over 400 wavelengths using 5 protocols, Terry will encrypt it all with one device. In addition to the commercial implications, beginning with the bank employees hoping to arrive home before dawn, the Hyperfine encryptor is of immediate interest to the military whose networks are strewn with proprietary protocols, often contractor specific, which would be costly to eliminate.

Turpin's panoply of unique technologies gives promise of many upside surprises.

But can the military and intelligence communities alone continue to catapult Essex? The world is undergoing a processing overload, and optics offers a tremendous amount of computational capability. Though it doesn't work widely, optical processing is virtually magical in its niches, and Essex claims the field to itself. National security will come to rely more and more on vast amounts of processing power and communications, and Turpin is driving Essex ever deeper into the furtive intelligence world where further breakthroughs are a good bet. Beset by terrorists and rising Asian powers, military and intelligence planners are unlikely to trim Essex's earnings and are more apt to raise the ante. Even Liberal Len likes the antiterrorism budget, and not just because it brings money into Essex. If congress or the presidency were to turn yet further left, Essex's uniqueness and anti-terror base would likely insulate it from military budget-cutting. The recent rise in short interest, which has helped to drive Essex down from its late heights, is probably being precipitated by traders looking for a quick buck on a budget cut. They will be sorry they picked on Essex.

But the stock price likely anticipates more than military. Though down significantly from its pinnacle of $25 in September, it still trades at 44 times the mean of analyst earnings estimates for 2005, which at 41 cents per share looks achievable based on this week's preannouncement. However, at these heights, even a slight shortfall to Wall Street's expectations could put short-term pressure on the stock. Next year, analysts are anticipating EPS to grow 66 percent to 68 cents, which would easily justify today's price. The problem is that margins on government services are capped to about 30 to 35 percent, even if you save lives and capture terrorists. A rough calculation shows that to earn 68 cents per share next year, Essex would need to more than double its revenue, to about $380 million from this year's projected $160 million, if relying on government sources alone, as it does currently. Clearly, investors are expecting big results from commercial products a lot sooner than Essex may be able to deliver.

But hold onto your hats. Essex will get there. The same computational and communications challenges attracting the military to Essex will eventually draw commercial clients in droves for modeling and prediction, cryptology, hypothesis testing, network security. Until then, Essex is buoyed on the bottom by its national security succors, so you shouldn't lose your shirt or shoes even if the stock does gyrate. And investors buying on dips with the same 3 to 5 year horizon harbored by Turpin should see their patience rewarded as his world-leading panoply of unique technologies gives promise of many upside surprises.

– Charlie Burger, with George Gilder
November 10, 2005

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