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Setting Records

The National Association of Tower Erectors's NATE Unite 2016 convention in February set an attendance record with 1,614 registered individuals, and at 137, the number of exhibitors also set a record. Congratulations to Kevin Hayden, president of Hayden Tower Service, and Diane Mueller, sales representative for Primus Electronics, for receiving honors from NATE at the convention. Hayden received the Bill Carlson Lifetime Service Award for contributing to the success of the NATE mission. He served as founding chairman, as a director and in committee leadership roles. Mueller received the Distinguished Service Award for committee work, including 18 years on the Member Services Committee, and for helping with the NATE convention and with forming NATE's first regional meeting.

Microwave Record

With the use of microwaves for high-speed, licensed communications, Exalt Wireless said it believes it set a record with a link that extends 235 kilometers over water. The 1 Gps link using frequencies in the 7-GHz band connects an island in the Mediterranean Sea with the coast of Lebanon. The link is part of a hybrid network of microwave radios and land fiber that has been operating for a year. The company said it has proven to be less expensive and more reliable than leasing undersea cable.

In the 1960s and 1970s, radio amateurs set microwave records using tropospheric ducting propagation between California and Hawaii. The fleeting connections were obtained only as atmospheric conditions were favorable.

"We believe that the previous distance record was 123 kilometers over water and 225 kilometers over land, using dual antennas and dual radios, respectively, at each end of the link," Amir Zoufonoun, CEO and founder of Exalt Wireless, said. "Our deployment uses just one radio and one antenna at each end of the link and we link over water, which creates significant transmission problems for ordinary microwave radios."

Milestone

In February, Eltek said it marked a milestone of having installed 10,000 hybrid solar-grid power systems in remote wireless and wireline telecom sites since it first launched its hybrid solar products in 2008. Initially, these were deployed only to off-grid sites, but now communications service providers are using them more widely. The company estimated that with the use of hybrid power systems, operators annually eliminate more than 350,000 tons of carbon dioxide reduce electricity expenses by more than $150 million.

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FEATURES

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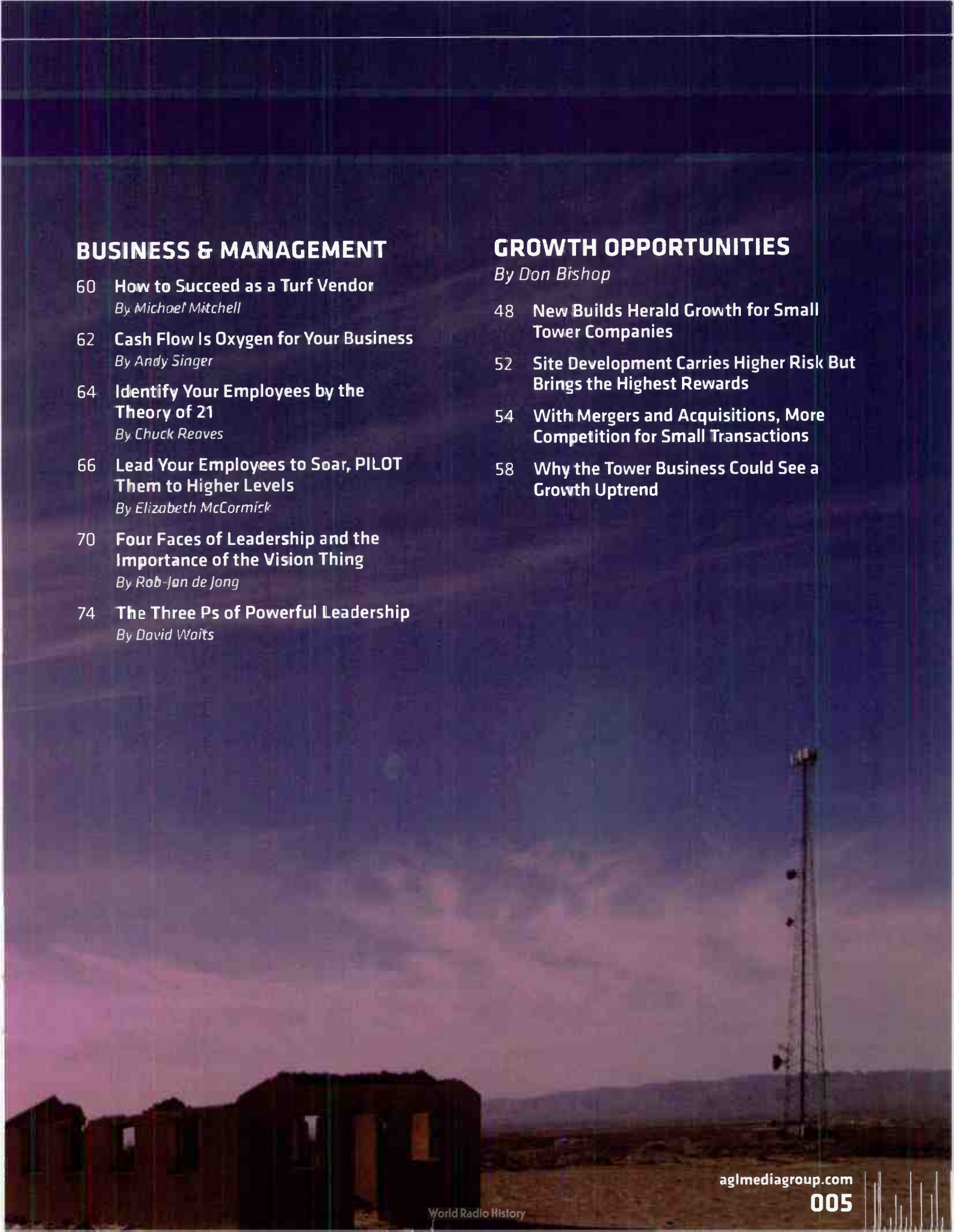
BUSINESS & MANAGEMENT

GROWTH OPPORTUNITIES

By Don Bishop



Drones and Auctions and DAS!

And FirstNet and Fiber and Spectrum and Earnings

There's nothing like a week spent at the NATE Unite 2016 convention of the National Association of Tower Erectors to pump up a topic list for a column. And a big congratulations to NATE; the convention set an attendance record this year.

I attended every conference session I could, and I made sure to be at every event. It's tiring but rewarding. I came away feeling positive about the eventual role drones will play in the wireless infrastructure. The science fiction-like imagery of drones may never become reality; however, the extremely detailed, high-quality imagery of towers that reveals exact details of installations, cabling and structural components is here. Early dreamers shared visions of using drones during tower construction, and those still appear to be just dreams. Nevertheless, practical reconnaissance and situational awareness scenarios will result not only in fewer climbs, but also in safer climbs and climbs with the right equipment and tools, minimizing how much stuff climbers will have to carry, and helping to get the climb right, the first time. Fewer climbs directly equates to fewer accidents, which is a great thing. Yay drones!

I was impressed with an update given by Phil Larsen about the National Wireless Safety Alliance's progress. This organization (*www.nws-a.org*) is developing the standards for what specific knowledge a person should have in order to qualify for specific jobs. Not a training organization, NWSA instead develops documentation and standards related to the qualification and knowledge a tower worker should have. And testing. But not training. It makes perfect sense to me, and it seems as though this type of industry self-documenting approach is highly positive.

With the annual Mobile World Congress in Barcelona, Spain, that took place in February came countless press releases about 5G cellular technology and the Internet of Things (IoT). 5G is happening and is tangible to everyone. The implementation of 5G will result in upgrades of all kinds to towers, rooftop infrastructure and almost every cellular site. IoT is still a bit of a mystery to me, and it appears to be equally mysterious to many people. It looks as though we need to think about trillions of devices trying to pass data from one place to another, and quickly. Or pretty quickly, but not instantaneously. The nice thing about the IoT idea is that few communications need to have the same quality of service (think speed and reliability) as voice traffic or premium data (packet data, with quality guarantees and reliability expectations).

We're seeing all the major players using buzzwords to attract attention, such as all manner of smart things and dense networks. One way or another, the number of things that can and will be IP-addressable will explode. I can watch my heart rate on an IP-addressable (NATed and IPV6, perhaps) device. Should I have a heart attack again, I want someone to know about it quickly, perhaps within a second or two, rather than a couple of milliseconds as is required for proper LTE packet throughput. This is a space to keep an eye on, just as voice over LTE (VoLTE) also will change how networks are deployed, and all non-LTE networks will sunset. This will happen. Eventually, this will happen. And the effect on our industry will be considerable.

I touched on this last month, and I probably will again; however, the industry as we know it will be changing. Companies that embrace DAS, small cells and dense networks will be here for a long time. For the holder of a large portfolio, a tower-only play no longer makes sense. The uniqueness of any one location is diminishing. Particularly with utilities, public safety users and potential IoT users, options are becoming numerous.

There is nothing like having a unique antenna site that covers a particular valley or town. My K1s have proven that point for years. Good towers in good places will always be winners; however, the days of "build it and they will come" probably are behind us. The time for being a network provider is slowly changing into the time for becoming a service provider.

Rich Biby, Publisher
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The Problem with Claiming the "Best Network" Tagline

By Iain Gillott

We all know that mobile operators are constantly trying to find an advertising tagline that works, one that resonates with consumers so much that it becomes part of everyday vocabulary. The most successful tagline in telecom was probably 'pin drop' all those years ago with Sprint's long distance service.

Kids, time for a history lesson: Back when mom and dad had just gotten out of college, you had to pay for long distance service separately from the other calls you made. These calls were made on things called telephones that had a wire connecting them to the wall — there was no Siri, screen, Google, camera or video on these phones. Anyway, back then, Sprint claimed its voice clarity was so good that you could hear a pin drop, hence the tag line. Candice Bergen was their spokesperson. Think of her as a reality star with a brain and class and you have the idea.

Success that Faded

Sprint's campaign was massively successful and the line stuck. Sprint cornered the "best network" image. In the last few decades, they have comprehensively lost that spot. Today, Verizon Wireless claims to have the best cellular network. And judging by the results of *i*GR's recent consumer survey, consumers agree with Verizon.

One of the fun things we did in this survey was to ask consumers to match recent advertising taglines with the mobile operator that uses that line. The big four operators use a variety of taglines; we focused on what we thought were the more well-known ones.

The bad news for the mobile operators not named Verizon is that their taglines are not resonating with consumers. And worse, they may actually be helping Verizon. Let me explain.

Confusion Among Consumers

Consider "Stronger. Faster. More reliable." This is from a Sprint ad. It promotes the Sprint network and all the improvements Sprint claims to have made recently. Bad news: Only 5.4 percent of 1,020 consumers correctly identified these words as belonging to Sprint. Another 12.1 percent said they belonged to AT&T, and 15.6 percent said these were Verizon's words. Nearly two-thirds said they did not know. Verizon execs are now calling Sprint to thank them for helping with Verizon's advertising.

How about "A Better Network"? This phrase belongs to Verizon, and 12.9 percent correctly identified this one, whereas 6.8 percent thought it belonged to AT&T. Verizon is not helping itself much here. Yes, please associate "best network" with Verizon, but why not just say "best network"? Do not complicate the issue.

Next exhibit: "Strongest 4G LTE Signal." This is an AT&T tagline, and 10.1 percent got this correct. But 6.7 percent thought it was T-Mobile's, and a cool 19.3 percent said it was Verizon's. Yet again, Verizon benefits from another operator trying to claim the best network. And again, 60 percent said they did not know.

Finally, how about "The World's Best Network"? This is a Sprint claim (not sure how they can claim "world's" on this one) that only 3.1 percent of people got right. But good news for the New Jersey Boys: 21.9 percent thought this was a Verizon tagline (as did I!).

Keep It Simple

The moral of this story is to keep it simple and find a claim you can make your own. Hijacking the best-network claim from Verizon is going to be difficult and it's confusing to consumers. For Verizon, keep it simple — just say, "the best network." Just as Sprint did a few decades ago, find something new and original.

Iain Gillott is the founder and president of iGR *and* iGR Semiconductor Research. *His email address is* iain@iGR-inc.com.

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Tower Engineering 2016

By Richard Bell

Modifying telecommunications towers to carry additional loads and to meet requirements of progressively changing standards poses engineering challenges that could be avoided.

The tower engineer's workload has experienced major changes in the past 20 years. With the slowdown of new tower sales, the engineer's work has changed from new tower design to tower modification design. In many cases, the workload is more challenging in modification than in new tower design, because with modification, the engineer isn't intimately familiar with the tower he is working on, nor does he have enough information to do an analysis. The owner's expectation of saving money by modifying a tower as opposed to replacing it is a reasonable assumption, but in most cases, the owner is in for a shock.

Little Choice

Many times, the cost of tower modification exceeds the cost of replacing an existing tower, but often, owners have no choice in the matter. The tower owner has to consider the loss of revenue and possibly losing tenants if they decide to build a new tower. The loss of service for the tenant and replacing antennas and rearranging lines to get back in service is costly. Sometimes the local building departments refuse to give owners permission to rebuild a tower, in which case modifying an existing tower would be their only solution.

Welding

The engineer's job appears to be simple — analyze the existing tower with the desired loading in mind, identify the overloads and replace or reinforce the overloaded members. The problem is that the majority of the towers have a welded section design that doesn't allow replacing a member. The triangular tower section with aerodynamic solid round members welded into a unit was considered state-of-the-art 30 years ago. It was more efficient than angle-iron towers, and it eliminated the internal corrosion that plagued tubular towers. Modification for additional loading was never given a thought in these original tower designs, so now engineers are scrambling to produce modification designs on a tight schedule and budget. Engineers are left with no alternative other than scab-welding half-round tubing to existing round members, welding or U-bolting on new gusset plates for mid-point bracing, U-bolting angles to the outside of the legs and an assortment of other remedies, none of which they are very pleased with.

> *"The task becomes even more complicated when the owners don't have a set of manufacturing drawings, and sometimes no drawings at all."*

Lack of Drawings

The task becomes even more complicated when the owners don't have a set of manufacturing drawings, and sometimes no drawings at all. Many of the towers are 40 to 50 years old, and the manufacturer is out of business. Someone has to provide a good set of drawings before the engineer's work can begin, so the tower has to be mapped. Mapping consists of field-generated information accumulated by climbing the tower and measuring every member, including the outside diameter, length and thickness of members, bolt sizes, guy wire sizes and guy hardware sizes, guy elevations, elevation drop and guy radii, plus antenna models, sizes, locations and orientations. The tower engineer doing the mapping also has to use ultrasound to measure the thickness of tubular members. In the absence of stated yield capacity, the engineer has no alternative other than to use the minimum yield of mild steel. The engineer designing the modification of an existing tower is working under a

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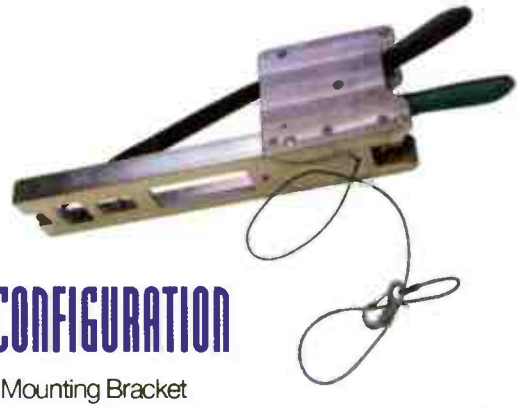

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severe handicap, and yet is expected to endorse the modification design.

Tower Mapping

Mapping is key in resolving this problem, and it is a difficult job. If it's done right, the whole job goes well, but a single mistake in measurement can result in many prefabricated reinforcement members not fitting. There is no question in any reasonable person's mind that design engineers are all qualified to do a complete and thorough job of mapping a tower, provided that the tower is indoors in a controlled environment where the design engineers have their feet placed on solid ground. Some engineers are fit enough to climb the towers and perform the mapping, but even the fittest will be more prone to make errors while under the stress of working off the side of a tower, exposed to the elements.

Limiting Liability

Mapping is costly, and most companies offering this service limit their liability with disclaimers regarding the accuracy of their details, and rightfully so under current conditions. If a mapping contractor charges $5,000 for tower information and makes a mistake that takes a field crew a week to correct, the cost is three or four times the original cost of mapping — and the engineering firm that did the design work is automatically ensnared in a costly trap. To avoid entrapment, most engineering firms use the mapping information only to perform the tower analysis. Then they detail the parts to be replaced with the overall cut length a foot longer than necessary. The final measured cut and hole-drilling of the blank end is done in the field by the installer. This remedy is costly; however, it's not as costly as a field crew spending a week correcting mistakes made by the mapping company. Also, on top of the increased cost, the quality of the modification is compromised by the use of cold galvanizing.

Field-welding

Years ago, field cutting and welding was never an option with the installation or modification of any AT&T tower, and this somewhat became the adopted standard for all other telecommunications tower owners. If cutting, drilling or reaming was required, it was only done with the approval and under the inspection of an on-site inspector. No torch-cutting was allowed, period, and any saw cuts or drilled holes had to be coated with a heavy coating of the zinc-rich ZRC compound. Field welding was never allowed under any circumstances, yet field welding is commonplace in tower modification today. How many times have we seen burning monopoles on the news, caused by modification crews setting the lines on fire inside the monopole.

> *"Mapping is costly, and most companies offering this service limit their liability with disclaimers regarding the accuracy of their details, and rightfully so under current conditions."*

The Welder's Work

Welding 101 teaches that the first thing a welder does before striking an arc is to place himself in a comfortable position where he can burn a full rod without having to stop and reposition himself. Then he has to consider slag and splatter dropping down inside his boots or getting caught in the folds of his clothing, or worse yet, dropping down inside his pants. On towers, the welder also has to take into consideration which direction the wind is blowing and position himself accordingly, and be careful not to start any grass fires or to ignite lines inside the monopoles. When all of these issues have been given due consideration, then he flips his hood down and starts welding. The welder is more than 200 feet in the air with his hood down and cannot hear anything other that the splatter of rod and slag burning, and the only thing he can see is his weld. Most of his welds are uphill, which are not the easiest welds to make, and he knows that his welds are going to have to pass inspection. Such welding is not an easy task to perform while working indoors with both feet on the ground, so one can only imagine the difficulty of performing high-quality welding while hanging off the side of a tower, fully exposed to the elements. Pipeline welders are provided

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with a shelter, usually a tent, when they have to work in the elements, and pipeline operators understand that this protection is necessary so the welder can do his best work and avoid inspection failures.

Standards Committees

The modification work that is currently ongoing is realistically nothing more than a Band-Aid on a serious wound. We don't know for sure what the needs of the next generation of technology brings with respect to tower loading, but more than likely it will increase loading and therefore require another modification. Alternatively, a new generation of standards committee members wanting recognition in pride of authorship will initiate changes in the standards that result in even more alterations and modifications. Since the EIA RS222-D Specifications governing tower designs were adopted in 1987, the minimum requirements for the design of steel towers has been a moving target from RS222-C to eventually RS222-G, with at least one revision to all the other letters.

Alternatives

This situation is a catastrophe that needs to be fixed. Maybe federal regulations should be imposed that force county building departments to allow owners the right to replace their towers with heavier towers, towers that are designed so they can be modified for future loading. Maybe consideration should be given to reintroduce the square angle-iron towers to allow easy modification. Maybe the wrap-around tower that can be installed over an existing overloaded tower is an option, one that has been implemented several times but is seldom seen. Whatever plans the powers that be adopt, it needs to be done quickly. This is the American telecommunication infrastructure we are discussing here. The professional organizations that have caused our infrastructure to deteriorate to the level it has are an international embarrassment. When the situation reaches a point at which a website has been created for the sole purpose of reporting unsafe towers, it's time to take positive action to correct the problem.

Richard Bell is president of Bell Tower in Chelsea, Oklahoma.

Providing Support by Standing Together

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"The Nevada Wireless Association supports the efforts of the Tower Family Foundation and has made them a recipient in our annual charity golf tournament. Best of luck to the Foundation as you continue to grow and help those in need!"

Chris Wener
Nevada Wireless Association President

"As a climber with 17 years of experience, I've seen firsthand the hurt and the pain caused by the loss of a fallen friend and fellow tower climber. I am grateful and humbled to know there is an organization that has resources to assist tower climbers and their families during times of need."

John Gates
Tower Climber from ATS

"I want to thank everyone involved for making this happen! Synergy Concepts will be donating to the Tower Family Foundation and encourages other companies in the industry to donate as well."

Russ Chittenden
Vice President of Synergy Concepts, Inc.

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The View from St. Charles Tower

By Mike Harrington

St. Charles Tower, Chesterfield, Missouri, works case by case with wireless communications carriers for build-to-suit towers and sometimes builds spec towers on its own. The company owns sites in Missouri and Illinois.

It all started for Chris Puricelli with a job offer from AT&T Wireless in 1995. "I was actually the second hire by the newly formed group at that time," said Puricelli, who had answered a blind ad posted by AT&T to assist a company with zoning and leasing.

Now managing partner of St. Charles Tower (SCT), Chesterfield, Missouri, Puricelli said his background actually kicked off with a business degree from Lindenwood College in St. Louis. "Always interested in real estate as a young man, I obtained a broker license at age 25 and began working as a commercial real estate appraiser," Puricelli said. "It was a very good education and included a three-year stint at the Missouri Department of Transportation to learn the ins and outs of easements, utilities and access rights."

After being hired at AT&T, Puricelli worked three years through AT&T's St. Louis build plan and then another three years for Bechtel on national AT&T projects, including one in Los Angeles. At Bechtel, the largest construction and civil engineering firm in the United States, he became involved in wireless networking services for the St. Louis major trading area (MTA). When AT&T signed a contract with Bechtel to do their national buildout, Puricelli transferred over to Bechtel, where he became involved in wireless networking services for the St. Louis MTA.

In 2002, Puricelli founded St. Charles Tower with his partner Bob Bell. "At the time, we had six employees, and everyone lived in about a three-mile radius of the office in St. Charles, thus explaining the origin of our name," he said. Bell and Puricelli left their jobs network building in the St. Louis MTA to found their company in the suburban St. Louis city of Chesterfield — and then looked westward for more tower-site opportunities. SCT now has tower sites in seven states: Missouri, Illinois, Indiana, Texas, Nevada, Kansas and Arizona.

Chris Puricelli, managing partner of St. Charles Tower, Chester, Missouri.

These days, SCT works on case-by-case contracts with carriers, the primary ones being AT&T Mobility and Verizon Wireless. SCT maintains contracts with all of its carriers and has worked with all of them in the past. "We only build spec towers for ourselves," Puricelli said. "In the past, we have provided RF services as well as construction management and site acquisition. It depends on the level of market activity any given year."

The company maintains a large portfolio of sites in Missouri and Illinois, all available for collocation. "We are a build-to-suit tower and collocation provider," Puricelli said. Over the years, SCT has established relationships with many municipalities, working with them on coverage needs for tower sites. The company usually maintains an inventory of about 40 towers with about the same number of billboards, which are held in a different name.

Taking Care of Business

Bob Bell acts as SCT's business manager while Puricelli runs the office activities and client relationships. "It's a good way to work together as partners as we do not get into each other's way," Puricelli said. "I value Bob Bell as a very important part of

To conceal a Verizon Wireless antenna installation at Gloria's Restaurant on Greenville Ave. in the art district of Dallas, where no towers over 30 feet high are allowed, St. Charles Tower designed an artistic partition on two sides of the roof with the same scalloped cornice work along the top edge.

our company and meet with him several times a week."

SCT divides work among its teammates in three categories. "Four of us are real estate agents and do the site acquisition," Puricelli said. "My partner and Brian Foehl run the construction component; Greg Yocom is our RF engineer to help with design issues. And we all work on sales. So the work is divided depending on which discipline is required."

Real Estate

The company also owns four office buildings, a subdivision, rental homes and a number of commercial sites. Everyone SCT employs in the real-estate section is licensed as a broker or salesperson. "I believe that real estate is relationship-based and requires years of knowledge in any given MTA," Puricelli said. Meanwhile, SCT LLC, the deployment services arm of St. Charles Tower, formed in July 2008, provides services that include site acquisition, architecture and engineering, project and construction management as well as build-to-suit. These services are made available in-house by SCT staff, which has more than 75 years combined experience in the wireless communications industry.

SCT tends to specialize in concealed and disguised designs — church steeples and trees, for example — but that specialty comes from the company being able to work for long periods on single projects. "We're not hampered by timelines to the same degree as a carrier or super vendor, so we can work closer and longer with government entities to place the best design," Puricelli said. "In fact, in the next quarter, we have a pine tree planned as well as a clock tower in a city park and a stealth boulder on National Park Service land."

SCT does most of its site acquisition in-house. "Most carriers do not have the ability to hire people with that level of experience, and super vendors change, as do their employees," Puricelli said. "The end result is that SCT has a clear market niche and an advantage at acquiring and zoning sites. We also have our own RF engineering in-house to assist with tower placement."

LightSquared

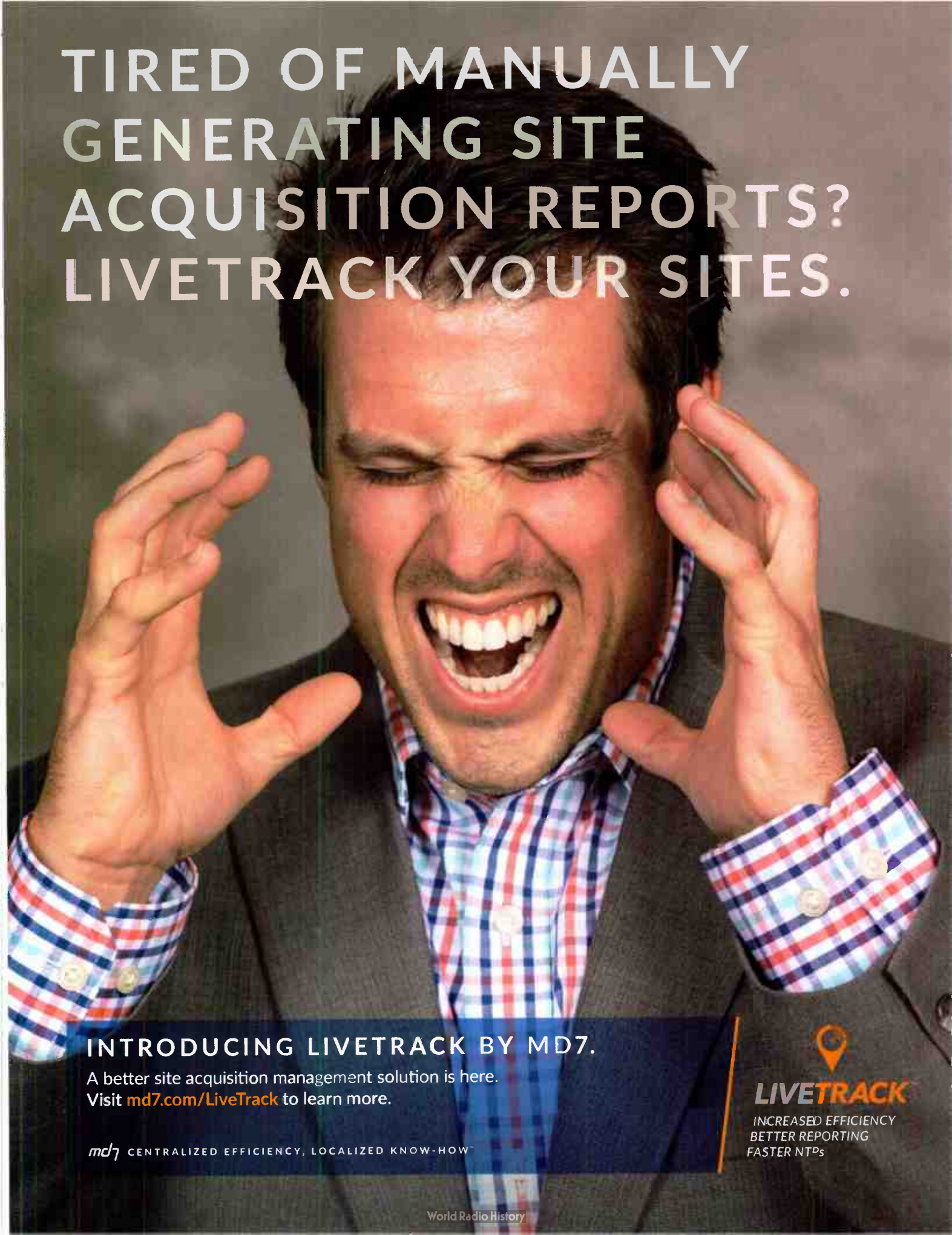
In 2010, SCT was the first company to sign leases on existing and future sites with LightSquared, the mobile satellite voice and data services provider that had plans to use its radio-frequency spectrum to compete as a wireless carrier with AT&T, Verizon Wireless and Sprint. "At that time, LightSquared was poised to implement a national build out with satellite- and ground-based 4G wireless broadband services to compete with other national carriers," Puricelli said. "There was a spectrum debate that ended LightSquared's push to deploy a system, so SCT never saw the full potential value of those contracts."

Puricelli has seen some changes since SCT started — the most dramatic ones probably being that there are only four carriers left in most metro areas and that future sites are planned in smaller design areas. "Small sites seem to be gaining steam for 2016," he said. "As for capital, we have seen no change. SCT has been proficient at just running a credit line. Every year or two, we sell some towers and pay off the line of credit. Interest rates have been stable for years, and internal rates of return seem to vary little. Also, the value of communication towers shows a constant positive trend, and that is expected to continue through the next fiscal year."

Business has been a little slow with Sprint and AT&T this year, and SCT's current staff consists of only two people in Las Vegas, two in Dallas and five in St. Louis. An additional eight people work in SCT's engineering and surveying department.

"Our business is driven by carrier growth and activity," Puricelli said. "If there is more work in Texas or Nevada, we will certainly be there to work in those markets as we maintain a constant presence. St. Louis is our home office, so all things considered, we would maintain a larger presence in St. Louis, but one cannot predict the future. We will go where the business is active as long as it lies within the Midwest, Southwest and southern regions of the United States."

Mike Harrington is a freelance writer in Prairie Village, Kansas.



Shown on the ceiling in the foreground in a conference room, top and center in this image, a MIMO communications antenna draws little attention.

Breaking Down the Walls: Achieving Maximum Coverage Indoors

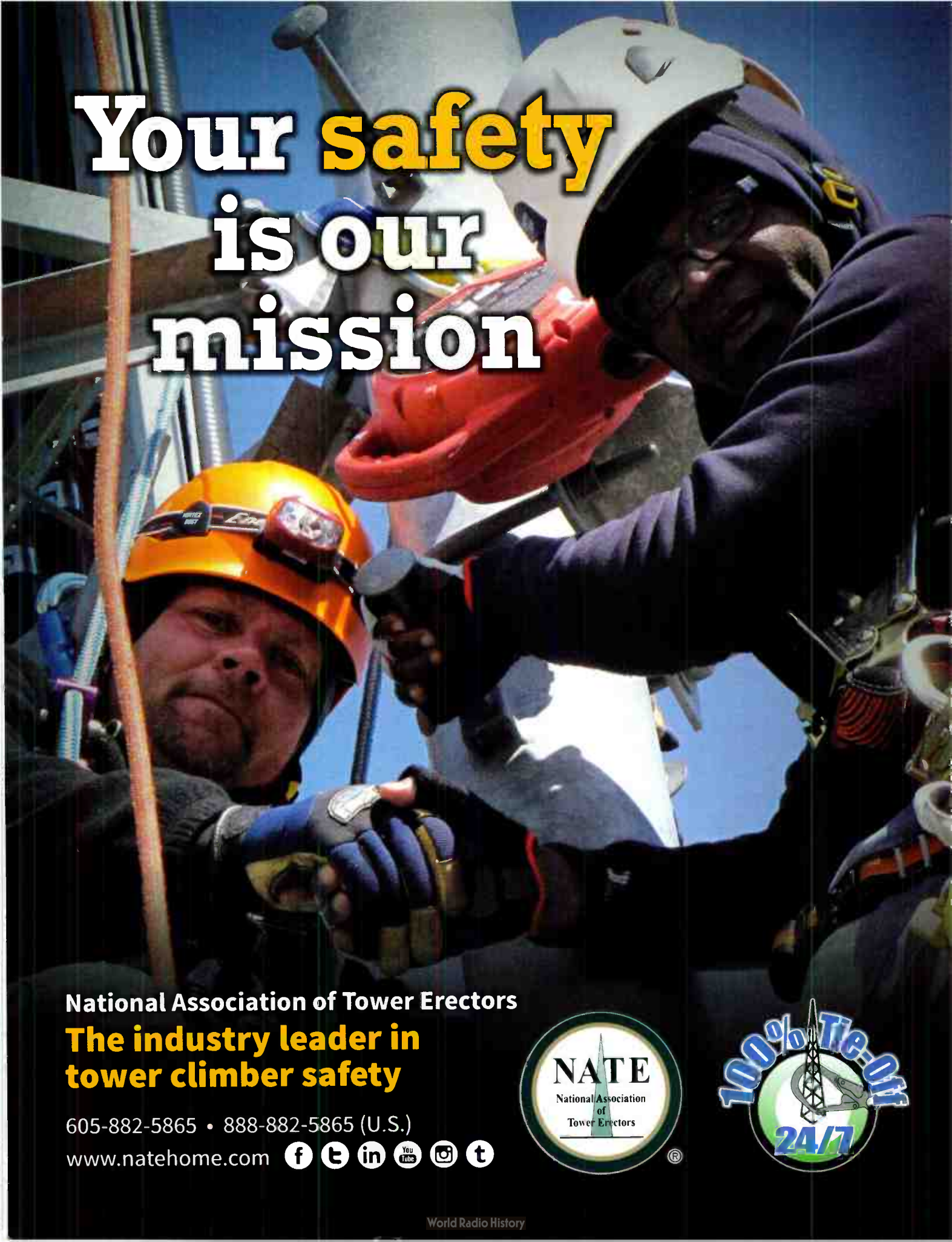
By Michele Martoccia

An antenna with a wide frequency range, omnidirectional coverage and high gain provides in-building wireless communications. Its stylish, neutral design appeals to architects, too.

When it comes to the availability and quality of wireless voice and data communication services, the high coverage requirements apply just as much inside buildings as they do outside. With millions of app-based Internet, data and voice services running on smartphones, tablets and notebooks, subscribers are increasingly expecting unlimited, seamless connectivity across 2G, 3G or 4G networks — making mobile connectivity within public buildings such as shopping malls, stadiums, railway stations, airports, convention and exhibition centers and hospitals a must.

According to a Cisco Systems white paper, "Cisco Visual Networking Index: Forecast and Methodology, 2014–2019," traffic from wireless and mobile devices will exceed traffic from wired devices by 2019, with wired devices accounting for 33 percent of all IP traffic, while mobile and Wi-Fi devices will account for 66 percent.

The study also suggests that the number of devices connected with IP networks will be three times as high as the global population in 2019. There will be three networked devices per capita by 2019, up from nearly two networked devices per capita in 2014. Accelerated in part by the increase in devices and the capabilities of those devices, IP traffic will reach 22 GB per capita by 2019, up from



8 GB per capita in 2014.

These ever-increasing demands for higher bandwidth will undoubtedly put a strain on aging antenna communications infrastructure, meaning that building proprietors must future-proof their systems before they become overloaded.

The shielding effect of a building's front and structure can also have a detrimental effect on radio signals and is often the reason behind insufficient service quality. To combat these obstacles, it is essential that additional technical measures are put in place.

What We Need for the Future

What is required, then, is an antenna that responds exactly to the highest standards of the crucial passive intermodulation (PIM) interference characteristics for distributed antenna system (DAS) networks and in-building coverage (IBC) systems, as well as meeting the ever-increasing market demand for indoor coverage of mobile voice and data traffic required to cover an ever-wider range of applications and services.

One Antenna for Almost All LTE Frequencies

Because of the massive and increasing demand in data traffic, future-proof multiband and multi-operator network technology should be deployed. This would support a wide range of communications technologies, including GSM (Global System for Mobile Communications), W-CDMA (wideband code-division multiple access), UMTS (Universal Mobile Telecommunications System) or LTE (Long Term Evolution).

With its multiband 698-MHz to 3800-MHz frequency range, omnidirectional pattern and high gain, Huber+Suhner's Sencity Rondo multiple-input, multiple-output (MIMO) communications antenna provides coverage across large areas in almost all LTE frequency bands and beyond.

An exceptionally wide frequency range of coverage means that it is not necessary to install separate antennas for individual applications, which can be costly and space-intensive. It also facilitates the integration of DAS in existing buildings at a reasonable cost for materials and installation and with the added benefit of aesthetic and unobtrusive design.

The Huber+Suhner Sencity Rondo antenna combines an electrically efficient MIMO antenna with an attractive design that fits different architectural forms. The neutral design allows architects to style the building with traditional elements such as lamps or other design elements, leaving the antennas in the background and almost unnoticed.

> *"Because of the massive and increasing demand in data traffic, future-proof multiband and multi-operator network technology should be deployed."*

Discreet Enough for Any Architectural Design

Another important aspect of the antenna that is chosen is aesthetics. Although it must perform for multiple applications across a wide frequency range, the antenna must also fit in well with its surroundings.

Ideally, alongside its state-of-the-art technical attributes, the antenna should feature an attractive design suitable for many different architectural forms. Its design must be neutral, so that architects can concentrate on styling the building with either traditional or modern design elements with absolute freedom, leaving the antennas in the background and almost unnoticeable.

The new antenna is an example of style combined with substance. Along with the classic below-tile mounting possibility, it has four other mounting options for a range of situations and architectural styles including below hard ceiling, above the ceiling, through ceiling tile and completely recessed through ceiling tile. All five mounting options use the same bracket. The range of options offers the customer the flexibility to make the communication

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system as discreet as possible, with the option of making the antenna ultra-thin and only protruding 1 millimeter from the ceiling.

The 2x2 MIMO and 4x4 MIMO options are fitted in the same housing, making it possible to reuse the mounting brackets or the mounting socket in the building for the next generation upgrade. This will continue to be the case when the LTE 600 version is launched.

The same concept, this time with a rectangular shape, has been applied to Sencity Cube MIMO, which is the corresponding antenna for directional radiation, ideal for covering corridors or rooms where the energy is needed in certain areas. The focus on the electrical performance has resulted in a highly stable PIM design, an optimal directional diagram and high gain.

"An exceptionally wide frequency range of coverage means that it is not necessary to install separate antennas for individual applications, which can be costly and space-intensive."

For added convenience, the cable can be passed through the wall behind the antenna or it can be hidden in the plenum space that houses air conditioning and heating systems, so that it is almost invisible.

The two antennas are equipped with standard N connectors on the pigtails. In addition 4.3-10 and 4.1-9.5 connectors are also available. Single-input, single-output (SISO) communications antennas can also be supplied in the same shape, to match installations where MIMO or SISO antennas are needed in the same building or for purely SISO installations.

One Solution – Many Options for the Future

With the implementation of dedicated solutions including DAS indoor antennas, the level of internal coverage required can be achieved in every situation, with the opportunity for additional voice and data channel capacity to be created as required. In the case of DAS, the appropriate use of active and passive system components results in guaranteed seamless availability of services across floors and individual rooms.

The use of such broadband system components also offers good investment protection to the customer by guaranteeing sustainable flexibility for future expansion. This will positively affect customer satisfaction and reduce overall expenditure, because components — rather than the entire system — can be replaced when required.

Michele Martoccia is DAS program manager Huber+Suhner. The company manufactures the electrically efficient Sencity Rondo MIMO antenna described in this article. For more information, visit wirelessinfrastructure.hubersuhner.com/en/products.

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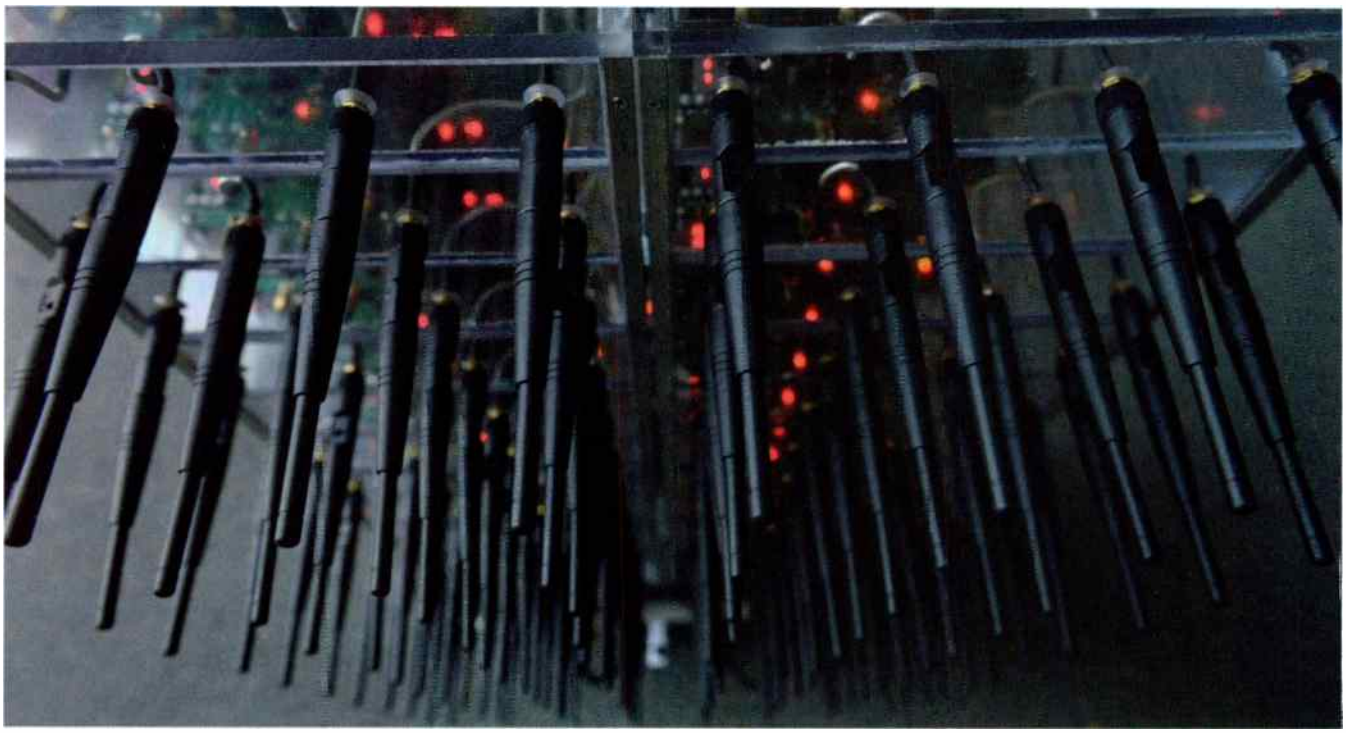


Rice University's Argos Network will use base stations with more than 100 antennas apiece to share spectrum by beaming information directly to many users simultaneously on the same frequency. *Photo by Jeff Fitlow/Rice University*

Rice Wins $2.4 Million to Study Many-antenna Wireless

By Jade Boyd

A Rice-led project will investigate beam-forming base stations with hundreds of antennas to send tightly focused beams of data to each user, even as they move.

Rice University researchers have won $2.4 million from the National Science Foundation (NSF) to conduct the most extensive experimental research yet of wireless technology that uses 100 or more antennas per base station to send tightly focused beams of data to each user, even as they move.

The research at Rice's campus in Houston will help the wireless industry determine whether and how to include the many-antenna technology — known in industry parlance as massive multiple-user, multiple-input, multiple-output (MU-MIMO) communications — in upcoming 5G wireless standards.

"Early tests of many-antenna technology at Rice and elsewhere suggest that wireless carriers could use this technology to serve many times more data than can be served with today's 4G networks. But there are still many questions about how to scale this technology for real-world implementation. Those are the challenges we'll be tackling with the new research," said Lin Zhong, associate professor of electrical and computer engineering and computer science at Rice and the principal investigator on the new grant.

The research will make use of ArgosNet, a many-antenna experimental test bed that Zhong's Efficient Computing Group is building, thanks to a 2014 NSF infrastructure grant. ArgosNet will eventually include as many as a half-dozen programmable base stations, each with 100 or more antennas. Zhong's

team will be able to reconfigure each to emulate cell-tower base stations or other types of wireless network nodes. The many-antenna technology being investigated uses a large number of base station antennas to serve many users at the same time. When the number of base station antennas is significantly larger than the number of users, the technology is also referred to as massive MIMO.

"Large-scale multiple-user MIMO technology is a key enabler in meeting the 1,000x data challenge — that of increasing spectrum efficiency by a factor of 1,000 when compared with current 4G data networks," said Thyaga Nandagopal, NSF program director. "The National Science Foundation has funded basic research in this area for several years, and this project will advance this research to the next level by addressing the system-level challenges that can hinder the realization of this technology's full potential."

Today's top-of-the-line 4G wireless data networks serve data to millions, but each base station only communicates with as many as four users at a time on a given frequency. They appear to serve thousands simultaneously by dividing their time and frequency to serve tiny slices of data to each user every few milliseconds. Ideally, users never notice they are sharing the network, but data rates can slow if too many users are online at once, and based on industry trends, slowdowns will become more common.

According to a 2014 study by Cisco, wireless carriers increased the average mobile network downstream speed from 1,387 kilobits per second (kbps) in 2013 to 1,683 kbps in 2014. That's a notable improvement, but nowhere near the growth that is needed to meet demand. The same report found that smartphones generated 22 times more demand for mobile data than did nonsmart devices, and 88 percent of the 497 million new mobile devices added worldwide in 2014 were smart.

Zhong said the new experimental research with ArgosNet, which draws its name from the many-eyed giant of Greek mythology, could provide the answer that wireless carriers need for the coming bandwidth crunch. ArgosNet uses its many antennas to beam information directly to numerous users simultaneously on the same frequency. It does this by constantly computing where each user is and altering the signal to each antenna to direct a focused beam directly to each user.

The payoff can be enormous, because carriers can use limited frequency bands to serve many more users, but there are also complications. The computing power needed to both track users and continuously form and reform beams in real time is significant, Zhong said. There are also issues related to interference because each wireless device must regularly broadcast so that the base station knows where to focus the beams.

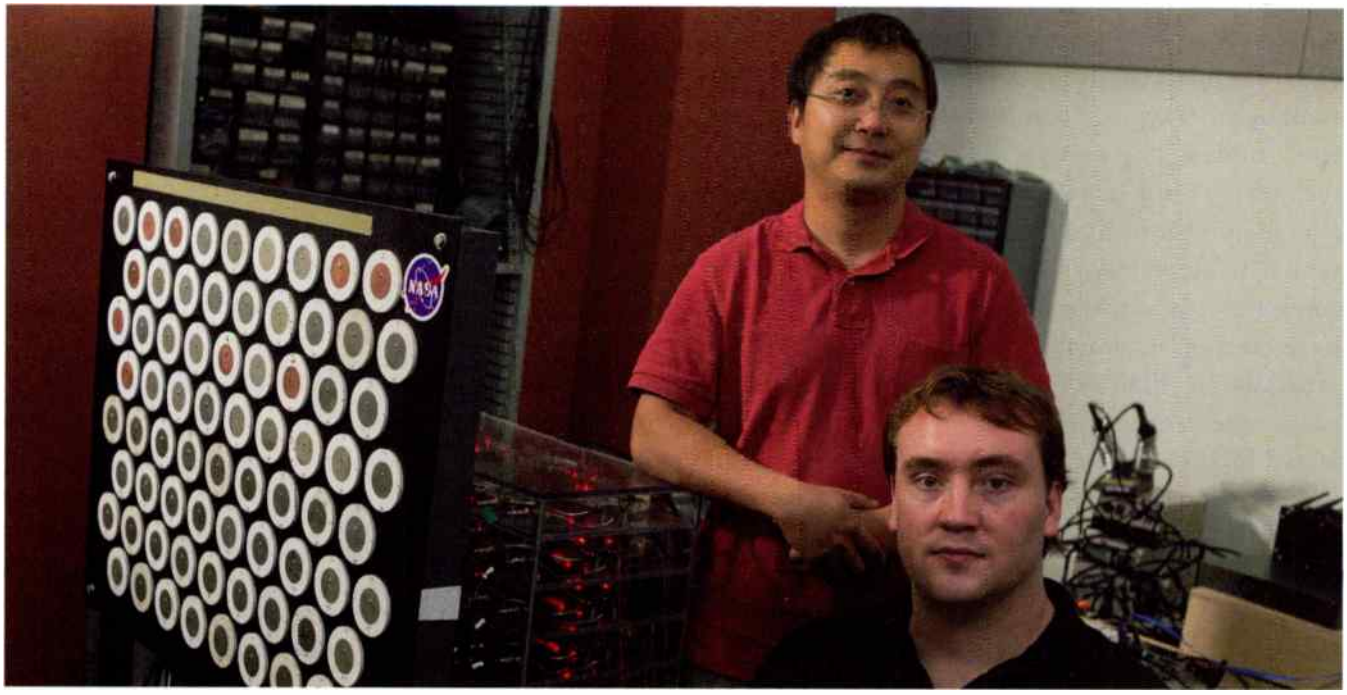
Among the ArgosNet team members is Clayton Shepard, a Ph.D. student who is building the ArgosNet base stations and mobile clients, and who's already worked with NASA to test massive MIMO designs using specialized facilities that were originally built to test spacecraft communications systems.

"ArgosNet is a very flexible platform," Shepard said. "We've designed it to work like Lego blocks; we can add or subtract antennas and other components to construct any kind of node that we want. The wireless test units also can be configured to act like everything from a laptop to a wireless handset."

Shepard said the flexibility will allow the newly funded project team to evaluate the overhead computing demands for beamforming, interference from pilot signal traffic, and how MU-MIMO might be co-implemented with densification, another potential 5G technology that calls for deploying many more base stations to make the best possible use of limited radio spectrum.

"MU-MIMO will almost certainly be included in the specifications for 5G, but no one knows how many antennas to call for because the trade-offs among cost, size, power and performance haven't been determined," Shepard said. "We'll be able to evaluate each of these and answer other questions about how to implement this technology in the real world."

Shepard said the team is exploring how to make ArgosNet compatible with existing smartphones and wireless devices, but the current base stations are not compatible with existing technology. For



Lin Zhong (standing) and Clayton Shepard with ArgosNet base station. *Photo by Jeff Fitlow/Rice University*

Rice's tests, Shepard and other members of Zhong's team will use reprogrammable, battery-powered test units.

The project team includes Rice's Edward Knightly, professor and department chair of electrical and computer engineering and director of the Rice Wireless Network Group; Rice's Ashutosh Sabharwal, professor of electrical and computer engineering; and Ohio State University's Ness Shroff, the Ohio Eminent Scholar in Networking and Communications and professor of electrical and computer engineering and computer science and engineering.

Jade Boyd is science editor and associate director at Rice University News and Media Relations. More information about Argos is available at http://argos.rice.edu.

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Future Trends of Wireless Networks

By Shawn Stapleton

Convergence, virtualization and a software-defined network will optimize spectrum use.

With the maturation of network technologies, many of today's networks primarily designed for voice are becoming saturated and stressed with unprecedented volumes of data traffic. Therefore, optimizing the use of spectrum, a finite resource, has become a priority for mobile operators globally. Mobile operators are now looking at convergence, radio access network (RAN) virtualization and software-defined network concepts to reduce operational and capital expenditures, and to reduce network complexity.

Convergence

In today's heterogeneous network, multiple technologies are often used, including distributed antenna system (DAS) networks, small cells and Wi-Fi, to deliver the required coverage and capacity — either for delivering in-building wireless, addressing dead spots, densifying the network in high traffic areas or offloading the capacity from the macro networks. Each of these technologies has its own advantages. Depending on the goals and requirements of each venue, one or more of these technologies can be used to provide the wireless experience that users demand.

The challenge in today's business environment is to do more with less. Simpler solutions are developed by converging the best elements of the in-building wireless technologies mentioned. Broadly speaking, this means the converged solution can deliver the high capacity of a macrocell and the flexible coverage of DAS with the small footprint of a picocell without traditional interference challenges. This solution should also have the intelligence to route traffic to where it is needed whenever it is required, ensuring optimal quality of service anywhere at any time.

> *"As mobile operators move to a direct common public radio interface (CPRI) or digital connection, they will realize further reduction in cost and footprint of the wireless network systems."*

Although licensed spectrum continues to be mobile operators' top priority for delivering optimal quality of service, the use of unlicensed spectrum is becoming an important complement to boost users' mobile experience and provide capital and operational cost savings. Deploying Wi-Fi access points to offload cellular traffic is not a new concept. However, in many cases, mobile operators have to invest in a separate backhaul to support the unlicensed spectrum in addition to the cellular infrastructures. Therefore, the objective of cost reduction is sometimes not achieved in an optimum fashion. Also, the lack of coordination between the cellular and Wi-Fi systems results in spectrum being used with low efficiency. Therefore, an integrated licensed and unlicensed spectrum solution is required to seamlessly support Wi-Fi calling, LTE and Wi-Fi aggregation (LWA), and licensed assisted access (LAA) to enhance users' mobile experience.

The converged solution should enable licensed and unlicensed spectrum to coexist in order to enable seamless operation among 2G, 3G, 4G, 5G and Wi-Fi services. This way, the solution has the flexibility to focus capacity on high-density areas and to augment coverage as required to optimize throughput based on each link's quality and load. In addition, it enables other IP-based functions to be integrated, including Wi-Fi access points and security cameras, and other future applications such as indoor navigation and location-based mobile advertising. This also

enables rapid wireless coverage and capacity deployment, and Wi-Fi offload, and it enables seamless interoperability between VoIP and VoLTE to support Wi-Fi calling, LWA and LAA.

To further simplify the complex wireless network, gigabit passive optical network (GPON) infrastructures that are traditionally only utilized to transport triple- and quad-play services including high-definition (HD), voice (also known as wideband audio) and next-generation TV services can also be used to deliver wireless coverage and capacity. By using existing fiber in the GPON infrastructure, both licensed and unlicensed spectrum can be delivered on top of the triple- or quad-play services.

An integrated system enables operation of multiple services including wireless, Ethernet, Wi-Fi and IPTV over the same infrastructure. With convergence, it significantly simplifies the network (see Figure 1).

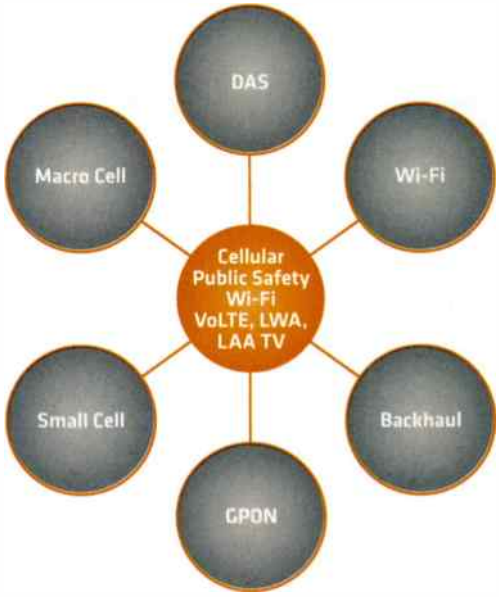

Figure 1. With convergence, an integrated system can support the operation of multiple services including cellular, public safety, Wi-Fi, VoIP and IPTV over the same infrastructure.

RAN Virtualization

Another way for mobile operators to optimize the use of spectrum is through RAN virtualization. Similar to the transformation in data centers and cloud computing that use virtualization to simplify complex or large computing tasks in the computing world, RAN virtualization is set to simplify the complex wireless network and optimize a mobile operator's precious resource — spectrum.

RAN virtualization, in today's wireless ecosystem, can bring in various benefits including better use of existing hardware resources to avoid over-provisioning. Also, as the wireless ecosystem moves toward a software-defined network, the routing configuration and control and monitoring functionality of the network elements will be virtualized in the cloud or in a data center. An all-digital and software-reconfigurable platform will enable mobile operators to migrate seamlessly to a software-defined virtualized network in the future while providing them with a platform that helps them maximize their current capital investment.

In a classic wireless infrastructure, a base station is connected to a remote radio unit with an antenna. This is a fixed 1:1 relationship, which means there's a static allocation of coverage and capacity to the desired area. With centralized RAN (C-RAN), the base station resources are moved to a centralized location where they may share space with other base stations to reduce power consumption and space. However, it's still a 1:1 relationship.

RAN virtualization with the RF Router platform takes it a step further by pooling all the resources so that one or more base station resources (2G, 3G and 4G, and 5G in the future) can be distributed to any connected remote radio units and their antenna points. RAN virtualization through RF routing breaks the bottleneck associated with the 1:1 relationship between the cell and its associated capacity and coverage area by making it a multipoint-to-multipoint relationship.

By virtualizing the radio resources through RF routing, spare capacity sitting idle in one part of the service area can be dynamically routed within the system to another part that may be in need of additional capacity, such as to cover a temporary peak in use. This ensures that no usable capacity is wasted, allowing mobile operators

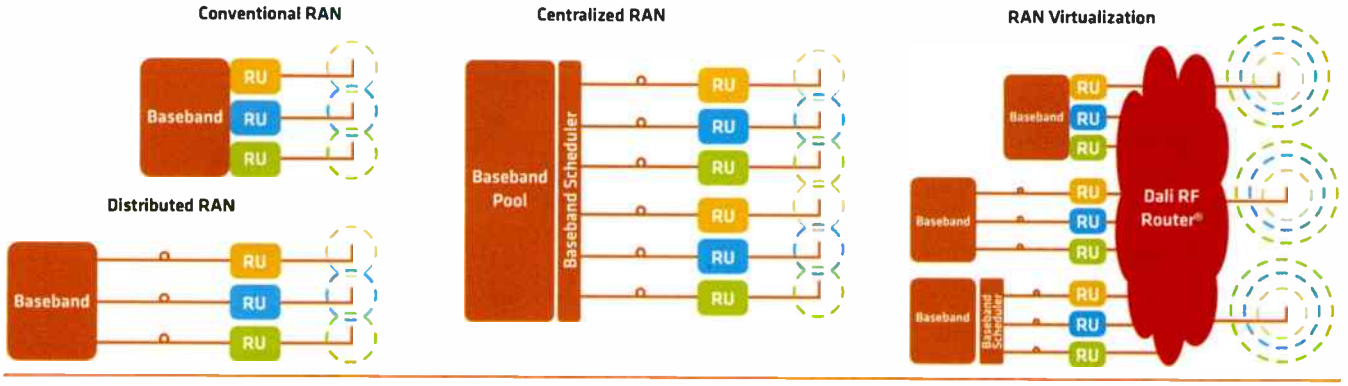

Figure 2. RAN virtualization through RF Routing breaks the bottleneck associated with the 1:1 relationship between the cell and its associated capacity and coverage area by making it a multipoint-to-multipoint relationship.

to maximize quality of experience for every device and user on the network. Reallocating radio resources to where they are needed and when they are required removes the need to over-provision by intelligently adapting to the capacity of users in a certain region of the service area. With this approach, mobile operators can take advantage of flexible resource allocation, reduced capital and operational expenditure, and reduced network complexity. More importantly, the virtualization of the entire cells allows for efficient usage of the most precious resource – spectrum (see Figure 2).

As mobile operators move to a direct common public radio interface (CPRI) or digital connection, they will realize further reduction in cost and footprint of the wireless network systems. The direct CPRI connection eliminates the requirements for a pair of radio transceivers serving as an analog interface. Beyond saving equipment costs, as unnecessary radios disappear, mobile operators and owners realize ongoing operational cost savings because of lower power consumption.

Also, as the wireless ecosystem moves toward a software-defined network, the routing configurations and the control and management of the network elements will be virtualized in the cloud so that configuration and management of the network can be done remotely and on demand. This will enable a software-defined RAN virtualized network while multiple data streams of licensed spectrum, unlicensed spectrum and other content can be delivered to the remotes. Similar to the virtualized server and storage infrastructure of data centers in cloud computing, mobile operators

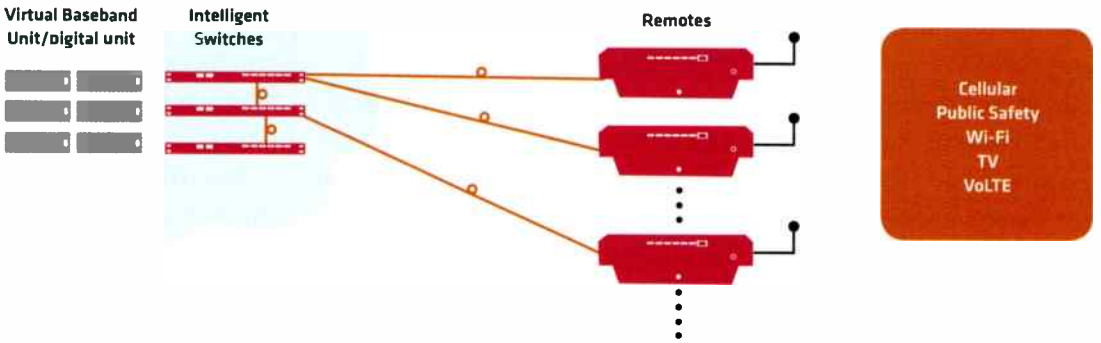

Figure 3. With a software-defined RAN virtualized network, the routing configuration and control and monitoring functionality of the network elements will be virtualized in the cloud or in a data center to eliminate much of the hardware. Multiple data streams of licensed spectrum, unlicensed spectrum, and other content can be transmitted to software-configurable radio units to enable a software-defined RAN Virtualized network.

can direct multiple data streams of content from a centralized intelligent switch without having to touch the individual switches. The delivery of data streams to wherever and whenever they are required in the network enables mobile operators to have more control over network traffic flow and can better manage the traffic loads in a flexible and more efficient way. This ultimately makes it easier for mobile operators to configure and maintain the network (see Figure 3).

Convergence and RAN Virtualization can benefit mobile operators by enabling better use of existing hardware resources to avoid over-provisioning. Also, as the wireless ecosystem moves toward a software-defined network, the routing configuration and control and monitoring functionality of the network elements will be virtualized in the cloud or in a data center to eliminate much of the hardware. An all-digital and software-reconfigurable platform will enable operators to seamlessly migrate to a software-defined virtualized network while providing a platform that helps to maximize current capital investments.

> *"Although licensed spectrum continues to be mobile operators' top priority for delivering optimal quality of service, the use of unlicensed spectrum is becoming an important complement to boost users' mobile experience and provide capital and operational cost savings."*

Shawn Stapleton is a cofounder and chief technology officer of Dali Wireless. The company makes the RF Router, a platform with end-to-end RF signal processing combined with software configurability that mobilizes cellular capacity and coverage. Visit www.daliwireless.com.

Software-defined Radio Offers Enhanced Custom Solutions for Wireless Networks

By Stephanie Chiao

Software-defined radios are especially useful in cellular wireless communications networks because they can receive and transmit widely different radio protocols according to the software used.

During the past 25 years, radio communication has been replacing traditional hardwired communication options. Traditional hardwired systems are inefficient and have a significant effect on productivity and scalability. Furthermore, traditional hardwired systems are expensive to install and maintain, and they fail to offer options for future expansion.

Incorporating software-defined radios (SDRs) with emerging wireless technologies creates a range of options. This advantage has not gone unnoticed. For example, rural communities in the state of Oaxaca, Mexico, have started to build their own 2G cellular networks using low-cost hardware and open-source software. In this way, these communities created an independent network themselves without the need for any particular carrier. Although this network has limited capacity and capability, it demonstrates the SDR's overall abilities. If larger carriers adopt the technology, it is highly likely that their own capabilities would improve while decreasing their costs.

All this is only possible because of SDRs, which are highly adaptable, interoperable and cost-effective. Because the software can handle several functions without making any changes to the hardware, it's easy to modify and to prototype equipment. Also, some 4G LTE open versions are becoming available and are being made to work with commercial-off-the-shelf radio systems.

> *"Today's fast, open-source 4G network is known as OpenAirInterface, and it could be the most complete 4G project at the moment."*

What Is It?

Software-defined radio is a wireless communications apparatus in which transmitter and receiver functionality is changed or modified by software alone. As a result, changes can be made to the functions without making any physical changes to the hardware. The goal is to completely configure the radio's functions with software as opposed to hardware, comparable to the functionality of a computer. SDR devices offer flexibility and portability in a single platform, negating the need to have multiple radio devices and multiple platforms. High-performance SDRs are capable of seamless and effective communication and enable applications including mobile backhaul connections and wireless base stations, spectrum allocation analysis, signal recording and spectrum monitoring in different communications systems, and near real-time signals analysis. SDR devices are suitable for commercial, industrial, medical and military use where flexibility is an asset and maintaining communications security is a concern.

It has taken decades of open versions of cellular radios to get to where the industry is at present. WiMAX and LTE networks were developed predominantly with open-source software to overcome complicated intellectual property conflicts. Today's fast, open-source 4G network is known as OpenAirInterface, and it could be the most complete 4G project at the moment. As programmers from various industries outside wireless have access

to high-end computing power, they can now write their own experimental codes to manage cellular networks.

As cellular hardware becomes cheaper and more accessible to smaller institutions, projects such as the one in Oaxaca have become possible. This unconventional approach eliminates the need to build multimillion-dollar core networks because network software can be moved straight onto the tower. These ad hoc networks operate on GSM bands with data transmission capabilities that are comparable with 2G cellular networks. Furthermore, because it is theoretically possible, there is a lot of chatter in the industry about building open-source 4G networks. What has been successful on a micro level can also be adapted on a macro scale. Large cellular network carriers can also benefit from incorporating SDR technology. With SDR devices available in the marketplace, large carriers can significantly increase their functionality in a cost-effective way. This in turn will also enable companies to keep expenses at a minimum as they evolve and upgrade to 5G and beyond.

Outdoor and Indoor Units

An outdoor unit (ODU) can be used as a receiver/transmitter to send and receive data over wide distances. The ODU is then connected with the indoor unit (IDU), which more or less acts like a modem, decoding the information that it receives from the ODU into a format suitable to the application.

In theory, the antenna connects with an ODU, which then connects with an IDU, which then provides the information. Many IDUs can operate across the same frequency bands as the ODUs because they are usually used only for decoding the information.

> *"SDR significantly decreases the capital expenditures required when rolling out new network functionality or preparing for a new standard."*

Why Choose SDRs?

When deciding to move to a wireless solution, the challenge is to select a system that meets specific requirements. Some of the important network characteristics to consider include:

- Network topology
- Data interfaces
- System throughput
- Cost of ownership

The latest innovations, such as Per Vices' Crimson software-defined radio, can act as both an IDU and an ODU, but they would need to be configured to act as either and not necessarily both at the same time. However, with the right customizations, a simultaneous IDU and ODU configuration may be possible. Furthermore, it's a highly cost-effective option that provides industry-standard functionality, lower latency and higher flexibility in the event that network requirements change in the future.

The majority of traditional radio solutions in the marketplace tend to be hardware-based and offer minimal fine-tuning and reconfiguration. For example, the user will only be able to adjust the RF packet sizes and choose

The Per Vices Crimson software-defined radio has four independent receive chains and four independent transmit chains, each capable of as much as 322 megahertz of RF bandwidth up to 6 GHz.

between a point-to-multipoint or a point-to-point setup. As a result, these devices cannot be optimized to transfer various types of data at different speeds to multiple data interfaces. Moreover, any future modifications will also require a significant investment to update the equipment. SDR, on the other hand, is able to address these issues and provide a software-based solution, which significantly decreases the capital expenditures required when rolling out new network functionality or preparing for a new standard.

SDR can be used to process all outgoing and incoming RF signals digitally with little-to-no analog hardware, depending on the needs. SDR takes advantage of field-programmable gate arrays, digital signal processors and analog-to-digital and digital-to-analog converters at its core. Thus, SDRs bring a high level of network customization that wasn't possible with traditional radios.

Interference with coexisting networks can also be virtually eliminated. Even after the system has been deployed, data types that are being supported by the network can be changed for optimization or as the industry needs change.

SDRs can be easily incorporated into already existing systems or can be added as full replacements to obsolete devices. Because SDRs provide full digital capabilities, the transceivers can be programmed to be compatible with existing wireless infrastructure. In other words, things can be modified in the future with little to no extra expenses.

What SDR means to the wireless world is simply enhanced reconfiguration, multiservice platforms and cost-effectiveness. It's a system focused on growth, which makes catering to future needs economical.

Stephanie Chiao is product marketing manager at Per Vices, a company that specializes in developing high-performance software-defined radio (SDR) platforms for telecommunication providers, networking and wireless equipment original equipment manufacturers, academic and research facilities, semiconductor manufacturers, information security analysts, defense and public safety providers. Her email address is stephanie.c@pervices.com.

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Moving Data through Grant Park with Small Cell Technology

By Michael Purpura

To serve crowds at festivals meant avoiding crowds at festivals during equipment installation for a small cell in Chicago.

Grant Park is a wonderful place to spend an afternoon and enjoy one of the many festivals and events that occur every summer and fall in Chicago. Lollapalooza, Blues Fest and Taste of Chicago are a few of the fun things going on in the park. Hundreds of thousands of people turn out for these events that run for four to five days. Where there are people, there are cell phones, sending real-time pictures and videos to Facebook, email and text messages. The demand for bandwidth is so high that the traffic can slow any network's ability to handle it — unless you build bigger, faster data pipes.

Electric Conduit Construction won a project focused on Grant Park to increase bandwidth and service for a major carrier. The carrier wanted high-speed infrastructure based on small cell technology with fiber direct to the radio and antenna system. The idea was to create capacity for high data transfer rates. This would allow the carrier's customers to enjoy a better experience on their mobile devices. The construction involved installing and testing 13 small cell nodes, directional drilling, pulling back up to eight conduits simultaneously, and connecting and testing fiber-optic and power cables. In addition, the existing light poles and their foundations would be removed and

Left: Horizontal drilling 800 feet under sidewalk. **Right:** Drilling a 500-foot shot in Grant Park.

replaced with new foundations and light poles that would accommodate the small cell equipment.

The caveat? Build it without interrupting any festivals, and have the entire project up and running before Lollapalooza in July.

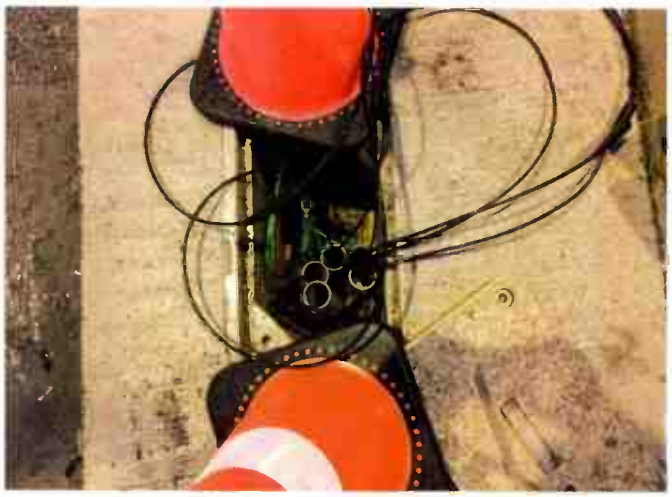
Making this project happen involved close coordination with the city government and the park district. It involved traffic control plans and detailed utility damage prevention plans to avoid cross bores with directional drills. It required shift work to avoid interference with ongoing festivals. Our safety supervisors put together a detailed jobsite analysis for each site and developed a plan to maintain safety protocols and identify possible hazards along with mitigation strategies.

Our permit department made all the arrangements with the City of Chicago and the Chicago Park District and put together the traffic and pedestrian control plans.

We deployed several crews. Some were charged with demolishing existing street lamp poles. This

Excavating for a hand hole.

Finishing up the hand hole turn point.



Left: Installing breakers and wiring power to small cell radio package. **Right:** Fiber-optice cable pulled through.

Installing light pole and small cell at night.

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Photography by Scott Dolash

The Perils of Personal Protective Equipment: Are You Prepared?

By Mark A. Lies II and Patrick D. Joyce

What personal protective equipment you, as an employer, must provide to your employees depends on a hazard assessment. Documented details will help you if OSHA comes to inspect.

Since 1974, OSHA has had regulations that require employers to provide personal protective equipment (PPE) to employees as protection for their eyes, face, head and extremities, together with protective clothing, respiratory devices, and protective shields and barriers. The employer determines what PPE is required through a hazard assessment that must be memorialized in writing. In addition, the employer is required to ensure that employees actually use the PPE when exposed to the hazard and that the PPE is maintained in a sanitary and reliable condition so that it would function as intended.

Throughout the history of the regulations, there have been ongoing disputes between employers and OSHA over when an employer needs to perform a hazard assessment. For example, does an employer need to conduct a hazard assessment for each individual worksite, or can it perform one global assessment for multiple worksites? In addition, there is often the question of what is required for a hazard to be significant enough that it requires the use of PPE. For example, are employees exposed to a hazard for a sufficient amount of time and degree for PPE to be required? Is there sufficient data in terms of actual experience with injuries or illnesses experienced at the workplace (or within the employer's industry) to support the need for PPE?

The following information discusses a recent Review Commission decision, *Sec'y of Labor v. Wal-Mart Distrib. Ctr. No. 6016*, OSHRC Docket No. 08-1292, 25 OSHC (BNA) 1396 (OSHRC April 27, 2015), outlining when an employer can and cannot conduct or rely upon a global hazard assessment for PPE in the workplace as well as when a hazard is significant enough that it requires the use of PPE.

Employer Duty

As a starting point, OSHA regulations have long required an employer to conduct a hazard assessment to determine if hazards are present, or likely to be present, which necessitate the use of PPE (29 CFR 1910.132(d)(1)). In that regard, employers are required to conduct a broad assessment of the various aspects of the job to determine whether the following hazards to employees may be present:

- Hazards of process or environment
- Chemical hazards
- Radiological hazards
- Mechanical irritants

Employers are required to determine whether, if they are present, any of those hazards are likely to be encountered in the workplace in a manner capable of causing injury or impairment to the body through absorption, inhalation or physical contact.

This assessment requirement has existed since 1994, and employers are subject to citation for failure to perform the assessment. Many employers are unaware that there is a requirement for an initial written certification that such hazard assessment has been performed (29 CFR 1910.132(d)(2)), which OSHA will request if an inspection is conducted involving PPE compliance and will cite as a violation if it is not forthcoming. There is also a requirement for a second written certification by the employer that it trained the employees in how to use the PPE and that the employees understood the training. (29 CFR 1910.132(f)(2).

Where to Conduct Assessment

Employers that have multiple worksites often ask whether a hazard assessment must be conducted for each individual worksite or if a global hazard assessment is sufficient. The answer is: it depends. *Sec'y of Labor v. Wal-Mart Distrib. Ctr. No. 6016* discusses the requirements for an employer to be able to use a global hazard assessment for compliance purposes.

OSHA cited a company distribution facility in New Braunfels, Texas, required setting a temporary pole, removing the wires and clipping them onto the temporary pole. The next step was to remove the foundation and pour a larger foundation to support the new, taller pole. While this was going on, other crews were open-cutting across streets at night. Others were using directional drilling rigs to make 500-foot to 800-foot shots from street corners to the node site. Most of the work was done at night with the strict provision that all excavations were to be backfilled and cold patched before the start of any festival, notably Blues Fest, a Craft Beer Festival, and the Stanley Cup celebration.

During the drilling phase, crew members reported smelling burnt wood. It turns out that Grant Park is built on fill from the great Chicago fire of October 1871. The fill, all 3 square miles of it, ended up making new land in Lake Michigan. The rubble layer in the soil was highly visible, and the odor was strong. We unearthed pieces of leather briefcases, belts and cobbles from the rubble.

Success on First Try

After the festivals, our crews returned to set hand holes, pull fiber, tap into power, set the nodes on the street poles and test the system. Everything worked on the first try. The entire job took two weeks' worth of 24-hour work days to complete during an unusually wet summer. The project involved more than 15,000 man-hours with no safety incidents and no injuries.

If you visit Chicago and use your cell phone in Grant Park, you will find your ability to send and receive video, pictures and text is vastly improved because of the efforts of the carrier, our customer, and the hard work of our crews and the city of Chicago.

Michael Purpura is director of business development at Electric Conduit Construction. Visit www.electricconduit-construction.com.

for not having conducted a PPE hazard assessment under 29 CFR 1910.132(d)(1). The company operates nearly 120 distribution facilities similar to the New Braunfels facility nationwide. The company argued it did not need to conduct a hazard assessment at its New Braunfels facility because it had completed a hazard assessment at its Searcy, Arkansas, facility, and the company's distribution centers across the country were sufficiently similar that the Searcy hazard assessment could act as a global assessment for all distribution facilities.

OSHA, on the other hand, argued that the language of 29 CFR 1910.132(d)(1) requires a hazard assessment at each individual worksite unless the employer verifies that the work conditions at its facilities are equivalent.

The administrative law judge agreed with OSHA's interpretation and the OSHA Review Commission affirmed his decision, finding that the company's reliance on the Searcy hazard assessment for New Braunfels misapplied the requirements of the standard. The company was relying on physical uniformity among all distribution centers, but the Review Commission said that the standard does not address workplace layout, it addresses employee work conditions. Further, the preamble to 29 CFR 1910.132(d)(1) indicates that the hazard assessment needs to take into account the hazards that are likely to be present at particular workplaces and that the written certification required under 29 CFR 1910.132(d)(2) requires the employer to identify the individual workplace evaluated.

The Review Commission found that the company's after-the-fact assertion that the New Braunfels and Searcy distribution centers had similar work conditions was not a defense. Rather, the Review Commission held that the verification of the equivalency of work conditions needs to take place as part of the initial hazard assessment for each individual facility.

When PPE Is Required

The company was also cited for an alleged failure to provide PPE to protect employees who worked as order fillers at the New Braunfels distribution center. The order fillers label merchandise and unload it from wooden pallets stacked on multilevel module shelves, working 10-hour shifts to separate the contents of the pallets onto conveyor belts and ultimately into boxes to be sent to company stores.

OSHA alleged that order fillers were exposed to eye hazards from wood chips and debris from damaged pallets as they slide forward within the module storage shelves. According to OSHA, the wood chips and debris would fall through metal slats in the shelves, potentially striking the order fillers in the eyes and face. OSHA also alleged that dust from the pallets could irritate the order fillers' eyes.

To establish a PPE requirement, a hazard must be present. Therefore, OSHA's initial burden is to establish that the employer had actual or constructive notice of the risk; that is, a reasonably prudent employer would recognize a hazard requiring the use of PPE in this particular work activity. Industry practice and custom can aid in determining whether PPE should be required in a particular circumstance, though it is not the only determining factor.

The company argued that it was not on notice of the risk to the order fillers because the recorded eye/face injuries relied upon by OSHA to issue the citation were infrequent and incidental and thus a reasonable person would not have known that PPE should be required. OSHA was only able to prove that three order filler injuries at New Braunfels were related to debris and dust from pallets striking an order filler in the face or eyes. The company calculated an injury incidence rate of 0.32 percent.

The Review Commission agreed that such statistical information was important in determining whether the company was put on notice of the potential for injuries and the need for PPE. Although the Review Commission did not endorse the methods the company used to determine its injury rate of 0.32 percent, the Review Commission did find that because there were only three eye/face injuries to order fillers over two years in an order filler population of 60 workers, there was not sufficient evidence to show Wal-Mart had either actual or constructive knowledge of the need for PPE. As a result, the citation was vacated.

Civil and Criminal Liability

This decision does not mean an employer has to provide different PPE for each individual facility or even conduct a full hazard assessment for individual facilities. It does mean

that if an employer wishes to rely on a global or even regional hazard assessment, the employer must conduct an equivalency investigation as part of the initial hazard assessment for each individual facility. Equivalency does not only mean that the physical layouts of facilities are the same, it also means the work practices and work conditions are similar. If the employer can verify that work conditions between multiple worksites are equivalent, use of a global hazard assessment will be permissible, and the employer does not need to prepare an individual hazard assessment at that facility.

This decision also means that employers may use statistical arguments regarding actual experience with injuries and illnesses to rebut OSHA's findings that the employer was on notice that there was a potential for injuries and that PPE was required. This is especially beneficial for very large employers where correlation of types or categories of injuries to specific tasks or groups may be difficult.

In the event that OSHA were to issue citations to an employer relating to PPE, they can take two forms. There are civil citations against the employer for violations of the regulations that can range from Non-Serious (up to $7,000) to Repeat or Willful (which can involve penalties up to $70,000). In addition, there can be criminal liability if the PPE certifications referenced earlier are false. Criminal liability can be asserted against the employer, as well as against the employee who created the false certification.

Conclusion

Because OSHA continues its focus on PPE compliance, employers must now focus on their compliance efforts including verifying that their initial PPE hazard assessment and written certification, including a detailed description of how the determination was made that PPE was or was not required; verifying equivalency of work conditions if a global hazard assessment is used; confirming employee training on the use of PPE and written certification; and developing policies on issuance of PPE, use of employee supplied PPE, inspection and replacement program for use of PPE and finally, discipline for loss or intentional damage to PPE.

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New Builds Herald Growth for Small Tower Companies

By Don Bishop

For a small tower company, the future looks better with investors who view the business more like commercial real estate, and new tower builds hold more promise than tower acquisitions.

Finding an equity sponsor or a partner with a long-term view led Ronald G. Bizick II, CEO of Tarpon Towers II, to Redwood Capital Investments for $60 million in equity and to a regional bank for a $40 million credit facility. Bizick sought to restart in the tower business in 2015 after his similarly named previous tower company, Tarpon Towers, sold the majority of its towers in October 2014 to return capital to its investors.

Speaking at the Tower & Small Cell Summit in September, Bizick said he started in the business in 1989, in the early days of what now is a large public tower company, SBA Communications. He said SBA took on early-stage private equity that has a different return threshold than infrastructure funds. SBA then raised high-yield money in bank debt and continued on to an initial public offering.

Bizick said when he left SBA to start his own company, the type of capital available was still mostly private equity-based. Since then, the industry has matured to a point at which opportunities to invest in the marketplace are plentiful, and participants have to compete on a cost-of-capital basis. "We sought a capital partner with a very long-term view so we would not be forced into a sale, and a partner with a different return threshold," he said. "This particular partner looks at the business much more from a yield or a real estate perspective instead of as an opportunity to build and ultimately exit. They're a holder. No one on our management team is necessarily living paycheck to paycheck or needs to ring the bell. The group's done well. We're all significantly invested, and that very much aligns us with Redwood."

Previous investors included ABS Capital and Spire Capital. Tarpon Towers built or bought more than 250 towers and sold them to American Tower in three transactions. ABS and Spire exited the Tarpon investment with the third sale in October 2014.

Ronald G. Bizick II, CEO of Tarpon Towers II. *Photo by Don Bishop*

> *"Bizick said he believes all the tower companies were living off of spending by Verizon Wireless and to a lesser extent T-Mobile USA during the six-to-12-month period leading up to September 2015."*

Bizick said Tarpon Towers II has an economic model that looks out at least 10 years, double what Tarpon Towers had with its investors because their view was that at some point their funding sunsets and the investors have to exit. This leads their partners to see what internal rate of return can be obtained during five years of operation.

"Redwood is looking at the

commercial real estate aspect of the tower business," Bizick said. "Essentially, that's what the tower business is. Year over year, we see pricing move more and more toward that model. Ten years is about as far as we look. But I would like to be able to say I'm in it 20 years from now. It's a different mindset to be a local tower developer with an eye on an exit as opposed to a holder that wants the yield aspect of the tower business and the cash flow. Eventually, you reach the point where you have either the ability to self-fund acquisitions or a market where you can't buy and instead you take a nice check at the end of year. There's nothing wrong with that."

Speaking of spending by the wireless carriers that supports the business conducted by all tower companies, Bizick said he believes all the tower companies were living off of spending by Verizon Wireless and to a lesser extent T-Mobile USA during the six-to-12-month period leading up to September 2015. "Sprint has not really existed in a meaningful way in the macro marketplace for well over five years," he said. He spoke of the perfect storm that tower companies hoped for, which would be Verizon, T-Mobile, Sprint and AT&T spending significant amounts of money at the same time. "I'm not so certain that it won't hit," he said. "It just certainly hasn't hit as soon as we would all like it."

Bizick said once in a while there are indications of AT&T spending some money on towers, but he doesn't see the company doing much of it. "But you have to believe that with the thousands and thousands of sites that AT&T put on hold, if they wanted them at some point, they're going to want some percentage of them in the future," he said. "If you start thinking about the possibility of DirecTV being delivered through your device, and you think about the stress and the strains that'll put on AT&T's network, not to mention just the overwhelming demand that continues for the more conventional means of communicating, you just can't imagine that AT&T doesn't come back to life and come back soon. You have to tighten the purse strings once in a while, figure out where you're going to make your investment, regroup and then come back."

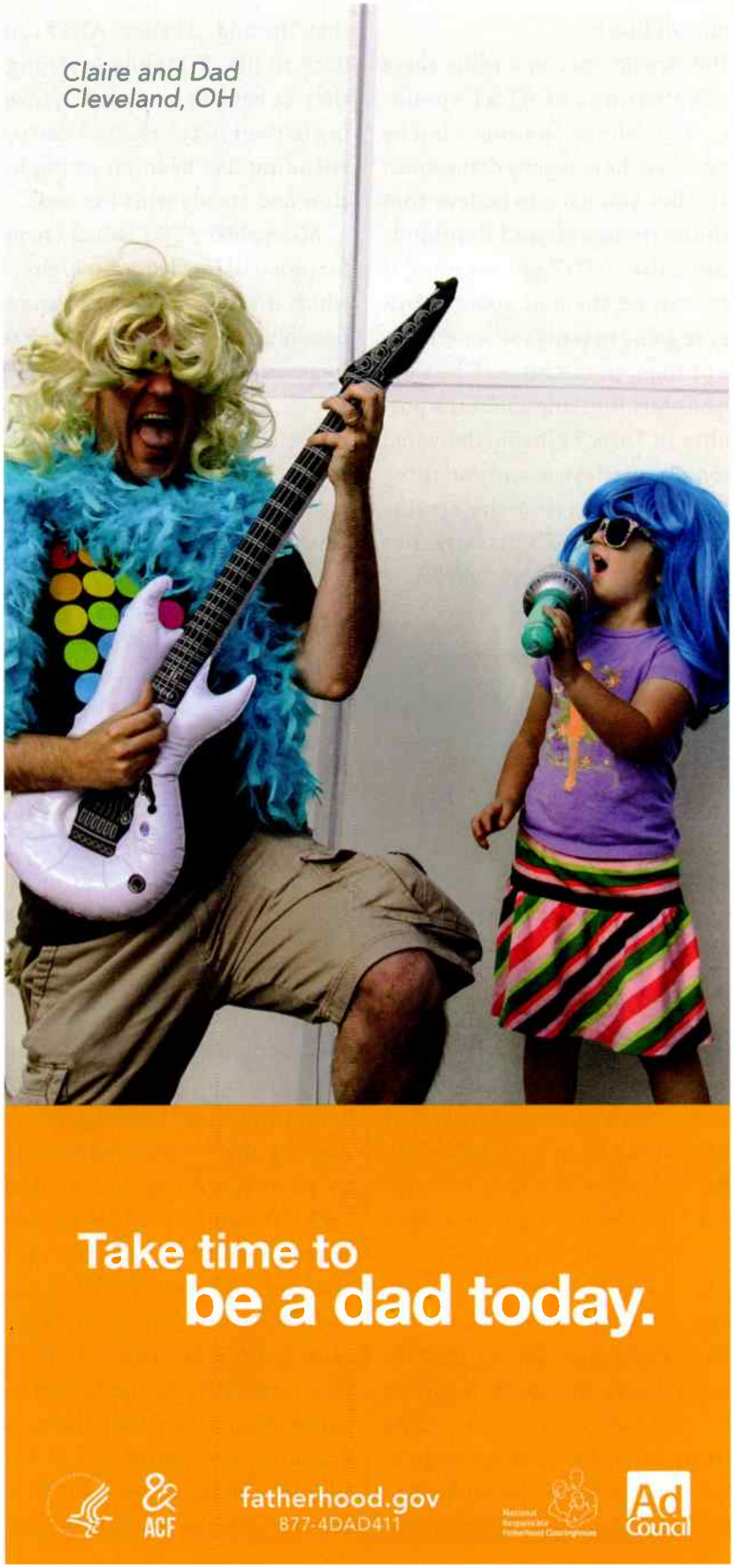
> *"With today's land use and land availability, Bizick said it's not as simple as walking down the street, knocking on a door, leasing a piece of property, and then putting a tower up without a zoning fight."*

In Bizick's view, one of the biggest catalysts the tower business could see would be Sprint really starting to deploy or to make good on everything the company has been promoting. "We just haven't seen that," he said. "I believe AT&T comes back to life. T-Mobile is strong as they've been in many years, investing in their network. And Verizon's spending has been an example of slow and steady wins the race."

Meanwhile, AT&T issued a request for proposal involving 2,000 sites for which it sought a reduction in rent, possibly meaning renegotiating rent for present sites or relocating to other sites, including possible new builds.

Bizick said some of the legacy towers involved have been around for 20 or 30 years, since the cellular markets were built out in the A and B Block spectrum. They were built in dense urban environments for the opportunity to capture the most customers. With today's land use and land availability, he said it's not as simple as walking down the street, knocking on a door, leasing a piece of property, and then putting a tower up without a zoning fight. He said people would show up at zoning hearings and say there's no need for AT&T to move down the street. "And if AT&T's argument is, 'Oh, we're just paying too much rent,' I don't think that's going to work," Bizick said.

Nevertheless, Bizick said AT&T's move represents a shot across the bow, especially to the large tower companies, to say that their lease expenses have gotten out of hand. With the older towers, AT&T may have amended its leases three or four



times during the lifetime of the lease. "They're saying, 'The cost is getting a little out of hand, and we'd like you to cooperate with us, and hey, we're going to go out there and see if we can leverage you a bit.'" he said. "Practically speaking, it's really difficult. Even if you could get to an economic model that worked for both sides, if AT&T succeeded in converting 10 percent of 2,000 site leases, I would say it hit a grand slam."

Speaking about the balance between developing new towers and acquiring towers, Bizick said his focus probably differs from that of the large public tower companies, and that he hopes the new build business continues to show signs of picking up. "I think it's largely a mid-2016 event," he said. "I think we could see more growth in that business in 2015 than we've seen in the last five years."

Bizick pointed to what he called a great flow of acquisitions and said the small deals are fiercely competitive. He said one of the tower brokers told him there have been as many as 20 people showing up for a bid. "Available towers are priced to perfection," he said. "You have a standard deviation of 5 percent on either side of the mark. This makes it really difficult to win in a brokered environment, unless you covet something immensely or have an inside track to know something unique about the asset." As a result, he said it is difficult for Tarpon Towers to compete with the public companies for tower acquisitions. "For us, the tower business will be more new build-oriented," he said.

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Site Development Carries Higher Risk but Brings the Highest Rewards

By Don Bishop

An extremely long, 50-year view contributes to decision-making when it comes to acquisitions and new tower builds for InSite Wireless Group. Taking time to resolve sellers' problems helps the company compete for purchases.

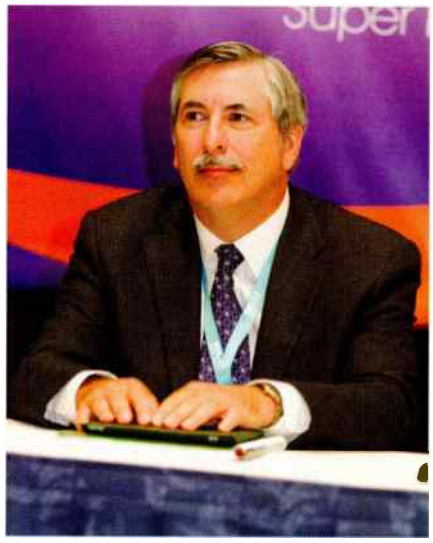
In the view of Lance Cawley, CFO of InSite Wireless Group, part of the success for companies in the tower business can be found in getting the cost of capital down. InSite owns and operates more than 1,200 tower sites in the United States and Canada. Speaking at the Tower & Small Cell Summit in September, Cawley said InSite accesses securitized debt markets and has locked in debt for seven years.

"We expect to lock in a lot more debt and access pension funds, sovereign wealth funds and infrastructure funds," Cawley said during the session "U.S. Tower Growth Opportunities" led by J. Sharpe Smith, editor of *AGL Link* and *AGL Small Cell Link* newsletters. "To compete with SBA Communications, American Tower, Crown Castle International and Digital Bridge, we need to drive down the cost of capital, which is a scaling function. When you get the company worth a certain amount, you can drive down the cost of capital, obtain a high EBITDA margin and generate free cash flow to help feed growth." EBITDA is earnings before interest, taxes, depreciation and amortization, a metric used to compare profitability because it eliminates the effects of financing and accounting decisions.

Cawley spoke about tower valuations. "We're seeing values from the low teens to up into the 30s for multiples of total cash flow," he said. If you look at the lease-up potential for the towers, and if you look at the expected return on those towers over time, whether it's a yield-to-maturity type model, valuations are high but not unreasonable." For the commercial real estate market, a cap rate of 4 to 5 percent isn't unusual, according to Cawley. He said that translates to 20 to 25 times total cash flow and that commercial real estate generally has a slower growth rate than the tower business.

InSite projects its business for the long term. "We model out 50 years," Cawley said. "We don't know exactly what's going to happen in 50 years, but we believe we need to look very long term. We're looking at the credit quality of the customers, the risk of churn, lease-up, amendments, escalators and competitive barriers to entry for any asset, whether it's land, distributed antenna system (DAS) networks, small cells or towers. You don't know when the carriers are going to come on the site. You can't be short term nowadays; you really have to look long term."

Cawley said placing a value on an asset based on exit multiples and thinking you're going to get exit multiple arbitrage is a risky model. Instead, InSite looks at yield to maturity and eliminates interest rates while limiting leverage assumptions. "If you're bidding on assets and counting on a high exit multiple, this game of musical chairs may not end well for you if you have a short-term exit," he said.



Lance Cawley, CFO of InSite Wireless Group. *Photo by Don Bishop*

With specific tower purchases, Cawley said sometimes it helps to have an affinity with the sellers. He said InSite spent well over a year working out a transaction in which it acquired 294 towers from CTI Towers. "I'm not sure the large public companies want to do that, but we work closely with sellers to make them

comfortable because there is some hand-holding," he said. "There are many issues to be resolved. That's something we may be able to do better than a large public company can."

When it comes to carrier spending on tower projects, Cawley said AT&T's spending was 50 percent less in 2015 from what InSite expected, reflecting a spending freeze. InSite saw it in the DAS and small cells business because it has some venues where all the carriers have to be. He said AT&T is committed to being there, but all the way up at the top, they were not allowed to sign a lease. "But we're a long-term infrastructure company," Cawley said. "The public community is focused on each quarter. We're not bothered by this at all. We look at an 18-month-to-two-year sales cycle for infrastructure assets that are going to be around long after we're here. AT&T's freeze is just a short-term blip in the spending. AT&T is going to come back. It's just a matter of what quarter it is."

AT&T issued a request for proposal involving 2,000 sites for which it sought a reduction in rent, possibly meaning renegotiating rent for present sites or relocating to other sites, including possible new builds. Cawley said that from InSite's perspective, what makes the difference is having towers in a restricted zoning environment that leaves little choice. With DAS, InSites assets are in exclusive venues with a legal and physical barrier to entry. And if the infrastructure provider owns the land under the tower and it's a restricted environment, the carrier has no choice. But with low-quality properties without zoning protection, there is some risk of a carrier relocating to reduce rent. "If they have no alternative, you have a good pricing model," Cawley said. "If you don't, you have to be flexible. It's more pride versus price."

Regarding the land under InSite's towers, Cawley said the company's CEO, David Weisman, recognized many years ago that it's important to have control of the land under towers. InSite prefers to own the land or to have a perpetual easement. The company set about gaining control of the land because many of the ground leases have 10 to 20 years left, and Cawley said that's not long enough. Two years ago, InSite bought a company that specializes in buying land under other people's towers.

"We think it's a perfect fit," Cawley said. "It's a pretty straightforward model, if you structure it properly. We look at a yield-to-maturity model. It's one of our growth engines, and we're buying land under towers from Australia to Canada to Puerto Rico to the Virgin Islands. We know all three public tower companies are doing it in the United States. We were a little concerned when we bought this company that maybe we didn't know something. Now, all three public tower companies are doing the same.

Addressing the risk posed to the tower business by DAS and small cells, Cawley said, "We've been in the DAS and some of the small cell business for a long time. It's incredibly expensive to deploy DAS and small cells. The carriers only do it where there's incredible demand or extremely restricted zoning. The cost is many times higher than it is for towers. There's going to be limited deployment of polygons and small cells for special solutions of very high capacity. To build out some of our DAS venues, it's $20 million or $30 million for 30,000 square feet. So, towers are going to be around for a long time. These are other adjunct solutions that are going to help with capacity and limited coverage."

Meanwhile, Cawley said InSite builds as many towers as it possibly can. "We built more than 120 towers," he said. "We're developing as many DAS sites as we possibly can. The highest returns and somewhat the highest risks are in development, but the returns are phenomenal. We just can't do enough of them."

> *"InSite projects its business for the long term. "We model out 50 years," Cawley said. "We don't know exactly what's going to happen in 50 years, but we believe we need to look very long term."*

With Mergers and Acquisitions, More Competition for Smaller Transactions

By Don Bishop

Vertical Bridge won bids for large tower portfolios and made a foray into radio broadcast tower ownership as it found smaller transactions were priced to perfection and thus carried too much risk.

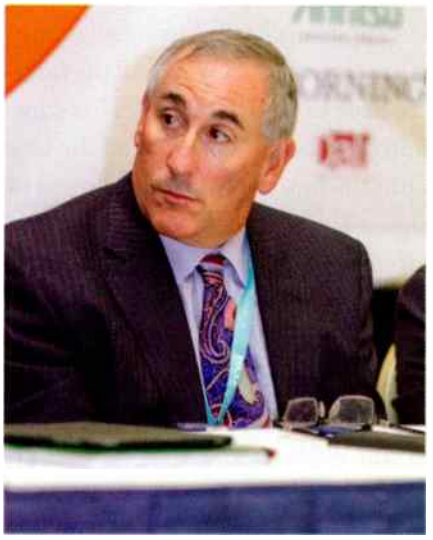
Competition among companies that acquire towers has been more intense with smaller transactions than with larger transactions, according to Alex Gellman, CEO of Vertical Bridge, a private owner and manager of wireless communications infrastructure in the United States. Speaking at the Tower & Small Cell Summit in September, he said the deals priced at $10 million to $15 million seem to have many more bidders. He explained that it seems to be a function of having many companies with a certain level of backing, but when transactions reach the level of $100 million to $300 million, it's more difficult for a company to raise that money at the same time it's trying to do a deal.

In the session "U.S. Tower Growth Opportunities" led by J. Sharpe Smith, editor of *AGL Link* and *AGL Small Cell Link* newsletters, Gellman said that at that point, it becomes primarily a matter of whether the public tower companies are competing for the deal. Depending on when tower assets become available, the answer may vary. In general, though, Gellman said the market has been less competitive with some of the larger deals Vertical Bridge has done. The company has been priced out on many of the smaller deals.

"We're seeing a lot of deals that are priced to perfection, meaning, you have to execute on that plan perfectly or you're not going to make money, and it's not a perfect world," Gellman said. "These are deals that we're not winning just because we're not comfortable with that level of risk."

Gellman said some of the transactions Vertical Bridge completed had features that prevented the public companies from being interested. With U.S. Cellular, many of its towers were naked because the carrier had exited the market. "That was something none of the public companies wanted to have to explain to Wall Street," he said. "We can cancel the majority of the ground leases with no penalty, and that gives Vertical Bridge a long time to rationalize that portfolio." Vertical Bridge acquired 595 towers from U.S. Cellular for $159 million.

To obtain funding for acquisitions, Gellman said a tower company can use its free cash flow, which is positive for the owners of the company. Second, a tower company can tap the capital markets. Gellman said Global Tower Partners, where he and other Vertical Bridge executives worked before GTP sold its assets, started with a private equity investor, Greathill, then went to bigger investor, Blackstone, before moving on to an infrastructure investor, Macquarie. Vertical Bridge started with infrastructure investors and moved to direct investment from pension funds. "It's all the same continuum, long-term investors who are more focused on where we're going to be in five or 10 years than in one year, and that creates a lot of opportunity," he said.



Alex Gellman, CEO of Vertical Bridge. *Photo by Don Bishop*

iHeartMedia, an owner of multiple radio stations, among other mass media properties, sold a portfolio of tower assets to Vertical Bridge for as much as $400 million in a transaction announced in December 2014. Gellman said iHeart-

Media had a lot of debt coming due in 2019, and selling the towers made the media company more stable.

"We thought the iHeart assets were a tremendous deal," Gellman said. "The purchase multiple was significantly lower than many deals out there, and appropriately so. Not many people bid. It was a long process, a year."

Something Vertical Bridge found attractive about the iHeartMedia towers was that they are with radio stations that were built many years ago in places that were fields and that now are neighborhoods where such assets can't be replaced. The towers also are quite large and have lots of capacity. Broadband carriers place their antennas lower down on the towers, which makes them easier to accommodate.

Along with the towers came more than 5,500 acres of land. Vertical Bridge created a team to work on commercializing the land. In one instance, Gellman said, Vertical Bridge is leasing land to Walmart to build a neighborhood store underneath the tower. "We keep 100 percent of the revenue that we underwrote at a good multiple for the tower business, and we get free money from leasing the land to Walmart, whose credit is as good as, if not better than, Verizon's," he said. Since then, Vertical Bridge entered into a transaction with Townsquare Media to acquire 43 towers for $22.8 million. Gellman said other transactions that focus on radio station towers are in the works.

Vertical Bridge is not buying TV towers because it sees the TV market as much riskier. "The FCC incentive auction puts a lot of risk in TV," Gellman said. "Local radio is always going to be there, or certainly for a very long time. The local football games will be on radio. We liked the hyperlocal strategy Townsquare Media practices. These are really good towers in dominant locations that have lots of capacity."

For the most part, radio broadcast towers haven't been marketed to broadband customers. Gellman said that previously, if Verizon were interested in an iHeartMedia tower, it would either have to wait for about half a decade to use the tower, or they would go someplace else. Now that the iHeartMedia towers are open for broadband service providers, Gellman said Vertical Bridge is seeing a tremendous uptick. To serve the new broadband customers, Vertical Bridge hired two broadcast engineers and a leasing person who was one of the first employees at American Tower when it was American Radio.

"Leasing broadcast towers requires a different set of skills," Gellman said. "You have to bring that in if you're going to be serious about that business. But we think it's a great opportunity, and we think it's a relative value versus some of the other alternatives."

Gellman said AT&T issued a request for proposal involving 2,000 sites for which it sought a reduction in rent, possibly meaning renegotiating rent for present sites or relocating to other sites, including possible new builds. "I don't know how many people responded," he said. "We responded in a very limited fashion. It's really a function of payback period and how long are they willing to look down the road. Historically, the answer has been, 'not that far.'"

> *"Something Vertical Bridge found attractive about the iHeartMedia towers was that they are with radio stations that were built many years ago in places that were fields and that now are neighborhoods where such assets can't be replaced."*

Site leases for antennas commonly have what are called escalator clauses, meaning the rent automatically escalates at given intervals, sometimes by 5 percent. For sites leased 20 years ago, escalations may have made leases quite expensive. "Let's say a lease is $6,000 a month," Gellman said. "If a carrier has only a one-year payback and perhaps can save $3,000 a month by moving, that's $36,000. It costs more than that to move the site. So a carrier has to have a 2-, 3- or 4-year payback to move any

volume of sites. Until carriers are willing to do that, I don't believe rent reductions or relocations will happen. Inevitably, what happens is that carriers get distracted by growing. They're not as focused on moving a site and going through the pain and disruption of doing that because instead they're trying to add more sites."

Meanwhile, Vertical Bridge is taking steps to buy the land under its own towers, but unlike some other tower owners, it has not taken the step of buying land under towers it doesn't own. "The buyout of leases and ground leases is a place where we see that our underwriting may be different from others," he said. "We've seen some land acquisitions made by others that make us really scratch our heads as to the underwriting. When you're buying out ground, your growth opportunity is significantly reduced versus owning a tower. So, you had better underwrite the revenue. It's hard to make up for any churn that you didn't anticipate because it's hard to grow the revenue." Gellman said although many companies are buying land under other people's towers, he has seen some mispriced deals.

Turning to the subject of wireless carrier consolidation and the prospect that Sprint and T-Mobile could merge, leaving the United States with three major carriers, Gelman said that three carriers spending would be better than four carriers not spending. He questioned how much Sprint and T-Mobile could spend on their network and singled out Sprint as having an unknown long-term future.

"If Sprint and T-Mobile together are healthier and spend more than each of them would individually, that's not necessarily a bad thing," Gellman said. " I believe that the United States can support a four-carrier market. But we've lived through times when there were seven carriers in every market, and it was horrible because nobody spent a dime. So, it's really more about who's spending. We're all living on one carrier right now. It's not hard to get better than that. I do think more and more that the carrier model for how they make money is pretty stale."

In saying the carrier model is stale, Gellman said he was referring to the fact that their pricing plans haven't changed much — unlimited data, bundled data, family plan, contract buyout. "It seems to me there has to be something more innovative," he said. "I'm not sure it's going to come from Verizon, AT&T, Sprint or T-Mobile. Maybe it's going to come from somebody else. But certainly, we're pretty much affixed to wireless devices 24/7. Where I live, people drive while using them all the time. I have a 16-year-old who uses 16 to 18 gigs a month. No kidding. I'm glad I have a grandfathered plan."

Gellman said he believes there is an opportunity and an opening for a more innovative, more customer-tailored, more location-based approach that could win a lot of market share quickly. "I think that's more likely to be a new entrant than it is to be an incumbent," he said.

For 2016, Gellman said he sees an opportunity, if not the need, for Vertical Bridge to build more new towers. "When prices are high and assets are trading for more than the replacement cost, you build," he said. "It's logical. All of the tower companies are trying to build more because there's a lot of value there. It would be impossible for us to do as many mergers and acquisitions in 2016 as we did in 2015."

Gellman said all the tower companies hope that carrier collocation activity heats up. "We know it's going to come, and so we have to do budgets and we have to plan," he said, "If it doesn't come this year, it'll come in the future. But I certainly wouldn't mind seeing more collocation."

> *"Vertical Bridge is taking steps to buy the land under its own towers, but unlike some other tower owners, it has not taken the step of buying land under towers it doesn't own."*

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Why the Tower Business Could See a Growth Uptrend

By Don Bishop

From spectrum auctions to carrier consolidation and capex spending to the Dish Network wild card, multiple factors weigh in favor of an improved environment for growth in the tower business.

All eyes will be on AT&T and what it does in the FCC incentive auction scheduled to begin on the 29th of this month, according to Jennifer Fritzsche, managing director at Wells Fargo Securities Equity Research. Speaking at the Tower & Small Cell Summit in September, she said there is a big difference in strategy between the large and small wireless carriers. In the session "U.S. Tower Growth Opportunities" led by J. Sharpe Smith, editor of *AGL Link* and *AGL Small Cell Link* newsletters, Fritzsche said that with AT&T and Verizon Wireless, it's less about network coverage and more about densification. For coverage, the carriers have completed their LTE build, and now the build is going narrow and deep in the more densely populated areas of the United States.

In the FCC's auction of H-Block Advanced Wireless Services radio-frequency spectrum called AWS-4, Fritzsche said both carriers participated in a big way. She said many people thought Verizon was a less aggressive bidder than they expected the company to be.

"AT&T spent the most at $18 billion," Fritzsche said. "What's different for AT&T, though, is that since its merger with DirecTV was announced in May of 2014, AT&T seemingly slowed its wireless build. They are making much more of a bid on spectrum."

Fritzsche said Verizon has taken a different approach that focuses on small cells. "AT&T, by its own admission, never saw through its promise made on November 12, 2012, to build 30,000 to 40,000 small cells," she said. "In AT&T's view, spectrum is key, and you grab it when it's there. Verizon has called spectrum prices they saw at the AWS auction very much a bubble and decided that small cell was the way to shift to a capex model and spend through it."

In Fritzsche's view, Sprint and T-Mobile USA are not yet as focused on densification. Sprint has a patchwork quilt of spectrum mostly at 2.5 GHz, which she said is the company's secret sauce. "We're one of the few on Wall Street who actually like Sprint, but we do believe that capacity is key," she said. "With 125 megahertz of 2.5-GHz spectrum, Sprint has an interesting opportunity if we see the equipment and the network come their way. But they still need low-band spectrum."

Fritzsche said T-Mobile has done a good job of deploying 700-MHz A-Block spectrum it bought from Verizon, although she said the carrier needs much more low-band spectrum.

"For both of these carriers, it's less about densification and more about coverage and just getting their networks in working order," she said.

Jennifer Fritzsche, managing director, Wells Fargo Securities Equity Research.
Photo by Don Bishop

Turning to the subject of tower purchases, Fritzsche said that American Tower's 2015 purchase of exclusive rights to nearly 11,500 wireless communications sites from subsidiaries of Verizon Communications was a needle-mover for the tower company and the last available big public portfolio of towers. She said Wells Fargo estimated that American Tower paid about 24 times tower free cash flow, and the company has assets in Brazil, Mexico and India.

With its focus more on the small cell side and on integrating its previous purchases of towers from T-Mobile and AT&T, Crown Castle International has been busy with acquisitions in other ways, Fritszche said. She pointed to Crown Castle's purchase of a fiber services provider, Sunesys.

In Fritszche's view, SBA Communications seems to be more focused on Brazil, especially, and to some extent other parts of Latin America.

With tower companies relying on spending by carriers to sustain and grow their business, Fritszche said something to note about AT&T was its increased spending on the wireline side of its business in comparison with its wireless business. "They've made a commitment to the FCC to build out fiber to 14 million homes," she said. As for the company resuming heavy spending on wireless, "I don't see them spending until we see them get beyond the auction," she said. "Some say it could go to Labor Day" before AT&T's spending on wireless returns to prior levels.

Fritszche commented about Dish Network and its stockpile of spectrum, although she said as an analyst she doesn't follow Dish, but others at Wells Fargo do. "I can't even pretend to get in Charlie Ergen's head," she said. Ergen is chairman of Dish Network and owns 52 percent of its shares. "I think Verizon would love to have that spectrum, but they're going to be a price-disciplined buyer. Every spectrum deal, even as low as $2 million dollars, needs to be approved by Fran Shammo the CFO of Verizon Communications. They're very cautious and conscientious on what they're going to pay for spectrum. I'm not underestimating what Charlie Ergen can do, but as for Dish Network going toe-to-toe with Verizon, Verizon can more than hold its own. I don't think Dish Network will build out the spectrum."

> *"With tower companies relying on spending by carriers to sustain and grow their business, Fritszche said something to note about AT&T was its increased spending on the wireline side of its business in comparison with its wireless business."*

As for some of the smaller carriers, Fritszche said the affiliation both companies have with Sprint might have something to do with nTelos acquiring Shetel. "I don't want to speak for Sprint, but having followed a lot of the Sprint affiliates in the past, I think it's fair to say that Sprint was trying to find a way to make these carriers give them a lower rate than Verizon would on the roaming side," she said. "It reflects the difficulty in competing with the AT&Ts and Verizons of the world when you don't have scale."

When it comes to carrier consolidation, Fritszche said that it makes a bad headline for the tower companies, but the amount of new cell sites added, with the possible exception of Nextel, probably has been decisive in almost every consolidation. "Bringing two carriers together and cutting cell sites shouldn't be considered a synergy because you are still supporting the same number of users, and a case could be made that with that kind of cost distribution and scale, prices could be lower and more usage could be seen," she said.

As for the profitability of tower development and operation, Fritszche said that from an analyst perspective, "it's unquestionable that the macro margins are that much better than for small cells because there's a lot of cooks in the kitchen on small cells. You have companies like Zayo, a fiber company, talking about small cells being a huge catalyst for them, and then there are municipalities and real estate owners. There are a lot of hands out there to get the money."

Fritszche said that although the margins favor macrosites, analyst reports still can be seen with headlines and content that center on small cells.

How to Succeed as a Turf Vendor

By Michael Mitchell

To make money with turfing, you have to do six things well.

When a company assigns contract work to prequalified vendors according to a geographic area, those vendors are called turf vendors. Some U.S. wireless telecommunications carriers use turf vendors.

The following information is intended to help small- to medium-sized companies compete and thrive in the rapidly changing wireless infrastructure industry.

Until about five or six years ago, small, independent wireless service providers were the backbone of the wireless infrastructure industry. There was a time when the carriers had their own construction and maintenance departments and built all of their sites using help from small businesses. Today, we see only a small portion of the industry carriers building sites independent of original equipment manufacturers (OEMs) or turf vendors.

Every small business owner has an opinion about the turfing business model. Some are positive about turfing, and others are not. Regardless of either view, I believe turfing is here to stay, so we all need to learn to live with it.

Turfing is what you make of it. If you work hard, you'll be rewarded.

I've made a lot of money with turfing, and I've lost a lot, too. Here are some recommendations on how to stay on the positive cash flow side with turf vendors.

In order to make money with turfing, you have to do six things well.

1. Build a lot of sites.
2. Build them to exact drawing specifications and quickly.
3. Complete the closeout as fast and as completely as possible.
4. Build the sites with the highest degree of safety.
5. Manage the inventory, including who provides what materials.
6. Keep track of any change orders.

The first three steps are the cash-flow-positive, make-or-break items. To serve carriers as a turf vendor requires completing the work accurately and quickly. In doing so, never compromise safety standards.

One of the most important things when it comes to turfing is actually reading and understanding the master services agreement (MSA) or contract. Having a good contract is the most effective way to make money. Keep in mind that making money isn't always about margin, because it can come in many forms such as saving capital or being paid more quickly.

You can and should negotiate contracts. First, take the time to read and fully understand what is in the contract. If you don't understand something, ask a lawyer or someone else who does understand it. Focus on payment terms, liquidated damages, insurance requirements, any language regarding change orders and anything else that would hold you or your company liable.

Make sure you completely understand the payment terms section, including when you will get paid and what you need to submit to get paid. These are two separate and distinct issues. What do you need to submit as a requirement for getting paid? Obviously, you must complete the scope of work as required, but there always will be a closeout to follow. What does the contract say about when you will be paid? You can ask for better terms, so why not do so? Never sign a contract that doesn't clearly state the number of days before you can expect a check.

Finally, I always ask for an example of an approved closeout. Nearly every contract I've seen spells out what you have to submit and the time you have to submit the closeout. Keep in mind that the payment clock usually doesn't start until you receive an acceptance letter from the client. You should ensure that what you turn in is 100 percent complete and accurate, because your payment depends on it.

We have a saying at our company: "Inspect what you expect." And when my money is on the line, you bet I inspect.

Michael Mitchell is president and CEO of EMF Telecom, a construction company with headquarters in Nashville, Tennessee. Mitchell has run a small- to medium-sized company for the past 11 years and has more than 20 years of managerial experience with large wireless companies. His email address is mmitchell@emftelecom.com.

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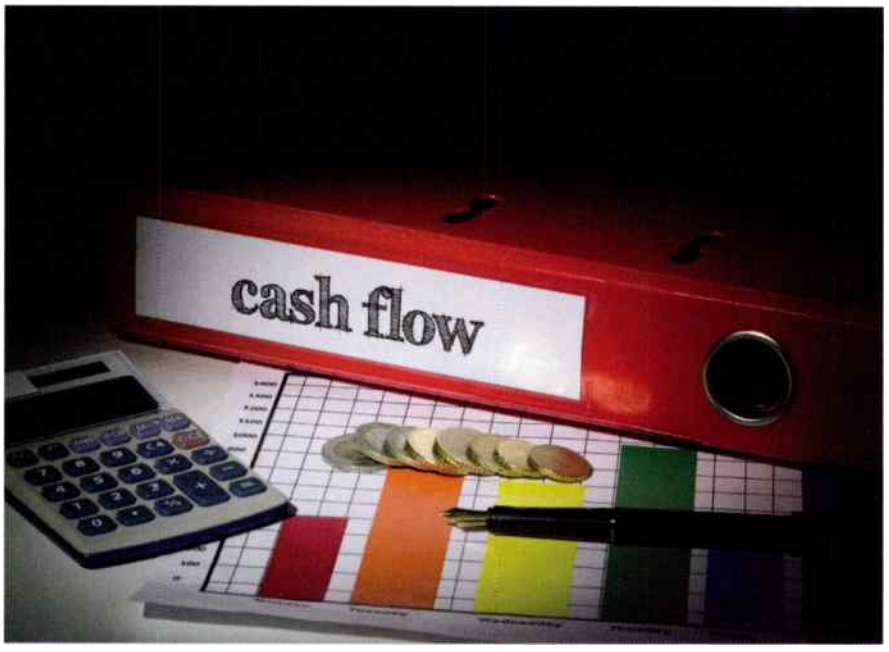
Cash Flow Is Oxygen for Your Business

By Andy Singer

Even if your business is profitable, if you suffer poor cash flow for too long, your business can close down because of a cash shortage.



No matter how great a business model may be, unless the business can deliver cash, in the long run the business will fail. Cash flow really is like oxygen for your business. Without cash, you can't pay suppliers, pay employees or pay for other critical services. Cash flow should be managed effectively for optimal results and to ensure positive cash flow. In the wireless industry, this is a particularly important skill because many wireless-related businesses are capital-intensive. Here are some ways to manage and improve cash flow.

Be prepared. When starting a business in the wireless industry, all too often entrepreneurs fail to properly estimate cash needs during the early years. Even an established business can go through a tough period. Make sure you have enough cash available or an open line of credit available just in case of emergency.

Improve receivables. Issue invoices quickly, and ensure that instructions are clear. Then make sure you are being paid in a timely fashion. If agreed-to terms are 30 days, don't let customers slip to 90 days. It's not fair to you or to the rest of your team to be treated this way by customers. I have heard every excuse in the book from customers who abuse the system. My favorite of all time was, "My printer is broken." Interestingly, although such abuses occur, often the problem lies within your own accounting team. If your receivables are poor, take a deep dive and look for delayed invoice transmission, poor communications, poor instructions and lack of tracking by your team. A simple system based on a team effort can greatly improve your receivables. Don't be afraid to stop shipments to a customer who is chronically late, and if a customer is questionable or has been a serial abuser, only accept payment in advance.

A great metric to use to monitor receivables is days sales outstanding (DSO). It measures how many days it takes your company to convert accounts receivable into cash. Your goal should be 40 to 45 days, and employees who can affect DSO should have some portion of their variable compensation aligned with it.

Manage payables. Ensure that your team has a system to ethically control payables. Don't pay them before they are due, work with suppliers on terms, and obtain outside help to improve inventory if required. But don't mistreat suppliers. If the agreed-to terms are net 45 days, don't stretch out payments to 100 days.

Monitor inventory turns. Inventory turns are a measure of the number of times inventory is sold

or is used in a given period. It's a key metric for many types of businesses and in particular manufacturing, distribution and retail. Although some small percentages of businesses I have seen have the best possible inventory turns, most companies have room to improve their inventory turns, which also improves cash flow. Ensure that you understand how your turns compare with those of other companies in your industry. If yours do not compare favorably with the best, seek help.

Calculating inventory turns is straightforward. It's the cost of goods sold (from the income statement) divided by average inventory for the period. By improving turns, your business ties up less capital in inventory and greatly improves efficiency. Over the years, my teams have made transformative improvements in turns. One of the first steps in this process involves a cultural change. That step is critical for success with these projects.

Educate your team. Ensure that all members of the team who can affect cash flow are trained to understand cash flow, what actions can improve it and why it is so important to your business. Develop a standard procedure for managing various aspects of the business that affect cash flow. After training, if some team members don't understand it, hire some who do.

Even if your business is profitable, if you suffer poor cash flow for too long, your business can close down because of a cash shortage. I've seen businesses with otherwise high potential fail because of poor cash management. Manage cash and ensure that your business is not only profitable, but also successful.

Andy Singer is president of Singer Executive Development. The company offers training courses in executive management, product management and microwave systems. An electrical engineer with an MBA, Singer is a former president of RadioWaves. He writes "Down to Business," a syndicated newspaper column. His email address is andy.singer@singerexecutivedevelopment.com.

Identify Your Employees by the Theory of 21

By Chuck Reaves

"For every person who will say yes, there are 20 who will say no. For a positive response you must find the 21st person." — The Theory of 21

The CEO of an electronics company had an idea. He asked two engineers to explore how his idea could work so he could test the feasibility of the idea becoming a new product line.

One engineer made an appointment and delivered a formal presentation to the CEO explaining why the idea would not work. He had color charts and graphs and even some data that suggested no one would want the product even if it were to make it to market.

When he finished, the CEO told him that the other engineer was in the process of implementing the idea. Instead of developing a knock-your-socks-off presentation explaining why the idea was a bad one, the other engineer had waded through the obstacles to find a way to make it happen.

The idea, by the way, was caller ID — that now-ubiquitous service on phones.

There are two types of people in the world: the "20's" and the "21's." The 20's are those people who consistently declare that anything new cannot, should not or will not be done. The 21's are those people who look for ways of making things happen — even those things considered to be impossible by others.

There are two types of 20's: Negative 20's and Positive 20's.

Negative 20's are easy to spot, and you already know who most of them are in your organization. You know that if you bring a new idea to them, they will shoot it down. Immediately and out of habit, they will let you know in no uncertain terms that it cannot be done, should not be done or will not be done. If you press them, they will give you valid-sounding reasons as to why their position is justified. They give away their position with statements such as:

- We have never done it that way before.
- It has never been done.
- We are already doing that.
- Nobody will like it.
- The boss will never approve it.

A Negative 20 is someone who comes right out and tells you that it cannot be done. By now, you have learned who these people are and what a waste of time it can be to engage them. In fact, when you want to get something done quickly and well, you tend to give it to someone who is already busy, a 21.

More difficult to recognize is the Positive 20, because they can sound like a 21. They can delay a project until it is no longer viable. They can dilute an idea until it has little resemblance to the original concept. They are dangerous.

The Positive 20 may say something like, "That's a great idea and something we need to do someday," or "We could do that if ..." or "It will be easier for us to do that when..."

Unlike the Positive 20's, the 21's are the people you know who somehow always seem to find a way to make things happen. Rather than offer excuses, they may offer alternatives. Instead of saying they don't have time to do what you're asking them to do, they will ask, "What is your timeframe?"

To differentiate between the Positive 20's and the 21's, listen for delays, "buts" and "ifs."

How do 20's find their way into otherwise successful organizations? First of all, there are more of them than there are 21's. In fact, there are not enough 21's in the world. So, eventually, despite your best efforts, you will find a 20, probably a Positive 20, somewhere in the organization. If they are in a position to influence a hiring decision, they will attract other 20's. After all, 20's don't like having 21's around.

So, what do you do with the 20's in your organization?

Teach. The single, most important function of leadership is to teach. You have achieved your level of success because someone took the time to teach you. As you teach, you will ascertain whether you have a student or not.

Exemplify. Praise the 21's in

public. When your employees know that you appreciate and respect the efforts of the 21's, more of them will aspire to be 21's.

Remind. There are no extraordinary people. There are only ordinary people who are doing things that other people consider to be extraordinary. Everyone on your team was brought onboard because they have a skill set or an ability that could make them extraordinary.

Henry Ford and Thomas Edison were friends and mentors. Ford was in Edison's facility when one of his engineers reported that one of Edison's ideas could not be done. Edison listened patiently and then said, "Build it anyway."

Later, when one of Ford's engineers came into his office to explain why a shiftless (automatic) transmission was impossible to manufacture, how did Ford respond? "Build it anyway."

Two lines from the movie "Apollo 13" are applicable for every business.

"Houston, we have a problem." Sooner or later every organization faces a seemingly insurmountable problem. How do you address it?

"Failure is not an option." For 21's, this is a lifestyle.

Chuck Reaves, CSP, CPAE, CSO, helps companies raise their prices and volumes simultaneously through innovative processes, tools and training. With his innovative presentations on sales and motivation, he has inspired hundreds of people to pursue and achieve their dreams. Along with pioneering many advanced sales tools and processes, Chuck's achievements include Vistage's "Impact Speaker of the Year" honors and being named the top salesperson for AT&T. Visit www.chuckreaves.com.

Lead Your Employees to Soar, PILOT Them to Higher Levels

By Elizabeth McCormick

Take the time to be the pilot in command and show your employees that you believe in the vision of your organization, your employees and the work they are doing.

Have you noticed that your employees or staff members seem stuck and unable to move upward? Do you have employees who sit in meetings like a plane stalled on the runway? Have you noticed that your employees don't seem to be reaching for the sky? If you've noticed any of these situations in your business, it may be time to pilot your employees rather than merely manage them. Not only will you notice an increased level of motivation among employees, you will also notice that they are contributing more and becoming more involved and invested in your business.

P – Potential. Leaders help others to realize their potential.

To develop leaders, you must be someone your employees can emulate. Show them that you are learning alongside them. Your employees want to learn from the way that you handle failure, and you can do so with grace and ease. When your employees see you fail, they see you are still learning and working at becoming a better leader. As a leader, you should share your failures as learning experiences with your team. Sharing your experiences will create a culture that allows for creativity and educated risk-taking to allow failure and not fear it. People tend to learn more when they feel safe and secure enough to make mistakes.

I – Implementation. Have you ever had a meeting to discuss the meeting before the meeting? Are you spending more time getting ready to get ready? These behaviors happen when we become stuck in analysis paralysis. Turn ideas into actions. There is a fine line between waiting for perfection and taking a calculated risk.

Ask yourself, "Is the speed of implementing this more important than perfection? What will we gain or lose from pulling this trigger? What will we gain or lose from waiting?" Then, ask yourself: "Am I hitting the mark? What are the performance indicators we need to watch for?" Involve everyone on the team in the problem-solving process, put everything up for consideration, and then discuss the pros and cons for each possible adjustment.

L – Leadership. Leading your industry demonstrates innovation, and innovation doesn't happen without first taking educated risks. Effectively leading requires clear, concise communication. Communicate your vision to inspire employees.

The sooner you take action, the faster your clients will be able to benefit from your products and services. As a leader, you need to commit to a course while you communicate with

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your team and take the required actions to achieve your goal.

O – Optimize. You are responsible for the nurturing and culture of your organization and how it responds to risk, change and learning from failures on any level. To evaluate the strength of your team, you should evaluate how your team embraces, welcomes, initiates and recommends change, and ask for ideas on how to change. If new ideas are raised in a meeting, do you properly explore them or shut them down immediately? Do you allow your employees to have a voice?

At the close of every meeting, do you take the time to ask your employees if they have anything they would like to address? Do they have any feedback over what was covered in the meeting? Effective leaders understand the importance of asking these questions and actively listening to the responses.

T – Tenacity. Too many people give up when they are so close to success. Don't give up on yourself as a leader, on your employees or on your organization. You are essential to their success. Be the pilot in command of your organization, not the copilot who follows along.

You want your employees to willingly follow you. No one asks himself, "How can I be an average leader today?" Every day, you need to show your employees that you believe in the vision of your organization, your employees and the work that they are doing. To do this effectively, you need to take the time to be the pilot in command and lead in order to drive the action.

Elizabeth McCormick is a speaker, author and authority on leadership. A former U.S. Army Black Hawk pilot, she is the bestselling author of her personal development book, The P.I.L.O.T. Method: the 5 Elemental Truths to Leading Yourself in Life. *McCormick teaches real-life, easy-to-apply strategies to boost your employees' confidence in the vision of your organization and their own leadership abilities. Visit* www.yourinspirationalspeaker.com.

Four Faces of Leadership and the Importance of the Vision Thing

By Rob-Jan de Jong

A behavioral strategist explains how any leader can responsibly boost their visionary side.

Whether it's a presidential candidate, a corporate executive or an NFL coach, people admire a leader with vision. They like someone with a clear idea of where he or she is headed and who knows how to motivate others to accomplish the goal.

As much as people might like to say someone is a born visionary, in truth, vision is something we develop, not something we are born with. One thing visionaries have in common is an ability to notice things early. They recognize when significant change is happening, and they make use of the opportunities it presents.

However, just identifying that a major change is afoot isn't enough. The visionary needs to connect the dots into a coherent picture that takes into account future developments. It's an ability leaders can develop.

In combination, the ability to notice things early and the ability to create coherence suggest four archetypes of leaders.

The Follower. This is someone who is neither good at noticing things early, nor skilled at creating and communicating a coherent story from insights about what the future might bring. The follower may be an excellent manager, but don't expect this person to inspire others or drive innovation.

Being a follower isn't necessarily a bad thing. Followers are often careful about their decisions and good at critical thinking, and in the short term that can work well. But their preoccupation with today keeps them from anticipating what comes next.

The Trend Hopper. On the

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upside, a trend hopper has a well-developed ability to see things early and is willing to embrace changing realities. These are people who are quick to adopt new technology and are among the first to imagine how things can be different — even radically different — really soon.

On the downside, trend hoppers aren't adept at turning their early insights into a coherent story that justifies an active strategic pursuit. After seeing them chase several flavor-of-the-month ideas, other people start to tune them out.

The Historian. These leaders are adept at connecting the dots and spinning a story that makes sense. They cite patterns, facts and figures and make everything that's happened so far look coherent and intentional. When you listen to them, it all makes sense. But they have their eyes trained on the factually true past, not the imaginative, uncertain future.

Certainly it's valuable to have some historical perspective, but you can't let history cripple your ability to engage the future. Historians also often are cynics, ready to explain why things are the way they are and why your unconventional idea won't work.

The Visionary. This is the one to strive to be. A visionary isn't quick to hop on every fad, but also isn't a naysayer about how things might be done differently. Instead, the visionary takes a mindful, future-oriented perspective, balancing the need for a compelling future with an awareness of the dangers of becoming dogmatic and overly optimistic. Visionaries are able to explain an imagined future in a way that energizes people and engages their imaginations.

A powerful vision isn't just a nice thing to have, it's the most important tool in the transformational leader's toolbox. A leader's imagination, inspiration and dedication are what will ignite excitement in the people he or she leads.

Rob-Jan de Jong, a behavioral strategist, is the author of Anticipate: The Art of Leading by Looking Ahead. *Visit* www.robjandejong.com.

The Three P's of Powerful Leadership

By David Waits

Performance, presence, and profitability combine effective actions and self-investment with bottom-line results. They maximize your potential and exploit your power.

Leadership is not a position.

A local newspaper has a daily section titled "Progressions" allowing companies to publicly recognize employees who have been promoted to leadership positions such as general manager. The announcement is a nice recognition for the new leader, but the promotion, in and of itself, doesn't make the person a powerful, productive leader. The promotion does allow the new leader to exercise the roles and responsibilities of the position, but the promotion has little to do with the leadership effectiveness of the person who received it.

The power of the position and the potential of the leader are maximized only when the leader understands and leverages their performance, presence and profitability.

Performance is simply what you do. Like it or not, at the end of the day or quarter or year (or term if you are a politician), leaders are evaluated by what they themselves get done and what they get done through others. Leaders are paid to get results. They are not paid for their intentions or for mere activity.

Intentions Matter; Results Rule

"I meant to have a discussion with the underperforming team member but I just haven't had a chance to talk to him," says the well-meaning leader. The question is not, "Did you talk to him?" the question is, "Did the underperforming team member's behavior improve?" Intentions without actions create nothing. Action — having the talk with the under performer — that doesn't produce results is simply activity not productivity. Performance is measured by results.

Aesop rightly stated, "When all is said and done, more is said than done." Performance, measured by results, is the metric of your leadership ability.

Presence is who you are. You can't be one type of person and another type of leader. Although you can try to fool people, and maybe even obtain pseudo-success for a short season, time will ultimately reveal the real you. Who you are, in the core of your being, will determine your presence. How big is your presence?

Someone who is physically large is noticed when they simply walk into a room. Former NBA superstar Shaquille O'Neal is over 7 feet tall, weighing in at over 300 pounds. Everywhere he goes, his physical presence is commanding.

When you enter a room, are you noticed? Are you respected? Do people want your input? Are you listened to? Are you commanding? Your presence is the key to positively and powerfully influencing people.

Remember, a title or position does not a leader make. A position can be conferred on you by someone else. It is recognition of a position. Your position allows you to perform the roles and functions of a leader, but it is your presence that determines your effectiveness. Presence is inferred. Something inferred involves a conclusion. People are concluding, "This person has a dynamic presence that makes me want to follow them!"

Are you working as hard on who you are as you are working at the job you do? Your job functions are important and your ability to be highly functional in your job as a leader is directly proportional to your presence. Your presence increases as you grow as a person. When you become great at who you are, you become remarkable at what you do. Constantly invest time and money in personal growth.

Profitability is the value you bring to those you lead. The bottom-line number reflects profitability, but it is more than that. Is your team profitable because of you?

In the arena of interaction with those you lead, are you profiting from them? Are they better—more profitable themselves—because they are around you? Do you inspire? Do you motivate? Do you create synergy?

There are many world-class athletes playing team sports who have tremendous individual skills, yet their team fails to obtain championship status. Michael Jordan was arguably the greatest basketball player of all time. His greatness wasn't only measured by his ability to make baskets and his incredible

desire to win, but by making others better. For many of his years in the NBA he was surrounded by, at best, serviceable players. Yet his presence made others profitable because he brought out the best in his other team members. He helped raise the entire team to a winning, championship level.

Your potential is maximized and your power exploited when you make use of:

- Your performance: your effective actions, not your noble intentions.
- Your presence: constantly investing in yourself, stretching and growing to increase the size of your presence.
- Your profitability: evaluate yourself by looking to the outcome. Is there profitability in your leadership in the bottom line and are people better because they have been influenced by you?

When you maximize the Three P's — performance, presence, and profitability — it is likely you will not only show up in the "Progressions" section of your local newspaper, but also make the front page headline. If you are not on your newspaper's front page, you will certainly make the headlines with the most important people in your sphere of influence — those who are following you.

David Waits, founder of Waits Consulting Group, is a highly sought-after consultant, speaker and author. As a proven expert in developing powerful initiatives that revolutionize culture, Waits helps his clients create a thriving organizational environment that facilitates rapid growth, innovative development and ongoing profitability. He has worked with clients in all 50 states, including Quest Diagnostics, General Dynamics, Major League Baseball, Walmart and Walt Disney World. Visit www.davidwaits.com.

Quick-Guide to Test Equipment Companies

As a supplement to *AGL Magazine's* January Buyers Guide, a list of test equipment companies offers more detail to help you choose a vendor for your next project. Where shown, logos and company descriptions were provided by and paid for by each company.

3Z Telecom

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See ad inside the front cover

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See ad on page 47

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www.l-com.com

Small Cell Outdoor DAS Antennas

Kathrein has engineered new small-cell network antennas that come in quasi-omnidirectional or trisector pattern configurations. The antennas are compact to reduce zoning challenges, and a tapered radome design provides environmental protection. The fiberglass antennas cover 698 MHz to 894 MHz and 1710 MHz to 2180 MHz to support 700/850/PCS/AWS. They have dual polarization to support multiple-input, multiple-output communications, and they have an integrated high-performance GPS antenna and amplifier.

www.kathrein.com

DAS Ceiling Antennas

Pulse Electronics offers ultrathin, clear, DAS ceiling antennas. Extending just 0.33 inches (8.4mm) below the ceiling, the see-through housing of the Dasutcc antennas makes them nearly invisible when mounted, yet they have a passive intermodulation interference rating of better than –155 dBc (decibels relative to the carrier) at 2x20 watts (2x4 3dBm). Their translucent design makes them suitable for providing access to wireless networks in hotels, convention centers, formal spaces, older buildings with low ceilings, shallow spaces or areas where aesthetics are a matter of concern. Part of Pulse Electronics' PIMinator line of low-passive intermodulation interference antennas, the Dasutcc omni antenna family now includes seven antenna product variants. Three connector options are available to support N, 4.1-9.5 mini-DIN, and 4.3-10 connectors, either with or without an energy director.

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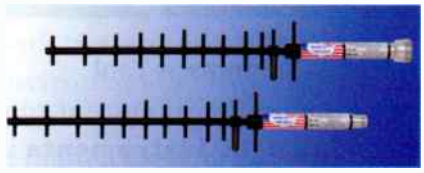

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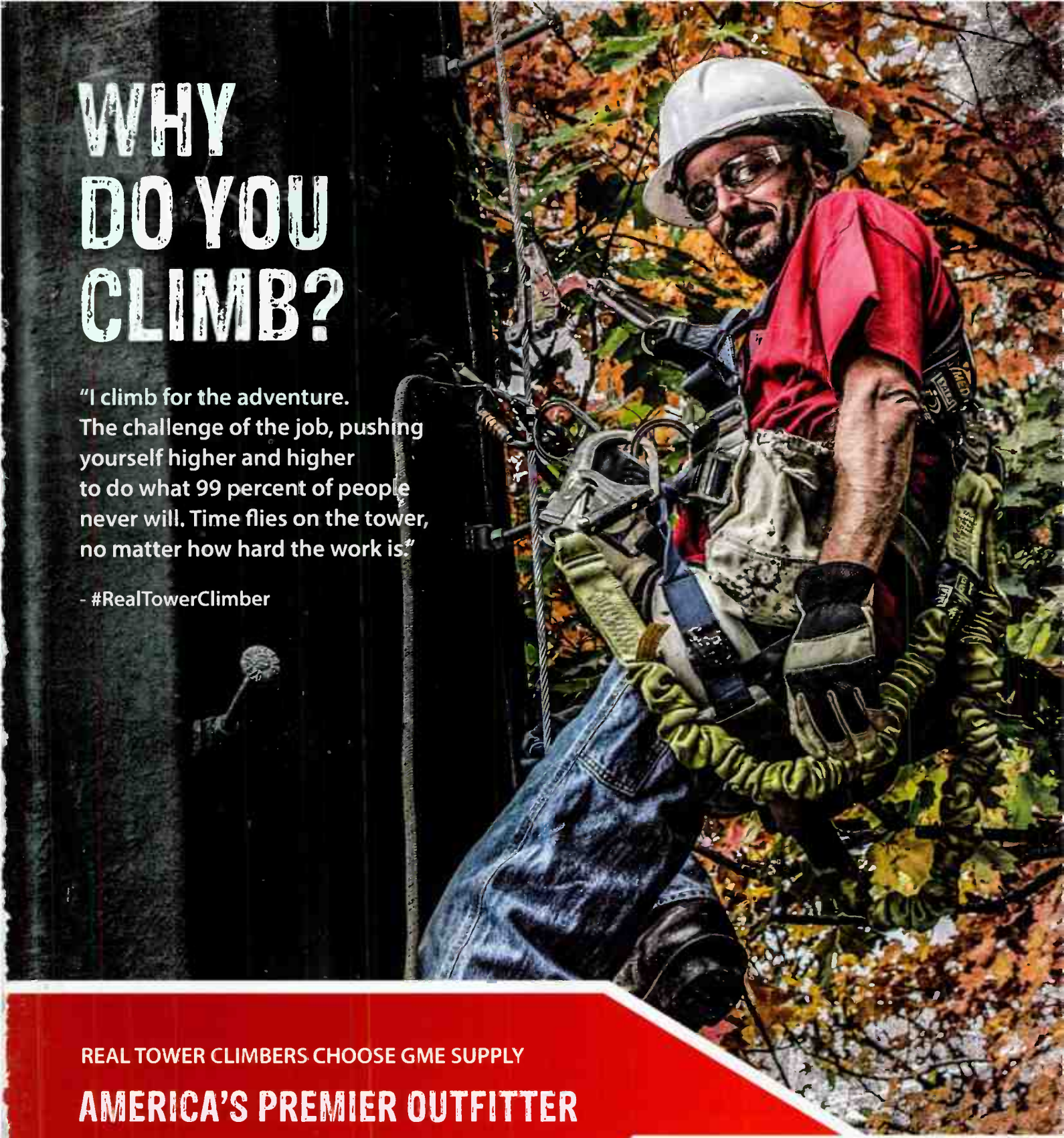

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