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THE BRIGHTER SIDE OF TOWER LIGHTING

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June 2015   ///   Volume 12   ///   No. 06

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DEPARTMENTS

YEAR OF THE CLIMBER

On the cover: The Flash Technology Vanguard II in action as the sun sets in Georgia. Photography by Roman Molla of Flyworx.

FEATURES

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EDITORIAL COMMENT

Regulatory Progress

From local, state and federal government come regulations affecting the siting, construction and maintenance of towers used for telecommunications. For those on the business side, knowing what to expect from regulation plays an important role in formulating strategy, conducting operations and managing risk. For those on the government side, responding to higher levels of government, recognizing public sentiment and protecting public interests can be among the factors affecting decisions.

This issue of *AGL Magazine* sheds some light on regulations affecting towers as they relate to migratory birds, and it isn't about uniformity. The Migratory Bird Act, the Endangered Species Act, the Golden Eagle Protection Act, the FCC's Antenna Structure Registration procedures and letters issued by the U.S. Fish & Wildlife Service affect the construction and operation of towers. A team of experts tackles the subject and offers some guidance in "When Birds Make Towers Their Home Sweet Home" on page 22. My thanks to authors William J. Sill, Dr. Richard Podolsky and Rachel S. Wolkowitz.

Meanwhile, FCC Commissioner Michael O'Rielly proposes that the FCC should help ease the regulatory burden and steer away from much involvement in formulating standards. He would like to see the FCC use its authority to smooth the way for small cell and DAS deployments. He recognizes problems site developers have with the historic preservation application and review procedures. And he wants the FCC to do something about an estimated 4,000 to 7,000 towers that he said have been left in regulatory purgatory. "How the FCC Should Help with Wireless Infrastructure" on page 18 brings the commissioner's own words.

O'Rielly said the FCC wants your estimates for current and future demands for tower construction teams. He wonders whether enough skilled workers are available for projects resulting from the FCC's radio-frequency spectrum auctions, and how it should affect FCC construction deadlines.

Meanwhile, at the state level, Rep. Eric Koch (R-Bedford) authored a bill that passed the Indiana House of Representatives in February that defines small wireless facilities using a volume-based, technology-neutral methodology developed by PCIA, a membership organization that represents tower companies and other wireless infrastructure providers. The bill establishes a uniform statewide procedure for applications and the issuance of permits for wireless facilities. Such uniformity reduces costs for tower developers.

Don Bishop, Executive Editor
dbishop@aglmediagroup.com

/ DEPARTMENTS /

Welcome Tam Murray

Congratulations to my old neighbor, friend and business partner, Thomas A. "Tam" Murray. I first met Tam in the early '90s (I think) when he moved in a few houses up the block from me. He was active as a commercial real estate broker and had family and friends in the cellular industry. It was an obvious professional overlap.

We had the opportunity to work together in the early PCS days, assembling leases for rooftops in major markets. The (shared) tower industry was already going strong, but still the opportunities were numerous. Tam studied the industry carefully and decided to fully engage. He founded Community Wireless Structures. I was lucky enough to have had the opportunity to be an early (very minor) member.

Tam's hands-on approach to the industry has allowed him to see it all and do it all.

Tam has absolutely been one of the most professional, polite, honest and considerate people I've ever known. I want to congratulate Tam on his new position as chairman of PCIA – The Wireless Infrastructure Association. The association will benefit tremendously from his knowledge, ability and perspective.

AOL and Verizon

$4.5 billion for AOL? Say what? I live in Loudoun County, Virginia, the home of AOL, and I know a number of people who were part of the old AOL management crew. Fun times they were, but it is kind of nice to see the remnants of AOL go to the benefit of Verizon Communications. Verizon is claiming it is all about content, and that makes sense. And although the argument is all about the acquisition of content, the idea that it would also be about developing apps and improving the end-user software and customer experience would make a lot of sense, too. There is a bit of a chuckle when you think that this amount of money is also almost exactly what American Tower paid for the Verizon Wireless towers earlier this year.

Fruitful Apple

Apple mobile virtual network operator (MVNO) rumors are plentiful, lately, too. Who knows, but it sure would make sense for Apple to figure out another way to suck more money out of your wallet every month. Apple customer service, online services, billing mechanisms, etc., all work very smoothly, and I would have thought they would have launched MVNO service some time ago. With the iDevice(s) being data-centric, you have to believe they will be consuming even more wireless data regularly.

Peer Networking

There was a bit of a scare out there for a while with the idea of LTE peer-to-peer networking, and everyone jumps to conclusions that this is synonymous with the demise of macro networks. Yeah, right. Do a little Googling of Flash-Linq and study up on what is actually being done. It's more of a location service platform and local network peering. I can see where it would be helpful filling in coverage in some of those always hard-to-reach nooks and crannies of tunnels and underground parking lots.

Acquisitions

Crown Castle has everyone's attention with the acquisition of Sunesys, picking up 10,000 miles of dark fiber. They paid a pretty penny for it, with a nice return baked in if things go as planned. This is the first big fiber play, in my opinion, and only the first of many. It is a bit of a different business model than what the two big companies have used before. However, as the tower industry continues to mature, and as it becomes more efficient (less growth), and with the attractive, well-managed businesses all the big companies are running, the capital is available for investments in new areas, as long as the new areas are at least in the same discipline (communications). This is why I think we've only begun to see investment in fiber. Crown has taken the time to figure out how to operate fiber with different investments over time. I doubt this will be the last deal we see.

Our friends at InSite Wireless Group acquired the DAS assets of Capital Tower Group, also picking up a senior dealmaker in the process. The InSite folks have always been a great group to watch. I call them my early indicator of what is going to be happening in the industry. Unfortunately, with InSite being a private company, you have to wait for it to issue press releases for details that otherwise might be in a public company's required reports.

Rich Biby, Publisher
rbiby@aglmediagroup.com

The Major Takeaways from the 5G Forum

By Iain Gillott

In April, I attended the inaugural 5G Forum (organized by Informa) in sunny Palo Alto, California. The location for this new event was interesting, especially considering that most of the discussions centered on what 5G cellular will be and what it will do. Palo Alto sits in the heart of Silicon Valley, so there was strong attendance from the large tech companies, IP and Internet-centric startups, and new wireless startups looking to mix up the status quo. The mobile operators and major mobile infrastructure vendors from Europe, the United States and Asia were there en masse. All in all, a great mix of attendees.

One of the most interesting sessions was held the morning of the second day (full disclosure: I was the event chair for this portion of the program) when the attendees split into various roundtable groups to discuss specific issues. Each table was asked to debate a specific topic and then come up with half a dozen conclusions. These could be issues that would need addressing, including specific action items or questions that could not yet be answered.

The main takeaways from these discussions were:

What is 5G? This discussion solicited a lot of responses, as you may imagine. The basic conclusion is that 5G is not simply a new technology family (as 3G and LTE were), but instead it is an extension of the LTE technologies into new architectures. What has not been decided is which release of LTE will officially qualify as 5G. Similarly, the expectation is that

> " *The general view is that there is real money in big business applications and relatively little potential revenue in consumer-based IoT apps.* "

5G will require significant densification of the network (more cells, and more content and services at the edge), and this will necessarily involve the use of millimeter-wave and centimeter-wave spectrum. But exactly which bands will be used is open for debate. The final question is if 5G is really cellular in nature or if the architecture is something new. The notion of a single cell handling a connection until the subscriber physically moves may be outdated; a new approach based on bandwidth demands or latency demands may be needed.

5G is a loose framework and a timeline. This notion is supported by the idea that 5G will use developments of the LTE air interface but will require significant changes to the network core architecture. That said, 5G will still need tight integration with LTE; this is not a rip-and-replace evolution from 4G to 5G.

5G challenges are far more than technical. This matter was raised in a couple of different discussions. Although the industry to date has been discussing technical aspects of 5G (spectrum, air interface and latency), there is a belief that the bigger issues will be political and especially related to intellectual property rights. The fact that 5G

TIRED OF 8 HOUR DEPLOYMENT CALLS? LIVETRACK YOUR SITES.

probably will be developed as a true global standard makes the IPR issue more pressing.

Densification brings many challenges. Aside from the obvious challenges of locating many more smaller cells (zoning, planning, locations and landlords), there is also the significant challenge of providing low-latency fronthaul and backhaul to all the new cells. These cells are most likely to be smaller than today's small cells (think of them as microcells) and could be located on street signs and billboards. How will fronthaul and backhaul be provided cost-effectively to meet the needs of low latency?

Network slicing is an integral part of 5G. The concept of network slicing was raised in several sessions during the conference. In essence, the 5G network will need to support not only a wide range of industry verticals (healthcare and finance were mentioned most often) but also a wide range of operator business models, including mobile virtual network operators. So the 5G network may be used by a health care provider to support patients and providers and also by an MVNO. The network is therefore sliced horizontally and vertically.

How do you manage quality of experience? This discussion centered on the belief (or fear) that today's network management techniques may not be enough to provide the required quality of experience for 5G. For example, it is likely that physical probes in the network will not be enough to manage all the various traffic types, network slices and services. New approaches may be needed.

Cloud radio access network (RAN) may need a rethink. One of the critical performance aspects of 5G is low latency — low enough to support connected cars and autonomous driving, for example. Consider that at 60 miles per hour, a car moves just over 1 inch per millisecond. Today's LTE networks have a latency of ~50 milliseconds, which means the car has moved 4 feet before the network reacts — plenty of room for a collision. So if cloud RAN is to be part of the densification of networks to get to 5G, lower-latency solutions probably will be needed. This may require new architectures and connection protocols. In short, the performance of the cloud RAN is likely to be critical to the overall performance of 5G.

5G needs new business models and revenue streams. There was general agreement at the conference that the wireless industry has exhausted the potential of the current model (the end user pays the mobile operator for providing mobile data and connectivity). The industry has squeezed every drop out of the current model. For 5G (and to justify the investment needed), new revenue streams will be needed, including the ability to provide an alternative for broadband service to the home. (Fiber deployment is slow and expensive.) Network slicing will necessarily lead to new business models, but the platforms need to be in place to support this evolution; simply producing a monthly bill is not enough. And this will require a monetization of machine-to-machine (M2M) and Internet of Things (IoT) communications. The billing platforms will need the granularity and flexibility to deal with everything from a smartphone and tablet to vehicle-to-vehicle communications to a connected combine harvester across a fully heterogeneous network. The general view is that there is real money in big business applications and relatively little potential revenue in consumer-based IoT apps. We shall see how this develops.

Security is needed, but what kind? Security is an obvious need for 5G, but how will this be implemented? At what cost? How will different levels of security be implemented?

Full network virtualization is an enabler of 5G. No argument here, and it is clear that the industry is well down the virtualization path. More flexibility will be needed to enable 5G, and it is clear that self-organizing network (SON) technology needs to continue to develop and be implemented within the virtualized framework. Virtualization will also extend to test beds to test both the air links and the core networks.

Looking at this list, it is clear that there is some way to go before the vision of 5G is realized, after the industry decides what 5G actually is. But the steps being taken now (cloud RAN, small cells and network virtualization) will enable 5G and should be seen as critical to future success. Investment now will reap dividends in 2020 and beyond. But this does not mean there is not a lot of heavy lifting left to do. There is.

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

/ **DEPARTMENTS** /

Technical Standards Key to Wireless at Marriott International

By J. Sharpe Smith

How does Marriott International, a global travel company with 4,100 properties across 79 countries and 18 brands, keep everyone on the same page concerning wireless technology? According to Page Petry, Marriott's senior vice president and chief information technology officer for the Americas, the answer is to develop technical standards.

Petry expanded upon this and more during her keynote address at the AGL Conference and during an interview with AGL Media Group CEO Richard P. Biby, P.E., Oct. 9, 2014, in Dallas.

"While some say technical standards result in a tremendous amount of bureaucracy, I believe they give you tremendous freedom in defining business relationships, defining terms and conditions, and developing infrastructure designs," Petry said.

At the beginning of the 21st century, the hospitality industry's telephone and Internet communications were still completely wired and systems were built to last. Around 2005, Marriott decided that it needed to build its communications systems with the ability to change.

"Since [1999], everything has changed dramatically, and we had to change, too," Petry said. "We needed to put an environment in place that allows us to take advantage of all the new technologies as they come at us. Otherwise, when new technology comes out, you have to do a major fork-lift in your buildings, resulting in a very lengthy, expensive process."

Marriott fundamentally changed the way it finds new technologies for its hotels, developing four key components that formed a foundation for its program: technical standards, certified suppliers, bandwidth guidance, and Wi-Fi in all guestrooms and public spaces. After developing its technical standards, Marriott invited 200 of its Internet service providers to test their products and, if approved, receive certifications based on these standards. To date, approximately 21 providers have received certifications as a result of this process.

In the wireless world where the deployment of each generation of wireless is quickly followed by anticipation of the next, Petry notes the standardization process is not over. "How do you build this environment to be capable of change?" she asked. "How do you make it live? We are constantly revising the technical standards to meet the demands of the wireless equipment that people are bringing into our hotels."

Petry said the iPad introduction in

Page Petry, senior vice president and chief information technology officer for the Americas, Marriott International.
Photo by Vasili Antoniou

2010 "woke up our business leaders to what we needed to do with the infrastructure in our hotels. It was a significant moment for Marriott IT when we realized that all access points inside the hotels would need to be realigned to handle the requirements of the tablet.

"The good news was that all of our manager teams were getting iPads, and they easily bought into upgrading the infrastructure," Petry said.

DAS Deployments
So far, DAS has been installed in Marriott's properties in a number of ways. In some cases, the hotel invites each carrier independently to bring in its service, and other times Marriott uses an integrator to bring in the carriers. Additionally, a carrier may partner with Marriott on a DAS deployment and then bring other carriers with it. All three processes have

their challenges, according to Petry.

"Each DAS deployment has been different. That is the challenge for us as a company. We don't have DAS standards cleanly laid out yet," she said. "We need to do a better job of articulating our requirements, so that the providers know what we are looking for and can deliver solutions that meet our needs."

Petry expressed a sense of urgency for driving Marriott's future wireless communications capabilities to meet the needs of millennials, who are estimated to account for 70 percent of room nights by 2018.

"We are spending a tremendous amount of time getting ready for the millennial traveler to get an idea of their needs," she said. "It will be a massive change in our customer base — they are very mobile. They want to communicate with us before they check in, while they check in and to get online as quickly as possible. How do you move that customer through that process?"

A good relationship between the engineers in Marriott's corporate office and their suppliers is essential to understand how wireless needs to change to keep up with new wireless demands.

"We have an architecture review board in place that comprises our engineers, our suppliers' engineers and associates from our hotels," Petry said. "They get together and talk about communications problems. Our suppliers are coming to us with new solutions to problems and ways to do it better."

The most challenging wireless component for Marriott is keeping up with the bandwidth demand, which shows no signs of abating, according to Petry. But the size of hotel does not equate to bandwidth demand. A small hotel in Silicon Valley can have more bandwidth demand than a medium-size suburban property.

"Bandwidth demand growth is through the roof. We are seeing 40 percent growth year over year. Our owners and managers ask me when it is going to stop. I say never. At least I cannot foresee it," Petry said.

At the beginning of the 21st century, the hospitality industry's telephone and Internet communications were still completely wired, and systems were built to last. Around 2005, Marriott decided that it needed to build its communications systems with the ability to change.

ENTERPRISE SYSTEMS

/ **DEPARTMENTS** /

Quick-Guide to RF Compliance, Monitoring and Management Companies

As a supplement to *AGL Magazine's* January Buyers Guide, a list of RF compliance, monitoring and management 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.

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fhernandez@3ztelecom.com
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See ad on the inside cover

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Rancho Cucamonga, CA 91737
Dana Dulabone
813.495.0038
dana@rfawareness.com
www.rfawareness.com
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5933 Sea Lion Place, Suite 112
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Ed Stevenson
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edstevenson@aeatechnology.com
www.aeatechnology.com
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Antenna ID Products
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Tom Moyer
610.458.8418
antennaid@msn.com
www.antennaid.com
Product: FCC signs

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862.242.5490
941.400.1960
gwagner@bcsops.com
www.bcsaudit.com
Services: risk management, vendor and tenant compliance
Company description: BCS is a risk management business that works as a third-party outsourcer to validate certificates of insurance and other tenant and vendor documentation including licenses, legal, safety, financials, W9s, disbarment, etc. BCS serves firms with sizeable numbers of vendors, suppliers, tenants, lessees, etc., to validate compliance with contractual terms and conditions.

ComSites West
2555 Third St., Suite 200
Sacramento, CA 95818
Charlie Feick
530.414.4376
charlie@comsiteswest.com
www.comsiteswest.com
Company description: ComSites West owns, operates and develops wireless communications sites in California and Nevada, including tower and rooftop communications facilities. We develop towers jointly with landowners and acquire towers through outright purchases and through purchase-leaseback programs.

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9500 Greenwood Ave. N
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David Pinion, P.E.
Thomas Gorton, P.E.
206.783.9151
hatdaw@hatdaw.com
www.hatdaw.com
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Company description: Hatfield & Dawson provides RF compliance analysis and expert engineering services. We have decades of experience in RF analysis, including complex problems at high power and mixed-use sites, and at all frequencies from ELF to microwave. The firm's engineers have been instrumental in "RadHaz" standards-setting for decades.

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Kiowa, KS 67070
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See ad on page 29

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sales@sitesafe.com
www.fdhvelocitel.com
Services: compliance, field/site monitoring, management, testing, consulting, studies, site evaluation, training, planning, certification

BUYERS GUIDE

Providing Support by Standing Together

"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.

TOWER INDUSTRY FAMILY SUPPORT CHARITABLE FOUNDATION
www.towerfamilyfoundation.org

FCC Commissioner Michael O'Rielly: "To relieve network congestion and provide capacity for next generation products, we either need more infrastructure or more spectrum, or ideally a combination of both." *Photo by Don Bishop*

How the FCC Should Help with Wireless Infrastructure

The FCC should help to facilitate small cell and DAS deployments, increase the efficiency of the historic preservation application and review procedures and resolve the problem of twilight towers.

By Michael O'Rielly

The wireless industry is experiencing an era of tremendous growth. Last year alone, U.S. mobile data traffic grew by 63 percent and a total of 401 million devices accessed the Internet. It is projected that over these next five years, mobile data traffic will multiply by a factor of seven, and there will be over a billion mobile connected devices in this country alone. Wireless infrastructure will support networks that will have to accommodate the increasing consumption of video, which is expected to increase 8.6 times between now and 2019 and will comprise 75 percent of mobile transmissions. Not to mention, in the same timeframe, the traffic from wearable devices and machine-to-machine (M2M) modules are expected to increase 19 and 49 fold, respectively.

Plans must be in place to ensure that we can keep pace with America's insatiable demand for mobile communications. To relieve network congestion and provide capacity for next generation products, we either need more infrastructure or more spectrum, or ideally a combination of both. I saw an interesting statistic recently. If the increasing mobile traffic had to be relieved by infrastructure alone, meaning no additional spectrum or improvements to spectral efficiency, it was suggested that we

would have to go from 300,000 cell sites in the United States to having a need for 4.3 million. Luckily, we are not in this dire situation due to the FCC's efforts on the spectrum front.

The FCC is in the process of releasing more spectrum into the marketplace. We recently completed the AWS-3 auction, raising almost $45 billion in gross revenue, demonstrating the great demand for exclusive-use licenses. Similarly, we will have the broadcast incentive auction, currently scheduled for early 2016, which will reallocate broadcast spectrum to wireless use. This effort will not only provide 600 MHz spectrum for auction, but also some bandwidth for unlicensed use. Further, the FCC has freed up 100 megahertz of unlicensed spectrum in the 5-GHz band, with hopefully more to come, 150 megahertz at 3.5 GHz, and is analyzing future uses of millimeter waves above 24 GHz. In the near term, we will be allocating sufficient bandwidth for both licensed and unlicensed wireless services, but we must not rest on our laurels. We must start now to look for the spectrum bands of the future.

Wireless Infrastructure Demand

The FCC can put these airwaves into the marketplace, but spectrum alone will not benefit this nation's wireless consumers without networks and infrastructure. Without infrastructure, the latest innovations and offerings will not be available to meet the demands of American consumers. Without infrastructure, the United States does not maintain its position as the leader in wireless and Internet technologies. Without infrastructure, the economic growth of the wireless sector and its corresponding benefits to the U.S. economy come to a halt.

Tower Worker Demand

This demand for infrastructure is completely understood, yet presents some real challenges. Not only do we have the continued expansion of LTE by wireless providers, but facilities will have to be installed to operate AWS-3 and 600-MHz spectrum. It appears that we are entering a period when those who work on large towers, in particular, will be in great demand.

> *I worry that potentially injecting ourselves and putting the government's heavy thumb on the scale of the standards process would lead us into treacherous waters.*

And I have been told on a few occasions that the number of crews that work on tall towers may be limited. This workforce shortage could be exacerbated if these crews also happen to work on broadcast towers, because the incentive auction repacking process will be occurring simultaneously with AWS-3 and 600-MHz build out.

If this skilled workforce is insufficient for the number of required jobs, work orders may get backed up. This may conflict with meeting the 39-month repacking deadline and create a domino effect for wireless facility construction. I recognize, however, that there are multiple companies involved in the broadcast tower construction business, so perhaps it is not a problem. Accordingly, it would be helpful if you communicated with the FCC regarding the current and estimated future demands for tower construction teams for both broadcast towers and others. We will need to take this into account as we consider the best timing for the start of the broadcast incentive auction.

What can be done to facilitate and accelerate network deployment? First, I applaud PCIA for taking a leadership role in training the wireless infrastructure workforce of the future. PCIA's program to educate veterans, displaced workers and others on how to build and maintain wireless infrastructure, along with its efforts to create an apprenticeship program promoting workplace safety and training, should help relieve workforce shortages in the future.

The FCC's role, on the other hand, is to ensure that the correct environment exists to promote infrastructure investment and deployment by reducing regulatory burdens and increasing market certainty. Lately, the FCC's scorecard has not been bad when it comes to matters involving infrastructure, although I wish I could say the same thing as it pertains to the burdens being placed on wireless carriers through items like net neutrality, which will have an effect on your industry. Let me suggest to you that it is in your best interest to be involved

REGULATORY ISSUES

Speaking at the Wireless Infrastructure Show on April 28, FCC Commissioner Michael O'Rielly said, "The FCC must always remain technology-neutral. I have concerns about the chairman's announcement at the last FCC meeting about an upcoming public notice that will seek information on LTE-U and the current undertaking to develop standards for this technology." *Photo by Don Bishop*

REGULATORY ISSUES

in the policy issues under consideration at the FCC — even those that may not appear to directly affect your company. Don't just sit on the sidelines and say it's not my problem, because every burden placed on your partner or potential partner means less investment in infrastructure.

In the good news category, last August, the FCC adopted an order that modified our tower lighting and marking rules. I was pleased to support an item that reduced unnecessary burdens on industry while ensuring the safety of aircraft.

Receiving greater attention is the FCC's October Infrastructure Order facilitating and reducing obstacles to infrastructure siting, including small cell and distributed antenna system (DAS) deployments.

Although the FCC implemented many positive and important changes, let me focus on one aspect. The FCC, in response to the clear congressional directive in the 2012 Spectrum Act, finally put an end to some disruptive practices of states and localities impeding the placement of wireless towers. Although we thought that pre-existing law already provided a reasonable process for tower siting, the industry still faced moratoria, delays in the decision-making process, unreasonable documentation requests and other tactics that maintained barriers to siting. Unfortunately, some localities have challenged the FCC's recent order in court. Hopefully, this litigation will conclude expeditiously and will not delay the deployment of wireless

broadband infrastructure.

Although much has been done, there is still much to do. First, as recognized in the Infrastructure Order, further steps must be taken to facilitate the deployment of small cell and DAS networks. The FCC committed to work with stakeholders to develop a program alternative within 18 to 24 months to expand upon the relief provided to small cell and DAS installations in October. Excluding certain collocations on buildings and non-tower structures that already host antenna and utility structures (e.g., utility poles and electric towers) from environmental and historic preservation reviews is a good start. Now, we must expand this exclusion to include small cell and DAS equipment that is being installed on any structure, including those with no pre-existing antennas. Additionally, if facilities in historic districts cannot be fully incorporated into such an expansion, installations that are not visible from public places should fall under the exclusion.

Twilight Towers

Second, the FCC should finally address the problem of twilight towers. These towers — constructed between March 2001 and March 2005 — were not specifically required to go through the historic preservation review process. I know that FCC staff, industry and other stakeholders have been working together to resolve this issue that affects somewhere between 4,000 and 7,000 tower structures. Until this review is concluded, these towers remain in regulatory purgatory; no antennas can legally collocate on these structures. We need networks to be deployed; we cannot afford to have tow-

ers that are not filled to capacity. Is it really preferable to have antennas not installed or duplicative towers built while we sort out this quandary? And one final note, it would seem to make sense that this process be done collaboratively, without the need for enforcement action against these tower owners, who are trying to resolve the issue in a productive way.

Third, the FCC should also work with industry and Native Nations to increase the efficiency of the historic preservation application and review procedures. I hear that improvements can be made to provide Native Nations the information they need to protect their historic sites, while ensuring that the process allows for the prompt construction of facilities. Creating best practices or guidelines, including reasonable timeframes and fees, could help provide greater certainty and finality to this process. Both industry and Native Nations should have shared expectations as to how this process works.

Additionally, the FCC must always remain technology-neutral. Although this would seem to be an obvious statement, I have concerns about the chairman's announcement at the last FCC meeting about an upcoming public notice that will seek information on LTE-U and the current undertaking to develop standards for this technology. For years, the standards process has successfully been conducted independently without any FCC input or interference.

I appreciate that certain members of the Wi-Fi community have concerns about the effect that the deployment of this new technology will have

on their pre-existing networks. As an ardent supporter of Wi-Fi, I, too, want to know more. But, these concerns need to be worked out by stakeholders through 3GPP, the standards setting body. I worry that potentially injecting ourselves and putting the government's heavy thumb on the scale of the standards process would lead us into treacherous waters.

Not only must the FCC be very careful that it does not — either intentionally or unintentionally — put itself in a position where it influences or sets standards, but it also should not be taking sides with various stakeholders in the midst of the process or have any say about what technologies should or should not be deployed. Even though this issue does not directly pertain to the infrastructure industry, any interference from the FCC that could impede or prevent the deployment of new technologies would

> **It is in your best interest to be involved in the policy issues under consideration at the FCC – even those that may not appear to directly affect your company.**

negatively affect your bottom lines.

These are just a few ideas. I would be interested in hearing all suggestions you might have. During my time at the FCC, I have been able to advocate for various reform measures through my blog, and some of these ideas have

resulted in changes or notices of proposed rulemakings. My staff and I have an open door policy, and no idea that you may have is too small.

Looking to the Future

I challenge the wireless infrastructure industry to be forward-looking. What will the next generation of infrastructure look like? Moving from large cell towers to small cell networks clearly has benefits. They are cheaper, quicker and easier to install and will face fewer regulatory challenges than their less-aesthetically pleasing, larger siblings. So what is next? Some people have suggested such ideas as a series of balloons, solar-powered drones or small satellites. This may sound far-fetched to some, and other options may be more likely.

For instance, there is the idea that next-generation devices may be able to bypass cell towers and become part of the cellular network. This could result in a diminished reliance on cell towers, and may even make them a thing of the past. There are reports of major manufacturers working on technology that would allow mobile devices to communicate with each other up to a range of 500 meters without draining a phone's battery life. Maybe such device-to-device technology will not become commonplace or eliminate the need for towers and small cells, but we must always look to the future and plan for what is next.

Michael O'Rielly is an FCC commissioner. He delivered these remarks to an audience at the Wireless Infrastructure Show in Hollywood, Florida, on April 28, and the FCC also published them.

REGULATORY ISSUES

/ **FEATURES** /

When Birds Make Towers Their Home Sweet Home

With proper planning, disruptions to operations can be minimized and birds can be afforded meaningful protection.

By William J. Sill, Dr. Richard Podolsky and Rachel S. Wolkowitz

As communications towers have proliferated over the last few decades, they have increasingly become the home for many birds as nesting locations and as perches for resting and for hunting prey. And although nearly all species of birds (along with their nests, eggs and nestlings) are protected, we also know that tower infrastructure needs to be maintained, Federal Aviation Administration-mandated lights must be replaced, and a steady increase in collocations must be accommodated. Authorized installers and various maintenance personnel need to have timely access to both the base station equipment and the antenna structure. When there are birds temporarily stopping by or taking up residence on the tower, this leads to inevitable conflicts of interests. The following information examines these conflicts, provides an overview of the patchwork of federal and state regulations to protect birds, and suggests how industry and government can

work together to ensure that critical public safety and economic needs are met while ensuring that the environment is sufficiently protected.

A History Lesson

In 2012, the Federal Communications Commission undertook a Programmatic Environmental Assessment (PEA) of the Commission's Antenna Structure Registration (ASR) program in response to a court case, *American Bird Conservancy v. FCC*, which held, among other things, that the agency must perform a programmatic analysis of the effect on migratory birds of registered antenna structures. (The ASR program is the FCC's way of cataloging and keeping tabs on all towers that require FAA determinations of no air hazard.) The FCC PEA record included nearly 200 comments from various stakeholders — the U.S. Fish and Wildlife Service (USFWS), major avian and conservation groups, the wireless industry and many individuals. A coalition of avian groups and the wireless

industry agreed upon key principles that formed the nucleus of the FCC's Interim ASR rules. The Final PEA found that the environmental impact of the ASR program would not be significant at the national level, but also determined that there was potential for significant effects on populations of migratory birds, bald eagles or golden eagles at the local level. Therefore, the FCC established a set of procedures, the ASR Interim Rules, that guaranteed that every ASR application would be placed on public notice so that the public could raise concerns over a given tower's potential for affecting migratory birds.

The FCC's Interim ASR rules eliminated automatic grants of ASRs. Instead, someone wanting to construct a tower must put the public on notice and allow the public at least 30 days to comment. If there are environmental objections or requests for further assessment, the FCC either denies the objections and requests or grants the objections and requests and requires the applicant

to file an environmental assessment (EA). The public is afforded an opportunity to comment on the EA. The time needed to prepare an EA, for comments to be received, and for the FCC staff to render a decision can elongate the formerly instantaneous process to six months or more.

Some Guideposts to Consider

In addition to regulations and regulatory processes, the FCC and the USFWS issued guidance that established pathways forward to avoid conflicts by encouraging tower owners and applicants to consider taking the following measures:

- **Collocate.** Install antennas on existing towers or within an existing antenna farm.
- **Minimize tower size.** Minimize the foundation footprint and keep tower height below 200 feet to avoid the need to install FAA warning lights that are known to attract night-migrating birds.
- **Minimize security and construction lighting.** Minimize and down-shield security lighting for on-ground facilities and equipment to avoid attracting night-migrating birds, and perform construction activities during daytime business hours. Decommission and remove obsolete or unused towers.
- **Choose your location wisely.** Where feasible, avoid siting new towers in avian high-use areas, including coastal zones, wetlands, ridgelines, bird staging areas, colonial nesting sites and riparian zones. Select new tower sites in areas with existing visual clutter where feasible and use vegetative screening to reduce visual effects.

Tower companies should also be mindful that risk of collisions increases with the height of the tower, with the addition of guy wire supports, and with the amount and type of FAA lighting. Approximately 350 species of migratory birds are most vulnerable to communication towers, and most at risk are thrushes, vireos and warblers that migrate at night. These and other nocturnal migratory birds are especially susceptible to collisions with towers on foggy nights or on nights with low cloud ceilings.

If You Build It, They Will Come

Once constructed, towers require regular maintenance and may be used as platforms for collocation of additional facilities. One emerging issue confronting tower owners is how to deal with both new and abandoned bird nests on towers. Chief among the nesters are the osprey. One tower company with towers nationwide estimates that osprey account for approximately 60 percent of the nests it finds on its towers. In addition, the tower company believes that approximately 3 percent of its towers are home to bald or golden eagles.

Tower owners and collocators are well advised to become familiar with both federal and state regulations and policies protecting birds and nests. The federal government allows inactive nests to be removed for all birds except for eagles and for any bird protected under the Endangered Species Act. Although many states follow this federal mandate, some still require permits for all bird and nest removals, even inactive nests and individual nesting sites.

In addition, state regulations can prohibit tower climbing, installation and maintenance during the active nesting season (which can begin as early as February and end as late as October for some species). This patchwork quilt of regulations complicates and can disrupt scheduled tower maintenance, new installs and emergency repairs needed as a result of storms or FAA lighting outages. For example, tower owners and operators must understand that in Pennsylvania, a special use permit is required to remove an inactive osprey nest; however, no such permit is required in Virginia.

Within this legal framework, industry has taken several steps to help birds and comply with the letter and spirit of the law.

Current Industry Practices

Under the FCC's rules, the wireless ASR applicants are required to make an initial determination of the potential effect of a proposed tower on migratory birds. As a result, tower companies and carriers have become familiar with the requirements under the relevant federal statutes — the Migratory Bird Act, the Endangered Species Act, the Bald and Golden Eagle Protection Act along with the FCC's Interim ASR procedures, and USFWS letters. Tower owners spend a significant amount of resources not only understanding and complying with the many laws and regulations governing avian activity on tower sites, but also developing and implementing best practices with their contractors.

To bring uniformity and additional avian expertise, some tower companies have developed companywide avian protection plans and regularly consult

REGULATORY ISSUES

with ornithologists or environmental consultants both for siting towers and, in some instances, before initiating repairs or installing collocators' facilities. This serves both to enhance their compliance efforts and to reduce the risk of harming birds. For example, American Tower's avian program, dubbed Bird Watch, includes comprehensive information and policies, such as its no-kill policy, for its employees and contractors on its website: *http://www.americantower.com/ Marketing227/1820MK_BirdWatch/ index.html*.

As an industry, the wireless carriers and infrastructure providers have established internal avian policies and routinely strive to proactively eliminate from consideration those towers that would have the most effect on migratory birds. In addition, wireless industry associations have acted as forums for discussing avian issues. PCIA – The Wireless Infrastructure Association recently established an avian working group to develop a more clear idea on the

incidence of tower nesting and the effect it has on tower operations. Zachary Champ, PCIA's director of government affairs, explained, "The wireless industry is committed to meeting the dual goals of building out the world's best wireless infrastructure to meet the data demands of tomorrow and preserving our valuable birds. We are utilizing this new forum to collaborate and share what we have learned from our shared experiences and continue doing what this industry does best — innovate."

Looking Ahead

Tower owners would benefit from consulting with a qualified avian expert with expertise in tower issues when siting towers in areas where protected species live, when dealing with nests or perching issues, when developing avian protection plans, and when choosing the latest methods to site and design towers to be less attractive to birds. In addition, companies should keep a log of work requests to document who is at each

tower and when. Although there is regulatory consistency at the federal level, it would be appreciated if state regulators would strive for a similar consistency. Greater regulatory uniformity would enable the industry to be even more responsive and flexible when responding to avian issues. Hopefully, industry efforts will bear fruit by sensitizing infrastructure owners and carriers to avian issues and by sharing information and experiences that will result in improved practices.

Although birds may become visitors or lodgers on your towers, you cannot charge them rent. However, with proper planning, disruptions to operations can be minimized and birds can be afforded meaningful protection.

William J. Sill is a partner at Wilkinson Barker Knauer and chair of the firm's Tower Practice Group. Richard Podolsky, Ph.D., is an ornithologist and expert in tower siting avian issues. Rachel S. Wolkowitz is an associate at Wilkinson Barker Knauer.

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Properly designed LED systems provide a controlled and tight beam pattern.

The Brighter Side of Tower Lighting

Many tower companies are receptive to upgrading from incandescent and Xenon lighting to LED lighting. It is up to the customer to make sure the chosen lighting system has the required certification.

By Mike Breslin

TOWER LIGHTING

Tower owners and managers have two primary concerns when dealing with obstruction lighting.

First, comply with complex FAA regulations governing lighting performance to ensure safety. This ensures proper warnings to protect fliers and the general public from unnecessary risk. FAA penalties assessed for violations can be severe, ranging from $10,000 to hundreds of thousands of dollars per violation.

Second, consider the cost of a lighting system, both the installation cost and the long-term operating expenses. Depending on the type and size of system, electric costs can be reliably estimated, but emergency repairs can kill the bottom line.

These days, many tower operators are looking to save on both electricity costs and maintenance costs by transitioning to LED (light-emitting diode) systems. Industry experts estimate that today only 15 percent of towers use LED technology, while 35 percent use Xenon lamps and 50 percent use incandescent bulbs.

Energy Star, the international standard for energy-efficient products, claims that LED technology uses at least 75 percent less energy than incandescent lighting and can reduce maintenance costs by lasting 35 to 50 times longer than incandescent lighting. GE estimates expected energy savings with LEDs to be 50 to 70 percent less than incandescent and cut CO_2 emissions by 50 to 70 percent.

Expert Opinions

Two knowledgeable individuals in the field of obstruction lighting are Wade Collins, director of sales, and Mark Lane, director of product management and marketing for Flash Technology, an SPX company. Founded in 1969, Flash manufactures obstruction lighting products specializing in LED and Xenon lighting for telecommunications, broadcast, wind energy, airport, utility and specialty applications. Even though Flash has

installed lights on the same towers a number of times over the years, it estimates there is still a tower base of approximately 65,000 to 70,000 with lights.

"Over the past few decades there have been major developments in obstruction lighting," said Collins. "Without question, the largest development over the past decade or so has been the introduction of LED technology. Before that, Xenon replaced a lot of the incandescent technology, particularly when white Xenon first became available as an option."

Marking Options

Collins and Lane provided background information: For daytime marking, the only options approved by the FAA are red and white painted bands or white flashing beacons. The FAA, through its lighting certification body, Edison Testing Laboratories, has established detailed technical specifications for obstruction lights such as intensity, color, beam pattern and how much scattered light can reach the ground. "It's very heavily regulated," said Lane.

For nighttime marking, the only options are red or white flashing beacons. "If you had a painted tower, it probably had an old, red, incandescent beacon on it," Lane said. "Once red Xenon lights became available for nighttime use, it seemed natural to also use white Xenon for daytime use. When that happened, dual (white day/red night) Xenon systems began to replace painted/incandescent markings. It was an easy choice due to the high cost of repainting, which typically is required about every five years."

One advantage of replacing incandescent lights with LEDs is a much

LEDs allow for a more compact design.

longer maintenance cycle. Although an entire lighting system may last 10 years or longer, a tower owner usually had to pay a tower climber to replace some of the incandescent bulbs every year. That could cost several hundred dollars per outage, per year. With a Xenon system, however, lamps would only need to be replaced every two or three years, thereby substantially reducing maintenance costs. With the newer LED technology, relamping is expected to exceed five years and could be much longer.

Transitioning from incandescent to LED will also generate significant savings in energy costs. "It's so significant our customers almost always convert if they plan to own the towers for at least two years," Collins said. Savings to transition from Xenon to LED are not quite as significant as from incandescent to LED, but they are worth running the numbers. Estimating savings will be surprising if you have a Xenon system that also has incandescent marker lights. By switching out incandescent marker lights to LEDs, Collins estimates an energy savings of about $200 a year per tower.

Lane estimated upgrading from a Xenon system to an LED system probably would save tower owners

from $300 to $600 dollars a year in energy costs alone on towers between 200 feet and 350 feet above ground level. For towers over 350 feet AGL, the power savings will nearly triple because of the additional lights.

"Most upgrades taking place now are from Xenon to LED," Collins said.. "The cost for a typical LED system as compared with Xenon would be about 50 percent more. However, the savings are considerable when truck rolls are reduced for a company with hundreds of towers. The typical bulb replacement cycle for a Xenon system is every two to three years, while an LED is some time after five years. Depending on the tower location, dispatching a maintenance crew could range from $750 to $1,200. Spending capital dollars for a new LED system with a five-year warranty that in turn reduces operating expenses is a formula that many tower owners find very attractive."

Watchtower

Another significant advancement has been in the area of monitoring. Prior to the mid-'90s, there were only two ways of monitoring tower lights, either a tower watcher who visually checks the lights and documents status in a log or the use of dry contacts, which is a simple mechanical relay device that opens or closes on alarm. Neither option is fail-safe, and they both pose high risk to the tower owner.

There are three FAA/FCC cornerstone regulations for monitoring obstruction lights:
1. Not to exceed 24 hours, a tower owner must establish communications with a site and confirm that obstruction lights are

TOWER LIGHTING

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working properly.

2. From the time a tower owner is aware of an obstruction lighting malfunction, and if that problem alarm continues to exist for longer than 30 minutes, it must be immediately reported to the FAA to open a NOTAM (Notice to Airmen).

3. Related to the first two, the third regulation requires a tower owner to keep records of its 24-hour working confirmations, any outages exceeding 30 minutes, and any repairs made at a site with an inventory of parts used in the repair.

Starting in the mid-1990s and perfected in the early 2000s, Flash Technology developed technology for establishing two-way communication between the lighting system and monitoring center. "From a monitoring perspective, I can ask the lighting system if it's performing to specifications, and it will instantaneously confirm," said Lane. "If not, you take the fastest path to correct the situation. In addition, you have the ability to remotely perform complete lighting system diagnostics. And, if you determine there is a problem, you have a good idea what it is. So when a truck is dispatched, the crew will know whether they need to climb or not, what needs to be done and what parts are

Even with the advancements in technology, ensuring that lights are properly tested before installation is critical.

TOWER LIGHTING

needed. Monitoring communications from a tower site to a network operating center can be via wire or fiber, but in most cases it is wireless.

"Now, we can easily and reliably comply with all these regulations with remote monitoring. We handshake with a tower every 24 hours and generate a log with a time and date stamp to confirm the lighting is functioning properly," Lane said.

Flash estimates that two-way remote monitoring systems for obstruction lights are currently installed on approximately 40 percent of U.S. cellular towers.

Technology Advance

Just as the lighting industry has progressed in advancing from incandescent to Xenon, and then Xenon to LED,

so has the capability of utilizing other spectrums of light. Infrared (IR) has become a more commonly requested feature on LED lighting systems.

"We are surprised at how much interest there is in LED lighting systems that are IR-capable so pilots can see the lights with night vision systems," Lane said. "We have some unique equipment that has set the standard for how IR should be implemented for obstruction lighting. For instance, by not just randomly spraying IR but making it part of the FAA-defined beam generated from the same focal point, we are able to ensure that a pilot will have the same visual experience whether using night-vision goggles or not."

Collins and Lane said that many larger tower owning companies are

receptive to upgrading from incandescent and Xenon to LED. They understand it. They like it. They recognize the financial advantages of lower operating expenses associated with longer maintenance cycles. With progress continuing with regard to lighting types, IR and monitoring, lighting companies must remain diligent in keeping in line with the FAA guidelines and regulations and ensuring that products have been tested by Edison Testing Laboratories. Collins stated that it is up to the customer to make sure the lighting system they choose has passed the required specifications.

Mike Breslin is the owner of Breslin Productions, Midland Park, New Jersey. His email address is MBrez@aol.com.

TOWER LIGHTING

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RF Compliance, Monitoring and Management Are in Flux

Although the FCC's RF compliance rules have not changed significantly since 1997, the wireless industry is paying much more attention to developing sites in such a way that people can access antennas safely and remain in compliance.

By Matt Butcher

Much has happened with radio-frequency (RF) exposure compliance in the past several years, and more changes are in the works. The roll out of LTE, especially at 700 MHz, has increased RF exposure at some sites. In 2013, the FCC adopted new rules, proposed others and issued a notice of inquiry, all of which have important implications for the industry. Last year, the FCC and Verizon Wireless resolved an investigation into whether Verizon Wireless had violated the Commission's RF exposure limits, an action that prompted many other carriers to reassess their own facilities. These developments are changing both the methods of achieving RF exposure compliance and how often it is done.

New technologies, and especially the addition of new frequency bands, have changed the RF environment. Operation at 700 MHz translates into more RF power at lower frequencies. The relationship between frequency and RF exposure limits means that 700-MHz installations lead to more RF exposure (relative to the limits) than the same configuration at 1900 MHz. LTE uses multiple-input, multiple-output (MIMO) signaling, so there are typically two transmitters for each LTE channel. Both of these factors lead to larger RF exposure levels, expanding the areas on rooftops that exceed the exposure limits and requiring more signage, barriers or other mitigation.

2013 Developments

In 2013, the FCC published rules and proposed additional new rules on the agency's RF exposure regulations — the first significant updates since 1997. In the same action, the Commission began to reassess the RF exposure limits.

The rules that went into effect were based on proposals from 2003. They clarify certain terms, labeling and procedures. They also reaffirm shared responsibility. The so-called "5 percent rule" says that an area that is out of compliance is the responsibility of any and all licensees who contribute 5 percent of the limit in that area. The Commission is encouraging more cooperation, saying that "it is in the interest of these licensees to share information about power and other operating characteristics in order to achieve accurate representations of the RF environment."

The new rules say RF exposure at antenna sites can now be evaluated using the specific absorption rate (SAR), which previously was allowed only for mobile and portable devices. But SAR assessments are highly complex and costly and are likely to be rarely used.

The new rules further define the training necessary for a transient individual, a person who simply passes through areas that exceed exposure limits but does not have to work in those areas. They state that these transients don't require training but simply notification verbally or via signs that they are passing through an area

that exceeds limits. This clarification does not create any significant change in compliance actions. However, the proposed rules would expand the requirements by having transients supervised by trained personnel. The FCC has received many comments about transients.

The proposed rules, filed as a Further Notice of Proposed Rulemaking or FNPRM, dive into other topics such as how signage, barriers and access controls should be implemented. They address sign content, which has been a perennial issue with RF exposure compliance programs. This proposal says signs should include:

- An appropriate signal word and associated color in accord with IEEE Std C95.2-1999 (e.g., DANGER, WARNING, CAUTION or NOTICE)
- An RF energy advisory symbol (Figure A.3 of C95.2-1999)
- An explanation of the RF source (e.g., transmitting antennas)
- Behavior necessary to comply with the exposure limits (e.g., do not climb tower while antennas are energized)
- Contact information (e.g., phone number or email address resulting in a timely response)

The proposed rules also replace the categorical exclusion limits. The current limits apply to only a subset of FCC licensees and have not consistently been interpreted or applied. The proposed limits would apply to every wireless transmitter. But sites that are currently exempt might no longer be exempt, possibly leading to more of what are called routine evaluations. My understanding, however, is that sites where levels do not exceed limits would not require more

evaluations. Many comments were made about these rules, and it is clear that they require more work.

Finally, in this 2013 action the FCC issued a Notice of Inquiry to review the RF exposure limits in light of more recent developments. Both the Institute of Electrical and Electronic Engineers and the International Commission on Non-Ionizing Radiation Protection, which is supported by the World Health Organization, have published updated standards since the FCC adopted its standard in 1997. A large change in exposure limits could have a major effect on RF exposure compliance, but these newer standards have been somewhat harmonized to agree with each other and have limits similar to the current FCC limits.

The FCC is reviewing the many comments submitted about the proposed rules and the notice of inquiry, but it has not announced the schedule of the next step.

Based on an investigation into reports of excessive RF exposure levels on rooftops, the FCC found two Verizon Wireless sites out of compliance in 2014. Verizon Wireless and the FCC entered into a consent decree whereby Verizon Wireless agreed to create a plan to ensure compliance with the RF exposure rules.

Consent Decree

Under the consent decree, Verizon Wireless has updated and is maintaining its internal policy. It has inspected all rooftop sites and is fixing any deficiencies. It has begun training network operations center (NOC) personnel, and it is reinspecting all sites to ensure compliance. Verizon Wireless has employed many compliance consultants

on rooftop installations all over the country as part of this action. This effort will ensure that all Verizon Wireless sites have the proper controls so workers and the general public are not exposed to RF levels beyond the limits. One important aspect of the consent decree is the training of NOC personnel. The NOC operator now can respond to RF exposure questions regarding a rooftop site. The operator will tell the person seeking site access where they can and cannot work safely, and the operator also can limit power or turn down a site should work in close proximity to antennas be required.

The consent decree has had a large ripple effect. All the wireless operators are ensuring that their sites are in compliance. They have revised compliance plans and have assessed current conditions across their networks. The net result is that wireless rooftops are becoming more cluttered and confusing to workers.

Signage

Some RF alerting signs don't provide clear guidance. Most indicate that they should be obeyed without providing details on how to obey them. Also, there are too many signs. Signs should be consistent and should be installed as close as possible to the area where RF exposure limits may be exceeded. But in the past, signs were simply installed at rooftop access points. Now, sites have the same or similar signs installed both at access points and near antennas, providing confusing messages. Too often alerting signs with different messages such as Notice, Caution, and even Warning, are installed at the same place. How is a worker to interpret that?

Barriers, too, have proliferated. They are placed to indicate areas that may or that do exceed limits and that should
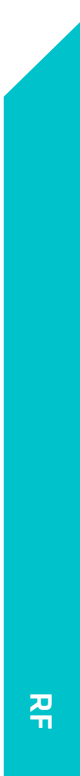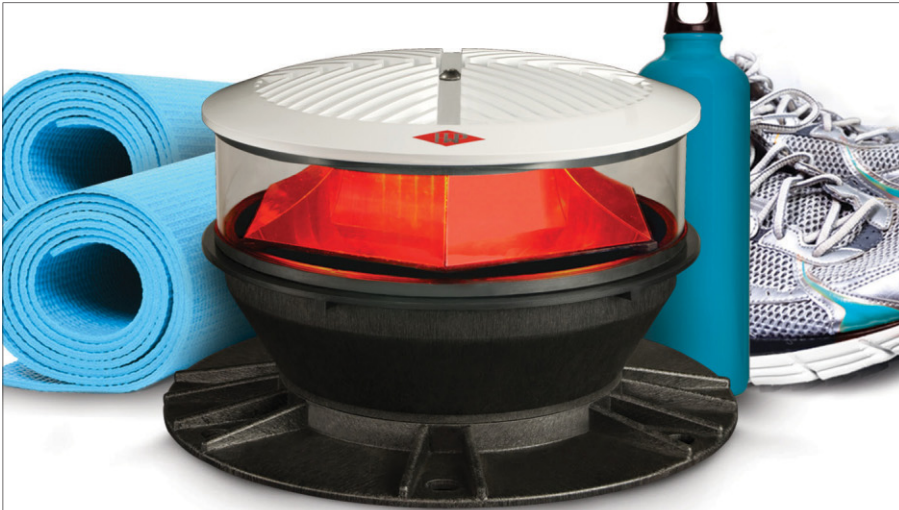
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only be accessed by trained personnel. But avoiding those areas may force a person to walk too close to the edge of a roof, creating a fall hazard. And sometimes workers or winds move barriers from their intended locations, creating an RF exposure or even a debris hazard. Compliance managers need to consider fall protection in their placement decisions and make sure barriers stay put. Furthermore, the FCC guidance on barrier placement needs to be more concrete, because at present, there are different interpretations of where barriers are required.

One solution to these problems is to implement site safety plans specific to the particular RF exposure environment. These include details of all the wireless operations on a site and provide clear guidance to workers. If these are developed with the participation of the landlord or site managers, they will be better adopted. As operators renegotiate leases, they should include an RF exposure compliance section so all parties understand the issues and the wireless operators can ensure that their compliance requirements are met.

Several standards bodies are providing better guidance for RF Safety. In C95.7-2014 (*http://standards.ieee.org/findstds/standard/C95.7-2014.html*) the IEEE's International Committee on Electromagnetic Safety outlines the elements of a safety program. The subcommittee responsible is coming up with more specific guidelines on barriers and signage. The International Electrotechnical Committee is also updating its recommendation 62232, "Determination of RF Field Strength and SAR in the Vicinity of Radiocommunication Base Stations for the Purpose of Evaluating Human Exposure."

Industry Consistency

Although the FCC's RF compliance rules have not changed significantly since 1997, the wireless industry is paying much more attention to developing sites in such a way that people can access antennas safely and remain in compliance. New FCC regulations and an update to the agency's almost 20-year-old bulletin, OET-65 on RF Compliance, will allow the industry to be more consistent on RF exposure compliance.

Matt Butcher, P.E., is vice president of engineering at SiteSafe. His email address is matt@sitesafe.com.

RF

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SITE NAME
TRIPLETS

HEIGHT
100 FEET EACH

TOWER TYPE
MONOPOLES

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VERIZON WIRELESS
AT&T MOBILITY
T-MOBILE USA

OWNERS
SBA COMMUNICATIONS
T-MOBILE WEST TOWER
NEW MEXICO RSA 6-1
PARTNERSHIP (VERIZON)

YEAR CONSTRUCTED
2004 TO 2011

LOCATION
CARRIZOZO, NEW MEXICO

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/ **FEATURES** /

Antenna Misalignment Causes Network Operators Losses in More Ways Than One

Using calibrated test equipment to accurately measure and record antenna location, tilt, roll and azimuth reveals enormous sums otherwise lost through deficient cell site antenna alignment.

By John Vetter

Consumers continue to use their mobile devices more for data-based applications than voice, a trend that places great emphasis on data throughput. Mobile wireless communications network operators must optimize data throughput to maximize revenue opportunities and achieve quality of service (QoS) and key performance indicator (KPI)

benchmarks that will reduce customer churn. Customers are quick to change carriers if they become frustrated with upload and download times they deem to be too slow.

Operators spend tens of thousands of dollars to build a single cell site to achieve these goals. Failure to install and align antennas that closely match the original RF design wastes a part of the capital investment. Engineer-

ing a mobile network for the highest-achievable system throughput — while minimizing the potential for interference — helps network operators obtain optimum network performance, increase data throughput and reduce the time it takes to achieve a positive financial return.

Unfortunately, many sites have misaligned antennas, a condition that causes losses for operators in

the hundreds of thousands of dollars in a typical market. How does this happen? And how can it be corrected?

Antenna Tilt

Azimuth and mechanical tilt errors mostly stem from the use of improper measurement methods and inadequate tools. Installation crews typically rely on a basic inclinometer for measuring antenna down-tilt. Placing the inclinometers on the antennas for measurement purposes often involves random choices, and that leads to errors. Mechanical tilt needs to be measured in a consistent manner at the same reference point on every antenna, based on a published method of procedure (MOP) and using approved calibrated tools for proper antenna alignment. Typical carrier MOPs dictate stringent azimuth tolerances of ±2 degrees (R99) because smaller antenna beam widths are being used more in designs. The MOPs typically specify down to ±0.25 degrees on tilt.

Similarly, azimuth errors are caused by improper measurement methods and the use of inadequate tools such as magnetic compasses or smartphone apps. Magnetic compasses are adversely affected by nearby metal and can be disrupted by nearby RF radiation or even electric current flowing in power cables. Magnetic compasses must also be compensated for declination, which changes with time and varies from region to region.

Misalignment Effects

A white paper, "RF Antenna Misalignment Effects on 4G/LTE Data Through," available from the author's company, details the importance of proper antenna alignment. For a copy, visit *http://sunsight.com/index.php/lte-white-paper-request/view/form*. One example the paper uses is a tower antenna 200 feet above ground level (AGL). A typical sector antenna down-tilt might be 4 degrees for a path length of 2,860 feet. If the down-tilt is 3.5 degrees, the path length grows to 3,269 feet. Conversely, a down-tilt of 4.5 degrees reduces path length to 2,541 feet. Presuming the use of a 120-degree sector antenna, the coverage on a tower 100 feet AGL should be 0.307 square miles. A down-tilt variance of ±0.5 degrees causes the site's coverage to range from 0.243

> *Azimuth and mechanical tilt errors mostly stem from the use of improper measurement methods and inadequate tools.*

square miles (4.0 + 0.5 degrees of down-tilt) to 0.402 square miles (4 – 0.5 degrees of down-tilt).

This difference can have a dramatically negative effect on an operator's bottom line. Consider a scenario with spectrum priced at $1.50 per megahertz per individual (MHz-POP) and a 5-megahertz FDD-LTE system in the San Francisco Bay area. Using the 120-degree sector antenna at 100 feet AGL as a basis, a down-tilt variance of +0.5 degrees will cause the site's coverage to change from 0.307 square

miles (4 degrees of down-tilt) to 0.243 square miles (4 + 0.5 degrees of down-tilt). In the 2000 U.S. Census, the Bay Area has an average population density of 17,246 people per square mile. By design, one sector of the example antenna site should be providing coverage worth $39,746, but because of the mechanical tilt error, the site is covering a smaller area worth only $31,377. In other words, left uncorrected, the +0.5-degree misalignment would waste $8,369 for the spectrum — on just that one sector.

The same spectrum valuation methodology can be applied to azimuth errors. Consider the same site, with a sector antenna that's misaligned by 10 degrees azimuth.

The value of that 120-degree sector (designed to cover 0.307 square miles) is again $39,746, but because it now overlaps with the adjoining sector it's only covering 110 degrees, and the covered area is only 0.282 square miles. The operator is wasting $3,312 in spectrum in this scenario.

Many Sites Misaligned

A 2013 audit revealed that 27 percent of site antennas are misaligned by as much as 10 degrees. Presume that a regional operator of a Tier 2 market network has 250 sites and that the average cost of spectrum wasted through each misalignment is $4,500 — a conservative figure, given the examples. The total cost of wasted spectrum because of misalignment is $303,750. Again, this is truly conservative — the real number is much larger because the conservative figure doesn't account

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for the 15 percent of site antennas found to be misaligned by more than 10 degrees.

We extrapolated this estimate to cover the situation of a national operator with a 20-megahertz FDD-LTE system with 40,000 sites. In such a system, the approximate total caused by wasted spectrum would be $4,500 per site, and with 27 percent of the sites misaligned by as much as 10 degrees, that would equal $48.6 million in total loss. Those amounts could easily double for a national operator with 40 megahertz of LTE spectrum.

This lost money can be revealed and recovered by ensuring that real-world antenna installations match the RF design. The measure of performance must clearly define accurate alignment methodologies

> *Customers are quick to change carriers if they become frustrated with upload and download times they deem to be too slow.*

and tolerances, such as ±2 degrees of azimuth and a tilt of ±0.25 degrees, or it must define an alignment tool that can meet specifications at half of the required tolerances. Relative to the opportunity cost of deploying RF networks that don't conform to original design criteria, calibrated test equipment that can accurately measure and record antenna location, tilt, roll and azimuth is an investment that will provide an immediate return on the investment and long-term network dividends.

John Vetter is vice president of business development at Sunsight Instruments. He has 20 years of experience in RF engineering for wireless network design, deployment and performance optimization. Visit www.sunsight.com.

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Use Dual-band Wireless in the Millimeter-wave Band for Superior Backhaul Performance

Make the switch from fiber optics in favor of faster, high-capacity wireless. Dual-band wireless technology outperforms fiber-optic communications links with single-antenna capability for reduced footprint and greater security.

By David Rizzo

With the advent of LTE networks came a new backhaul connectivity problem, and the question became how to connect the growing number of smaller base stations to the core. For example, concerns about frequency congestion and interference in dense cell deployments where four or more picocells would be mounted on light poles in a single parking lot or on a rooftop exacerbate the problem.

High-speed Transmission

A physical connection using fiber-optic cabling offers the most obvious solution for high-speed transmission of data-intensive content. However, implementing fiber to each microcell or picocell site comes at a prohibitive cost, particularly in urban areas where streets and sidewalks cannot easily be trenched.

The typical link distances for picocell backhaul are estimated to be a few hundred meters between sites and for microcells less than two kilometers apart. These represent ideal distances for implementing the highly directional characteristic of millimeter-wave systems.

Narrow-beam millimeter-wave antennas allow systems in these bands to be engineered in close proximity to one another without causing interference. Dual-band, single-polarization antennas result in higher use of the spectrum with less visual pollution.

Minimize Latency

Renaissance Electronics introduced a millimeter-wave-based product for cellular backhaul applications called GigaLink Light Speed. The radios are designed to minimize latency, or lags in data transmission, which is critical to data-centric devices that must accommodate Voice over IP (VoIP), live digital streaming, large file downloads and video conferencing through mobile handsets.

The technological advancements made in dual-band millimeter-wave wireless radios promise to catapult them over land-bound fiber as the communications medium of choice for many other applications and industries in the coming years.

Evolving Wireless Technology

For years, wireless communication has enjoyed modest success over that of fiber-optics and coaxial cable, thanks to its untethered ability to span distances without the need for digging trenches and laying fiber or copper wire. But wireless has been traditionally limited in its capacity to transport gigabit quantities of data because of bandwidth limitations set by the FCC.

That all changed, however, with the opening of the 71-GHz to 76-GHz

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and 81-GHz to 86-GHz bands, referred to as the E band range of millimeter-wave frequencies.

Relatively unknown in the commercial world, the millimeter-wave spectrum has been utilized for military communications for decades. Unlike frequencies found lower in the electromagnetic spectrum, the E band offers tremendous, uninterrupted bandwidth to enable wireless data transmission at speeds and capacities on par with the best fiber-optic communications systems. Practical data rates in the E band can meet and exceed 40 gigabits per second (Gbps).

No longer limited by ground-bound fiber — which requires the underground trenching of streets and sidewalks to establish a physical connection across city blocks — businesses can now channel vast quantities of data between buildings and campuses.

Faster than Cable

At the same time, transmission speeds via wireless prove faster than cable because of less latency. Even high-quality fiber-optic cable experiences significant latency issues in some applications that require precise synchronization.

The recent development of dual-capacity millimeter-wave wireless in a single polarization that only requires one antenna expands upon the improved functionality of wireless.

Pioneered by the HXI subsidiary of Renaissance Electronics & Communications, a Harvard, Massachusetts-based provider of RF, microwave and millimeter-wave components and subsystems for military and commercial applications, this technology

simultaneously carries two, independent, full-duplex GigE signals for a total throughput of 2.5 Gbps. Two dual-capacity models, the HLS8454 and the HLS8654, are the latest in HXI's Gigalink LightSpeed radio product line. The company's earlier Giga-Link Speed radios were among the first millimeter-wave radios in the 60-GHz and 70-GHz bands to achieve FCC certification for unlicensed and light licensed commercial applications.

"This technology creates a value proposition by providing two high-

> " *The technological advancements made in dual-band millimeter-wave wireless radios promise to catapult them over land-bound fiber as the communications medium of choice for many other applications and industries in the coming years.* "

speed, high-bandwidth lines for the price of one, since putting two communication links on a single antenna gives you twice the capacity with half the hardware," said Wayne Pleasant, an independent RF consultant for HXI. "If you have multiple customers or users in a building, you can sell, or dedicate, one radio link channel to one customer and the other channel to a different customer or user, without crossover."

Previous systems required the use

of two antennas to attain full duplex capability. To compensate, some systems multiplex the outgoing and incoming signals on top of each other, but that process exacts a big penalty in terms of latency, losing many nanoseconds that add up quickly. The use of a single antenna with a single polarization eliminates the need for multiplexing. Latency is negligible at less than 2 nanoseconds.

Single Antenna

At the same time, using a single antenna adds to the already-increased security that millimeter-wave wireless affords.

"Channelizing two signals together on one frequency poses a greater security risk," Pleasant said. "But by using two independent frequencies that single-polarization technology allows, each line is kept totally separate from the other. It's the highest security you can have for independent GigE transport."

As if millimeter-wave radios and antennas weren't already quite small — measured in inches rather than feet — the use of a single-polarization antenna further reduces the system footprint. This addresses the concern over potential visual pollution caused when mounting a large quantity of antennas to the side of a building.

Given just a single out-the-door unit consisting of both the transmitter/receiver and a single antenna on each end, dual-capacity millimeter-wave wireless saves duplication costs. When compared with the expense of laying fiber across the ground, wireless becomes extremely cost-effective.

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Speed and Capacity Benefits

Now that the E-band spectrum has opened to the commercial world, many businesses are taking advantage of wireless communications instead of fiber.

In their quest for secure, high-speed capability, stock trading firms are increasingly turning to wireless millimeter-wave transmission systems. For example, a trading company can install one of the microwave radio links on top of its data center in New Jersey and use it to create a direct connection to an exchange in Manhattan. By using microwave instead of fiber-optic cables, a trading firm can establish a much shorter path to the marketplace to reduce latency and facilitate the rapid execution of millions of trades each day.

Wireless technology is also finding wide acceptance among motion picture, television, sports and electronic news gathering organizations for the placement of digital video cameras in remote locations as far as 500 meters or more from the receiver without wires or fiber cluttering the shot or needing a grip to manage the cables.

Dual-band wireless, in particular, facilitates 3-D programming because it is filmed utilizing two cameras that record slightly offset images to create a dimensional effect. With two channels on one antenna, two independent high-definition streams can be transmitted simultaneously without latency issues that could cause ghosting.

The technological advancements made in dual-band millimeter-wave wireless radios promise to catapult it over land-bound fiber as the communications medium of choice for many other industries in the coming years.

Torrance, California-based author David Rizzo has penned three trade books, 200 technical articles and 500 newspaper columns. Rizzo covers a wide range of topics, specializing in technology, medicine and transportation. For more information about millimeter-wave technology, visit www.hxi.com/D_Radios.asp.

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Wireless Benchmarking – How Do the Networks Do It?

Drive, venue and crowdsourced tests collect key performance indicators.

By Dr. Paul Carter

One of the biggest debates happening in the wireless industry relates to the results of mobile network benchmarking tests. Wireless carriers such as AT&T and Verizon use network benchmarking to evaluate performance and compare the quality of their service against competitors. However, industrywide benchmarking standards do not exist, and every carrier has its own unique methodology for measuring network performance. It's easy to see why this has become such a hot button issue — each carrier has much at stake and worries about how its reputation would be damaged if the results don't end up in its favor. Breaking down what network testing actually encompasses and the different approaches companies are taking is the only way for stakeholders to understand the validity of any claim. To do this, those stakeholders must understand what data is being collected and how it is used to make those claims.

The Benefits of Benchmarking

Benchmarking programs provide significant advantages to carriers by substantiating their place in the market, supporting advertising campaigns and providing insight on how to further optimize network performance. However, these benefits are exactly why many stakeholders oppose standard methods of testing being introduced. If each carrier believes its preferred methods are best and that these methods also result in outcomes that customers would find favorable, why change? That being said, carriers must carefully consider their approach in order to support the claims they make lest they open themselves up to criticism or, worse, legal action.

Benchmarking Program Basics

Any benchmarking approach must at the very least plan for consistent deployment and accuracy. This means carriers must ensure that all benchmarking programs include repeated, systematic testing scheduled for regular intervals. The data collection process itself should be set against firm key performance indicators (KPIs), be technology-agnostic and provide statistically valid results.

To ensure this is being done, there must be a controlled testing environment for the wireless networks under assessment, so there is no reason claims being made, whether in the marketplace or advertising campaigns, could be legally challenged.

Methods Being Used

Despite the lack of industry standards, operators primarily gather benchmarking data in the following three ways, often with the help of an independent company.

Drive Tests: Drive tests are conducted when a carrier is looking to improve its network voice and data coverage in a given geographic area. The test engineers in this case use predetermined testing routes and a motor vehicle with advanced equipment on board to collect network performance data during the drive.

The KPIs collected include call setup success and failure, call drops, call quality, handovers (the act of transferring a connected cellular call or data session from one cell site to another without disconnecting), data network access, retainability and throughput.

Venue Tests: Venue tests are also used when a carrier is looking to improve voice and data coverage, but the focus is more on a specific pedestrian-oriented location than a wider geographic area. This may include, for example, areas that have high traffic

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such as shopping centers, mass transit zones or arenas. Using custom-designed backpacks equipped with the same advanced equipment as used in the drive test, test engineers walk along predetermined venue routes to collect data.

The KPIs collected are used to assess the voice, coverage and data throughput of the network to help carriers solve the tricky problem of quality coverage in high pedestrian traffic areas.

Crowdsourced Tests: Crowdsourced tests are generally used for supplemental testing and are the least-controlled of the three methods. Using open source software already installed on consumer devices, it can be used to paint a broad picture of network performance.

The KPIs collected here include aggregated speeds of app-loaded devices already in the field including upload and download speeds, latency and other device-specific performance criteria. It must be noted, however, that the lack of control makes it the least reliable method of the three.

Although the debate over standardized testing continues to heat up, carriers must ensure that any benchmarking tests undertaken will result in meaningful data reflecting the true end-user experience. That means ensuring rigorous methods are being used that account for all possible factors that impact performance — from deciding on the right type of testing, to the proper equipment designed to collect network performance data, to developing a consistent and accurate plan for testing, and finally to the methods used in assessing the data collected.

Dr. Paul Carter is CEO of Global Wireless Solutions.

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Speakers at the Tower & Small Cell Summit session about new opportunities in the tower business, from left: Jake MacLeod, president, Gray Beards Consulting; Jeff Lime, vice president, Ventev Wireless Infrastructure; Jose Sola, CEO, Mexico Tower Partners; and Richard P. Biby, P.E., CEO, CoverageCo (and CEO and publisher of AGL Media Group). *Photo by Don Bishop*

Macrosites in the New World of Microsites and Small Cells

Success comes with using the right kind of technology in the right place. Even as small cells and microsites proliferate, macrosites are expected to continue in a key role for years to come.

By Don Bishop

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At the Tower & Small Cell Summit in Las Vegas in September 2014, Richard P. Biby, P.E., CEO of CoverageCo (and CEO and publisher of AGL Media Group, the owner of *AGL Magazine*) spoke at a session about new opportunities in the tower business led by Jake McLeod, president of Gray Beards Consulting. Biby is an RF engineer who traces his start in the wireless infrastructure industry to helping to pick some of the early cell sites when he was 14. He sold his

engineering and regulatory compliance companies to Crown Castle International, where he then worked and for a time served as Crown's chief technology officer. CoverageCo deploys rural microsites on telephone poles in Vermont along corridors and roadways. Biby continues an active involvement in RF engineering and regulatory compliance issues.

What follows are Biby's remarks, edited for length and style.

Looking five years into the future

and beyond, the cell site will be served by fiber-optic cable for backhaul. Other than that, the site will be the same as it is today. It will have power, a lease and backhaul. Someone will have to go out and touch it to maintain it.

What we're seeing now is the beginning of a revolution of sites that are 40 to 80 feet tall that the carriers own, much as they did in the early tower days. "It's mine, I own it, go away." Over time, you'll see the same pushback that there

was in the tower industry. Carriers will have to find where to share these sites, even the shorter sites, and sharing is going to be more practical. If you've already torn up the parking lot and put the fiber in, and you built something that looks like a light pole, why shouldn't there be two or three carriers on it? There's a long way to go toward what will be a sea of additional 60-foot sites.

The wireless infrastructure industry has always been about change. It's going to continue to be different, whatever happens. Take the project that you're afraid of. Take the one you may lose a couple of dollars on, but could learn a lot from. Five years from now, the industry still is going to be good to all of us, the way it has been for 30 years. So embrace the change and, five years from now, hopefully we will all be looking back and saying, "I'm glad I did that."

Small Site Economics

The economics for site development still seem to hold even for microsites. The cost of the base station is 25 to 35 percent of the cost of building the site. For small sites, by the time I do some site acquisition, I do some zoning and permitting and I've figured out what the architecture and engineering plan looks like to be able to build the site, I still have the same rough economics. I'm just not covering as much area. I've got a smaller, cheaper base station. I've got a smaller, cheaper site.

Thus, from what I've seen, the economics still hold even on the smaller sites and maybe up to the

light pole size. I'm not going to disturb the ground. I'm not using tower climbers. I'm coming in with a crane to put a site up. So everything about it is cheaper, and although I'm not getting as much coverage, my cost of building the site is also less. The economics still hold, and there's no doubt that to achieve the necessary capacity, we're going to need a ratio of five, six or seven microsites to one macrosite.

CoverageCo uses small, software-defined base stations and deploys microsites along rights of way and roads in rural Vermont. We have about one site per mile along roadways. We're using fairly inexpensive backhaul. We can deploy with just the traffic on a rural roadway and make it profitable with one site per mile. You couldn't do that in an urban area and expect a 2G voice and data solution to be attractive. It's going to be an LTE solution. But with small sites, microsites, different technologies, different solutions for different areas, there are a lot of different ways to skin this cat.

Planning and Zoning

There's no consistency for zoning with cell sites in the United States. It comes down to the local municipality, and I'm seeing a wide range of requirements across different municipalities. I'm on a communications commission in Loudoun County, Virginia, near Dulles Airport. I've applied for towers there. I lost my kids' college fund one night when the board of supervisors said no.

Conversely, I've seen site applications fly through for sometimes no

Richard P. Biby, P.E., CEO of CoverageCo, at the Tower & Small Cell Summit. *Photo by Don Bishop*

rhyme or reason. We're actually talking about doing an 80-foot single carrier by right in the county. We applied for an electrical permit and a construction permit, and off you go.

It seems as though if a municipality wants the infrastructure, they can certainly make it easier for us to develop, build and deploy it. As the fight with Google Fiber in some municipalities demonstrated, some municipalities embrace it and Google's coming in and building it, and others are not embracing it. If not, their residents and businesses are stuck with DSL speeds. So it's going to be up to the municipalities to decide that they want the wireless infrastructure.

In my municipality, it became pretty clear. Part of the area is urban and everybody has fiber; everybody has Comcast. Where I live in the western part, we are lucky to have little pockets of coverage. And then, the municipality wants to talk about how great it is for educational purposes, and it's trying to give every kid an iPad. But guess what? You can't do it on a countywide

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basis if broadband is not available. In that case, I saw the municipality want to embrace wireless and to make sure that it was available.

It's a hodgepodge of regulation, and it slows us down. When I started the rural project using telephone poles for sites, I found that some utilities want to just embrace it, get it done and take it off their to-do lists. With them, I can apply for a pole and be on it in 30 days. With others, they're still following the state regulations, but it can be 120 days before I'm on the pole.

It's going to change, yet it's going to continue to be a problem. One can hope that as a result of public pressure, either from citizens or publications, municipalities will embrace change and they'll want to see this infrastructure get built, particularly as the radiation heights come down or the pole heights come down. It's less visually unattractive. And it's necessary infrastructure that one hopes the municipality wants.

New Opportunities

Fiber-optic cable represents an opportunity for tower owners that some are not yet exploiting. Bring in fiber or find a way to bring in a host-neutral fiber, if you can, if it's not already there. Plan your sites to be accessible to fiber providers. With some of the towers I've invested in, I watched the staff go crazy with the applications to bring fiber in. I've seen a couple of other companies go in with the host-neutral approach. They bring in one

fiber, put the pedestal in, and everyone can obtain fiber access from one feedpoint. That's been a pretty nice little market.

I've also seen people look at the idea of data caching. As the equipment goes up on the tower, they turn the shelter into more of an edge cache, providing other types of hardware at the site instead of what intrusion had gone into the shelter.

The End of Macrocells?

Rents will be much less for a microsite in a parking lot or in a municipal right of way. At the same time, it won't cost nearly as much for ground rent and operating ex-

> **"** *What we're seeing now is the beginning of a new revolution of sites that are 40 to 80 feet tall that the carriers own, much as they did in the early tower days.* **"**

pense. You probably can make money with one tenant or two tenants, instead of the classic macro monopole that costs $100,000 to $150,000 or more to build.

A macrosite is always going to cover more area, no doubt about it. Depending on where you are, you might see a decrease in a carrier's desire for coverage from a traditional macrosite as microsites and small cells pop up around it. We've seen that with every RF technology that's come along. The first thing

you do when you come out with a new technology is to cover as much ground as possible. And then over time, the sites' coverage areas become smaller and smaller and antenna radiation centers come down.

I don't believe we're ever going to start ripping the traditional sites out of the ground, but the function of today's macrosites probably will change, whether it involves data aggregation, overlay or both. You're also going to see that the requirements or the service-level agreements on the microsites are going to be lower because you don't have as much invested in them and they're not as critical to the network, but they are serving the capacity needs.

You're not going to start taking down your macrosites, and you're going to always want to make sure you have good coverage and good overlay. We're not seeing the end of macrosites, but maybe a little bit of a de-emphasis. Carriers used to have to make sure they had the exact sites needed, and they were willing to pay a lot of money to obtain those sites to complete their networks. Those days are over. But we're not taking macrosites down anytime soon.

The next Tower & Small Cell Summit will be held Sept. 9–11, 2015, at the Sands Convention Center in Las Vegas. The Summit is collocated with Super Mobility Week, a convention owned by CTIA. The Summit is owned by UBM Tech. AGL Media Group provided programming for the 2014 Summit sessions as the conference's content partner.

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Marc Ganzi Shows that Tower Aggregation Still Brings in the Big Bucks

Once a tower aggregator gets past 2,500 towers and more than $50 million in cash flow, it's a different business.

By J. Sharpe Smith

BUSINESS

When Global Tower Partners sold all of its U.S. towers, it might have seemed as though Marc Ganzi left the tower industry. Nothing could be further from the truth. He has been busy rebuilding his wireless infrastructure empire, investing in wireless infrastructure companies, raising capital and aggregating towers.

Success Stories

The tower industry has many success stories among the small private firms and the giant public companies. But Ganzi's new company, Digital Bridge Holdings, which he formed with former Blackstone telecom chief Ben Jenkins, bridges the divide between private and public, taking on the advantages of each. It is, indeed, in a league of its own.

In fact, Digital Bridge has amassed more than a billion dollars in the private markets. It may be the Ganzi halo-effect, but investors continue to be enamored with the prospects of tower aggregation.

Digital Bridge Holdings announced that it has raised $750 million in equity for Vertical Bridge, its U.S. tower arm, through investments by leading institutions, foundations, family offices and individuals, along with Jordan Company and substantial new commitments from Goldman Sachs Infrastructure Partners and Stonepeak Infrastructure Partners.

In September 2014, Vertical Bridge Holdings secured more than $500 million of incremental capital, including new commitments from Jordan, Edgewater Funds, and additional capital from Digital Bridge Holdings. Vertical Bridge also announced that it has closed on a $270 million senior credit facility led by TD Securities, Deutsche Bank and CIT as part of the recent round of capital formation.

Robust Wireless Industry

Ganzi credits the confidence in the robust nature of the wireless industry and the private status of Digital Bridge for its early successful investing.

"I believe we have proven that we can raise capital very fast and efficiently," he said. "I don't know if we could have had the same type of success if we were public. The formation of capital on this scale would not have been possible unless we believed there was still an asset-aggregation opportunity within the United States to buy and build sites and support our customers."

Digital Bridge began in earnest in November 2013, and by the end of 2014, it was managing three separate investments. It has invested in the United States tower market through Vertical Bridge, in the Mexican market through Mexico Tower Partners and in the Chinese tower market through a small local firm.

U.S. Market

Vertical Bridge has been active in the U.S. market, having closed 23 transactions for a total of 1,051 sites as of the first of December. It had plans to close another 22 acquisitions before the end of the 2014.

"Vertical Bridge has very quietly amassed the largest private tower portfolio in the United States," Ganzi said. "We think there is an opportunity to acquire an additional thousand sites in the next six months. We are also building quite a few new tower sites now as well. … I am thrilled that we have gotten our new tower build team up to speed and in full execution mode."

Ganzi has built Vertical Bridge with many of his former operating partners from Global Tower Partners, which itself is known for becoming a tower aggregating giant. Vertical Bridge was founded by Alex Gellman (former president and chief operating officer of GTP), along with Bernard Borghei (former senior vice president of operations at GTP) and Michael Belski, (former senior vice president of leasing and marketing at GTP). Ganzi has also enlisted GTP alumnus Mark Serwinowski (former vice president of IT for GTP) as the chief information officer at Digital Bridge Holdings.

M&A Activity

Ganzi is engaged in the merger-and-acquisition activities at Vertical Bridge alongside the company's senior vice president of mergers and acquisitions, Robert Paige, who formerly ran the TMT (telecommunications, media and technology) banking practice at Brown Brothers Harriman in New York, which speaks volumes about his growth aspirations. "All the critical operational aspects that we had at GTP, we have re-created at Vertical Bridge," he said. "We have rebuilt the M&A practice, as well as our new tower development capabilities, at a very high gear."

Developing a proven management team that has performed well across multiple markets is one of the keys to gaining the trust of investors, Ganzi said. The success of GTP with the sale of its portfolio to American Tower for $4.8 billion looms large in investors' minds.

"Vertical Bridge is a great story for our new investors," he said. "Alex [Gellman] and I have been together for 20 years as partners and there is a depth in the quality of leadership behind Alex. We had a great team at GTP, and that was a unique group of professional managers that achieved great things together — I am eternally grateful to all of them. Thankfully, many of them decided to continue to work with Alex and me again. Investors liked the GTP story and that outcome. Our hope is to deliver again."

Don't expect Ganzi to slow down anytime soon. One of the keys to the tower industry is scale, which allows access to the debt markets in beneficial ways, he said.

"That is something that we particularly excelled in at GTP," Ganzi said. "We were able to have a conversation with the rating agencies that was similar to the public companies. We had great success in raising CMBS (commercial mortgage-backed securities) and ABS (asset-backed securities) debt on terms that were comparable to the public companies."

Different Business

While at GTP, Ganzi and Gellman learned that once a tower aggregator gets past 2,500 towers and more than $50 million in cash flow, it's a different business.

"To really achieve the economies of scale in the tower business, you need to get to a size where you are generating a lot of free cash flow," he said. "One of the secrets to GTP was we were able to access debt instruments and debt pricing akin to the public companies and not be public. That was part of the magic of GTP and, we believe, now Vertical Bridge as well, as being private allows us to aggregate capital quickly and efficiently."

As sold as Ganzi is on towers, he still sees opportunities in other related areas of wireless infrastructure, such as fiber, data centers and small cells.

"Investors really crave the safety and the yield that come from long-term contracted cash flows from investment-grade carriers," he said. "It is a story that transcends towers and is now permeating other asset classes, whether it is fiber, data centers or small cells."

Diversification

Ganzi and his partner Jenkins pay homage to the diversification that John Malone, chairman of Liberty Media and several other giants, achieved in media and cable as he discusses the importance of exploring the different facets that come together to make up the wireless infrastructure ecosystem. He sees opportunities in diversifying into long-haul fiber and cloud sourcing, as well.

"There are a lot of different ways to think about communications infrastructure," Ganzi said. "We are thinking through it carefully as to where they intersect. Investor appetite is really strong for other facets of communications infrastructure. We think there is a lot to be done in the fiber space and in the small cell space."

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Sprint Helps Rural Carriers Build 4G Cellular Networks

Rural carriers use their resources and local knowledge to speed LTE network builds. Sprint brings guaranteed roaming, standardization, and access to spectrum and Sprint devices.

By Don Bishop

BUSINESS

At the Tower & Small Cell Summit in Las Vegas in September 2014, Todd Rowley, vice president of business development at Sprint, spoke at a session about competing with the duopoly in rural markets. The session was led by Jake MacLeod, president of Gray Beards Consulting.

What follows are Rowley's remarks from the session, edited for length and style.

During the past year or more, Sprint has been focusing on wireless partners in rural areas to help accelerate the LTE build out across the country, using rural roaming partners. The Sprint Rural Roaming Preferred Partner program includes 27 carriers, extends 4G LTE coverage in 27 states with a population of more than 38 million people (pops) and encompasses 565,000 square miles. We're looking to continue that effort and accelerate builds in other areas around the country.

Three million square miles of rural territory represents 80 percent of the U.S. geography, home to 15 to 20 percent of the population. In these sparsely populated areas, we seek partners to build and operate 4G cellular networks. We not only bring a certain amount of roaming dollars, we bring soft contributions that help operators build out.

First and foremost, we generally want to start with a rural local exchange carrier or an existing wireless carrier that already has an established base, established assets, access to towers and probably access to backhaul. The partners we seek have a brand, and they have a community of interest in place. That's important because they can share those costs and scale on top of it. A greenfield build today in these markets wouldn't work. Even for our network, we have to look at the pull-through benefit in major markets to justify a build.

Better, Cheaper, Faster

Rural partners are in a position to build 4G cellular networks better, cheaper and faster. Meanwhile, we bring radio-frequency spectrum that saves our partners hundreds of millions of dollars they otherwise would need to spend for spectrum. We can bring low-band, 800-MHz spectrum, among other spectrum positions. We bring an LTE core and access to a Sprint core, again saving lots of money. And we bring access to Sprint's device portfolio to our rural partners. And most important, Sprint brings access to our national footprint at a low roaming cost — low-cost reciprocal roaming — and a guaranteed revenue stream.

What we get is low-cost LTE coverage, upgraded from 1X or 3G in these areas.

We believe the program gives rural partners stability and makes them able to compete with Verizon Wireless and AT&T Mobility. Generally, rural areas only have two operators. Thus, our rural partner would be a strong third local wireless service provider.

Upgrades – Who Pays

Our rural partners generally pay for the base stations, software revisions and maintenance loads that must be part of the LTE upgrade. We spend a

significant amount of time forecasting and calculating as best we can what investments and commitments are needed for three to five years. Some of our deals require the rural partner to remain in lockstep with Sprint. Others don't require that. They're actually free to do it as they wish. That may affect capacity usage and quality of service, but we allow others to make that decision, depending on the extent of the relationship. The more we contribute, the more we would want and require a partner to remain in lockstep. The less we're doing, the less risk we're taking and the more that it's a variable cost deal, the more comfortable we are letting each party decide to upgrade.

Planning and Zoning

We're averaging 12 to 18 months in most of our market builds with planning and zoning, leading up to the launch. Our rural partners do it in half the time at a fraction of the cost seen in urban areas. It first has to do with easier restrictions and zoning and second with their knowledge of the market. They probably go to church and school with the guy in charge of zoning. There's a tighter community, and they're just able to do it faster and cheaper.

Obtaining Resources

When it comes to personnel requirements, attracting the necessary talent to build out and operate the network, we defer to our partners. It's competitive work, subject to supply and demand. We're making it through, although the challenge it represents probably has delayed some projects. Our agreements generally require the partner to build LTE out over 12 to 24 months. So over the

Todd Rowley, Sprint vice president of business development, at the Tower & Small Cell Summit. *Photo by Don Bishop*

next year to a year and a half, you'll see the market areas we announced built out covering 38 million pops.

We bring our pricing models and technology alignment to rural partners, so vendors tend to embrace it because we make their jobs easier with standardization. They don't have to take the time to figure out 200 customized carriers. The program has caused a lot of standardization and technology alignment among dozens of U.S. carriers, not only with infrastructure, but also with devices, handsets and spectrum management, together with interoperability among carriers.

Originally, we looked at building 4G cellular networks in many of the rural areas ourselves. The economics didn't look great. We asked some of our previous affiliates that had done this before, and they said they didn't want to do it because the economics didn't look good to them, either.

We set about to do the math that you have to have to make it work. One factor is that our rural partners have some guaranteed roaming from Sprint. I'm sure our partners would

love to have another roaming partner besides, but at least they have roaming from Sprint, and I'm prepared to make it a fixed fee in some cases, so that they can count on so many years of guaranteed revenue. But that's a small piece of their operating cost. They have to be prepared to have a solid retail store and customer care presence and operate on their own.

Fixed Broadband Revenue

Offering a wireless service alternative is probably not enough. We've worked really closely with the NetAmerica Alliance team and a number of their customers, and we're running some trials on our own. What seems to be the case is that in the rural market areas, carriers need a third source of revenue outside of the traditional model — fixed broadband revenue. Fortunately, because of the low population density, rural operators have access to excess or low-cost spectrum. Their ability to provide fixed broadband service in their low-density areas has much more potential than it would in a congested market area where the spectrum cost couldn't be justified.

From our perspective, providing 4G cellular service in rural areas depends on partnering with someone who already has another business so they can build out LTE more cheaply than we could.

The Tower & Small Cell Summit is owned by UBM, and it is collocated with Super Mobility Week, owned by CTIA. The next Summit is Sept. 9–11, 2015, at the Sands Convention Center in Las Vegas. AGL Media Group provided programming for the 2014 Summit sessions as the conference's content partner.

BUSINESS

YEAR OF THE CLIMBER

By Don Bishop

The program "Cell Tower Deaths" aired on May 22, 2012, as part of the PBS series "Frontline." The episode still may be viewed here: *www.pbs.org/wgbh/pages/frontline/cell-tower-deaths*. Produced for "Frontline" by ProPublica, the episode drew support and criticism for bringing attention to the risk to tower workers and for placing the blame for worker injuries and fatalities where some thought it belonged and where others thought it didn't.

When the FCC and the U.S. Department of Labor invited individuals to speak at last year's Workshop on Tower Climber Safety and Injury Protection, among the speakers was Liz Day. When "Cell Tower Deaths" was produced, Day was the director of research at ProPublica. She now is a senior news researcher for the HBO series "Last Week Tonight with John Oliver," and she is an adjunct professor of journalism at the City University of New York Graduate School of Journalism. The following pages offer what Day had to say at the workshop. The pages also present a viewpoint from Art Pregler, national director of AT&T's civil infrastructure programs, who also spoke at the workshop. AT&T is a company the "Frontline" episode singled out for criticism.

Cell Tower Deaths Result From Dangerous Conditions, Poor Training and Poor Equipment

Safety experts and people who have studied safety in many other industries told researchers that the most change could happen at the top. Safety experts told researchers that the culture from the carriers and the people at the top use what might be called "CYA contracts."

By Don Bishop

On Oct. 14, 2014, Liz Day, an adjunct professor of journalism at the City University of New York Graduate School of Journalism, spoke at the Workshop on Tower Climber Safety and Injury Protection conducted at FCC headquarters in Washington. She previously was director of research at ProPublica where she worked with "PBS Frontline," investigating the deaths of workers who build America's cell tower network. The following are her remarks, edited for length and style.

In 2012, when I was its director of research, ProPublica published a documentary with "PBS Frontline" and a lengthy series on cell tower deaths. In order to do that, we spent more than a year researching the industry and all the accidents we could

find. It entailed about 100 telecom tower deaths from 2001 to 2012. We pulled the OSHA investigation reports, we pulled autopsy records, we searched for lawsuits, we interviewed victims' families, and we talked with tower company owners, co-workers and eyewitnesses to try to identify themes on why accidents happened.

Hundreds of Interviews

We also wanted to look more broadly at the industry, so we interviewed hundreds of tower climbers, the most important people, the people who know this industry the best. We also talked with tower company owners, construction managers, turf vendor executives, carrier executives, safety experts, lawyers, current and former OSHA officials, and stakeholders at every

layer of the industry.

We published our investigation in 2012. In early 2014, we did a follow-up looking at the spike in accidents in 2013 and 2014, and also discussed why and how OSHA has changed its approach to policing the industry.

Of the 100 telecom deaths, 50 were on cell towers. What we saw again and again were deadlines, and that seemed to differ from qualitative research in other industries. We would see deadline pressure cited bluntly in an OSHA report as an OSHA inspector writing, "time, money, go faster," in the notes. We saw it from talking with co-workers and company owners who said, "We had to work from 8 a.m. to 8 p.m., 10 days straight. We had to work overnight with head lamps. We were working in dangerous conditions because we had to meet deadlines that were set

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by company owners, that were set by turf vendors, and that were set by the carriers at the top."

In addition to deadlines, we also saw poor equipment. We saw it in too many deaths. We saw a 10-year-old harness that was caked in rust found on a worker who had fallen. There's no reason anyone should be using an expired, outdated harness that isn't working. We saw people using hooks that were missing safety latches. We saw all sorts of equipment that never should have been used.

In addition to that, the third element that we saw often with accidents was poor training. That could be anything from workers saying, "I was never trained, and I was put up on a tower," to people saying, "Yes, I was trained, but I watched a video and I circled some multiple choice answers correctly. That was the extent of my training."

Narrow Escapes

Fatalities are reported, but narrow escapes and many serious injuries are not documented. From talking with workers, you do hear that injuries and near-misses happen more often than anyone would like. It's someone making a bad decision or having a slip or dropping a piece of equipment and it just misses striking someone who is on the ground.

This year, OSHA started requiring employers to report when one worker is hospitalized as a result of a job-related injury. Prior to this year, reporting was required only when three or more workers required hospitalization as a result of an incident.

It rarely happens in the tower industry that three workers must be hospitalized for related trauma.

The first step toward understanding the causes of injuries is collecting data to learn how often they happen, why they happen, and so forth. Without suitable data, it's difficult to say much about causes or ways to prevent serious injuries. The best we can assume is that they are similar enough to what we know from studying fatalities.

I would love it if OSHA published

> *We saw a 10-year-old harness that was caked in rust found on a worker who had fallen. There's no reason anyone should be using an expired, outdated harness that isn't working. We saw people using hooks that were missing safety latches. We saw all sorts of equipment that never should have been used.*

more data online. OSHA has a new initiative to collect more data after an accident and identify other companies involved in the management layer and carriers. I hope they will publish that data and put that online because right now, in OSHA's database, if you query the names of prime contractors or wireless carriers, no death will show up. You have to know the subcontractor. It's difficult to ob-

tain data. I would love it if the names or the dates of accidents were also more fully available through OSHA. One thing that we did was to use Freedom of Information Act requests to obtain OSHA investigation reports of all of the deaths.

It would be advantageous if OSHA extended access to the public, so after an accident, everyone could read the investigators' notes and see comments on the weather, the time and equipment, and be better informed and make decisions themselves.

Federal law and OSHA regulations place the responsibility for worker safety on the employer. That's not as clear as it sounds because sometimes there are multiple layers of employers as represented by contractors and subcontractors. When we looked at the industry, we wanted to talk with stakeholders at every level. We talked with many climbers and company owners. We talked with turf vendor executives, general contractors and people in the middle management layer. And then we also talked with the carriers and the tower owners at the top who ultimately are the ones bidding out the work. You can discuss and debate the definition of control, but they are in essence controlling the work.

CYA Contracts

What we learned from talking with people in all of these layers and also from analyzing contracts was that there was only one time (that we saw) when someone tried to sue a carrier on behalf of a family of a tower worker who died from job-related injuries. Analyzing the

legal filings and arguments made in that case revealed what safety experts who reviewed our documents also told us, and that was that the culture from the carriers and the people at the top is to use what might be called "CYA contracts." They have their general contractors and turf vendors sign contracts that say, "We agree to do work safely. We will do drug tests. We will do background checks, and we will ensure that everyone's trained."

Contract Not Enough

Wherever it is in the system that this approach to ensuring safety breaks down differs in every accident, but what we did see over and over again was that signing the contract did not ensure that people were well-trained or that people were drug-tested or that people were wearing proper equipment and working safely. Whose ultimate responsibility is that? People have many different opinions.

What safety experts told us was that the people at the top have the most control to change everything. If you want to just try to weed out bad contractors at the bottom, it's a game of whack-a-mole. You're never going to really have systemic change. But the people at the top who are ultimately paying the bill and have control over who is doing the work could do more to change the whole system by not hiring unqualified contractors and contractors that do not comply with safety requirements that would protect their workers, thus putting an end to fatal injuries.

We saw instances where the company was fined for having safety violations after an accident investigation. We would find the company was back

working shortly thereafter for other carriers or even for the same carrier or tower owner they were working for when the accident occurred. Why was that happening? What we were told was, "Well, we don't know why, but we have our middle-management firm sign a contract saying that they vet these companies at the bottom." There's some breakdown there.

We would also hear from construction managers and project managers in the management firms that were supposed to be overseeing the safety and providing oversight for the workers at the bottom that there was no way they could check on all of these sites that they were supposed to be randomly inspecting. And also sometimes they would show up and it wouldn't be the contractor they were expecting on-site because the company that got the bids subcontracted it out. Sometimes because of multiple contractor and subcontractor layers, the construction and project managers don't know who's on-site.

Change from the Top

Did the companies whose employees actually were performing the work sign a form saying, "We did a safety checklist before we climbed the tower"? Sometimes they did; sometimes they didn't. Although there is some responsibility at all of the different layers, we've been told again and again by safety experts and by people who have studied safety in many other industries that the most change could happen at the top.

One of the important themes that people brought up again and again during our year-long investigation was that there's not enough skin in

the game at every level. If a worker dies, the effect is felt more heavily at the bottom, through his family and through the owner of the company that he was working for. But when you move up through the layers, there's not as much liability or responsibility from different companies in that contracting chain.

Statements

What we heard from safety experts is that something — whether it's OSHA fines, legal liability or transparency to the public when there's an accident — would have more effect if it were clear that the accident was not an isolated incident from "Joe's Towers," but instead it also involved companies that you may know of and that you may subscribe to for your cell service. Another thing that we heard again and again was the desire on the part of victims' families for more public transparency with data. What I often heard from victims' families was, "We just want people to know when they use their phone that my brother died working at towers so that your cellphone can work."

It's important that the work tower climbers do and the incredible risk to which they expose themselves every day should be better understood by the public. As part of that, OSHA can be a powerful force in making its data more public, collecting more variables and sharing the information so it isn't up to researchers doing news-clip searching and interviewing people to obtain the number of workers who have died in the past 10 years and how many more have been on cell towers versus telecom towers, or how many injuries there have been.

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/ **YEAR OF THE CLIMBER** /

What AT&T Does to Ensure Tower Worker Safety

Four themes underpin AT&T's tower worker safety program. The company builds safety into its contracts, selects contractors carefully, reviews contractor safety programs and works with industry partners, including trade associations.

By Don Bishop

On Oct. 14, 2014, Art Pregler, national director of AT&T's civil infrastructure programs, spoke at the Workshop on Tower Climber Safety and Injury Protection conducted at FCC headquarters in Washington. The following are his remarks, edited for length and style.

I was asked to provide the carrier perspective and explain what the carriers can do to improve tower safety. I cannot speak for other carriers, but I can tell you what we've done at AT&T to create conditions that we believe enable climbers to be safer. We believe these practices, along with our comprehensive program, have contributed to our excellent safety record for the past several years. We've been able to maintain our safety record during a period when the annual number of jobs requiring tower climbs has increased more than 600 percent.

There are four main themes that underpin our safety program. Number one, we build safety into our contracts, and we align our contracts with our programmatic approach to safety. Number two, we are deliberate in our choice of contractors. These contractors are supplemented with our tower crew augmentation program (TCAP) to ensure that contractors are not stretched too thin. It's a program for a few selected vendors to train, certify, equip and stage large numbers of well-qualified first-year tower crews. Number three, we review and validate the safety programs of our contractors. Essentially, we inspect what we expect. And number four, we work with our industry partners such as the National Association of Tower Erectors and PCIA, which offer great forums to create and design flexible solutions.

When it comes to subcontracting, it's not so much that we're discouraging subcontracting. It's that we have a portfolio of options, and we use whichever one is best for the situation. For example, we have employees who climb towers. They've been climbing towers for more than 50 years, and I'm not aware that we've ever had a fatality at AT&T with an employee tower climber. We also have direct contracts with vendors for tower crews, not subcontracting, and we have more than 5,000 tower climbers available to us at the first-tier level, from our turf vendors and from other contractors that we have direct contracts with.

We allow subcontracts at that level, but we hold our first-tier vendors accountable for those subcontractors. We put damage clauses in our contracts that come into play when there's an unsafe condition. We regularly review the safety programs of each of our vendors. If an unsafe

practice is being done, we can and do remove work from the vendor. That's a very powerful incentive. We also remove vendors completely from our program, and we impose stand-downs when conditions warrant for an unsafe practice.

At AT&T, we don't just say, "These are the standards, follow them." We also follow up to ensure that the standards are being upheld. We measure, monitor, report and review the vendor performance against standards, specifically safety. We review their programs on a regular basis. We look at the training that they're providing their employees and their subcontractors, specifically what types of training, how often are they training and the results of that training.

Not Too Much Haste

We look at the incident reports. Vendors are required to report all incidents to us. In addition to the reporting that they give to us, we have our own alternative methods of tracking incidents. Then, we review what we're getting from other sources against what comes to us from our vendors to ensure that we have accurate reporting. We monitor the amount of time that the tower crews spend on the tower to make sure that they're not being too aggressive. We have controls in place, and we measure vendors against each other using standards such as how much time we believe it should take to do specific tower work, to ensure that they're not going too fast.

I look forward to working with all the stakeholders and the folks in the industry to make it a safer place for our tower climbers.

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Ouch! OSHA's First Aid Requirements Can Sting

Uncertainty about so-called voluntary permissible exposure levels makes it difficult for employers to craft safety programs to meet OSHA's expectations. Meeting OSHA's own rules may not be enough.

By Mark A. Lies II, Kerry M. Mohan and Ilana R. Morady

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Unfortunately, accidents happen at work. No matter how thorough an employer's training program may be and how much personal protective equipment an employer requires, employees still get injured. Because injuries happen at work, OSHA requires employers to make first aid and medical services available to their employees. This article addresses OSHA's first aid requirements, issues employers may encounter with first aid, and how first aid may implicate an employer's recordkeeping obligations.

General Industry Requirements

Under OSHA's general industry medical and first aid regulation, employers must ensure that either medical treatment for all injured employees is in "near proximity" or that a person at the workplace is "adequately trained to render first aid." See 29 CFR 1910.151(b). In other words, if medical services (e.g., a hospital) are not close by, then employers must ensure that someone at the workplace has first aid training.

Naturally, the most common question employers have is, "What is 'near proximity'?" The answer is, it depends. OSHA takes the position that "near proximity" in cases of serious hazards and injuries — such as falls, suffocation, electrocution, or amputation, and stopped breathing, cardiac arrest, or uncontrolled breathing — means a three- to four-minute response time. For employers in lower-hazard settings, such as offices, OSHA has stated that up to a 15-minute response time could be acceptable. Thus, "near proximity" depends primarily upon what types of injuries an employer can reasonably expect in the workplace, but other relevant factors include the location of the workplace, how much time it takes to reach medical attention, traffic and weather, geographic distance from medical care, travel distance from medical care, whether employees are provided with a means of calling for help in an emergency (e.g., a phone to dial 911), whether employees have a means of transportation available, and whether the employer has notified or has made arrangements with local emergency response units.

Employers should consider what types of injuries could be reasonably anticipated at their worksites in addition to the other factors mentioned. Part of this analysis can include evaluating OSHA 300 logs and workers' compensation claim histories at the worksite. If an employer determines that medical services are not in "near proximity," then first aid training must be provided to ensure that someone with such training is available during all shifts.

First aid training is typically provided through organizations such as the American Red Cross or private institutions. It refers to medical attention that is typically administered immediately after an injury occurs. It usually consists of one-time, short-term treatment and requires minimal technology and training, such as cleaning minor cuts, treating minor burns, applying bandages and using nonprescription medicine.

First aid does not include CPR, but many employers choose to offer CPR training. First aid does not include the use of automated

external defibrillators (AEDs), but employers should consider providing them in the workplace, given their life-saving capabilities.

Moreover, throughout the country, Good Samaritan laws and, in some jurisdictions, the workers' compensation laws, serve to protect employees from potential liability in connection with the use of AEDs. If an employer chooses to provide an AED in a workplace, it should be sure employees are trained to operate the device in accordance with state law. Regardless of the topics covered by an employer's first aid training, employers should make sure training consists of documented written and practical tests.

Employers should also ensure that first aid training is tailored to the worksite. For example, if employees work outside, then first aid training should include how to treat injuries arising from temperature extremes, such as how to respond to heat exhaustion and heatstroke. The training program should be periodically reviewed and updated with current first aid techniques and knowledge. Employers should remember that first aid certificates typically expire after several years. OSHA recommends that employees receive first aid skills and knowledge retraining and updated certification cards every three years.

OSHA's general industry medical and first aid regulation also mandates employers to ensure that "adequate first aid supplies [are] readily available" in the workplace (see 29 CFR 1910.151(b)). Employers should be mindful that the meaning of the word "adequate" depends on the workplace. Accordingly, employers should evaluate the kinds of injuries that

occur in their workplaces when deciding on the contents and quantity of materials in a first aid kit.

Another important facet of first aid pertains to its location. The first aid kit must be "readily available," that is, easy to access in the event of an emergency. This issue is often relatively simple at fixed facilities, but can become more complicated when employees work off-site or drive in company vehicles. In situations like these, employers cannot forget that a first aid kit should be "readily available." Accordingly, if employers have, for example, delivery truck drivers, it is recommended that these employers equip their trucks with first aid kits.

A question that many employers ask is how to prepare for injuries that may occur due to an employee's pre-existing or unknown health condition, such as an allergy, epilepsy or a cardiovascular condition. It is essential for employers to remember that requiring employees to disclose health information can run afoul of the Americans with Disabilities Act. Employers can, however, request employees to voluntarily inform their supervisors if they feel that they cannot safely perform a certain job or task because of a health condition, and also to immediately report when they feel ill or have been injured. This can help employers plan for potential emergencies. If employers encourage self-disclosure, they should be mindful to avoid asking employees about the actual health conditions beyond what is necessary to take action to protect the employee's health and safety.

Construction Requirements

OSHA's construction standards have many of the same first aid requirements already discussed. For instance, the

construction standards require that an employee at the worksite be trained in first aid when medical care is not "reasonably accessible" (see 29 CFR 1926.50(c)). The construction standards also require that first aid materials be "easily accessible" (see 29 CFR 1926.50(d)(1)).

However, unlike the general industry standards, the construction standards require that the first aid materials be stored in a waterproof container, that each item in the container is individually sealed, that the employer checks the first aid kit every time the kit is sent to a worksite, and that while on the worksite, the first aid kit is checked at least weekly to ensure that used items are replaced (see 29 CFR 1926.50(d)(2)).

The construction standards also require that when an employer is unable to contact an ambulance service, the employer must provide equipment for the "prompt transportation" of an injured person to a physician or hospital (i.e., backboard and vehicle) (see 29 CFR 1926.50(e)). Further, on worksites where employees may be exposed to corrosive materials, the employer is required to provide "suitable facilities" for the quick drenching or flushing of the eyes and body for immediate use (see 29 CFR 1926.50(g)). Thus, the question is what constitutes a "suitable facility"? In short, if the facilities are insufficient to treat an exposed employee for the particular corrosive materials, the facilities are noncompliant.

State-specific Requirements

In addition to federal OSHA's first aid requirements, employers must be aware of state-specific requirements that may impose additional obligations upon employers. For instance, under California OSHA's General Industry Safety

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Orders, an employer's first aid materials must be "approved by [a] consulting physician" and that approval must be in writing (see Cal-OSHA GISO § 3400(c)). Thus, Cal-OSHA requires employers subject to its General Industry Safety Orders to "consult" with a physician in evaluating what materials to include in their first aid kits.

Employers must also be wary of what materials they include in their first aid kits. For instance, many employers make available to employees single-dose medications such as Tylenol or Advil. However, under Cal-OSHA's Construction Safety Orders, if an employer has more than basic first aid equipment in its first aid kit (e.g., bandages), such as "drugs, antiseptics, eye irrigation solutions, inhalants, medicines or proprietary preparations," that additional equipment

must be approved, in writing, by an employer-authorized licensed physician (see Cal. Osh. CSO § 1512(c)(3)).

These are just two examples of state-specific requirements that employers may face with regard to their first aid kits. Accordingly, employers should evaluate what states they do business in to determine what additional requirements, if any, they must follow to avoid potential liability.

First Aid Recordkeeping

Employers should be aware how the type of first aid or medical treatment provided to employees can complicate their recordkeeping obligations. OSHA requires employers to maintain an OSHA 300 log and supporting 300A and 301 documents for all work-related illnesses and injuries. Relevant to

the current discussion, OSHA deems a work-related injury or illness to be recordable, in part, when the employee receives medical treatment beyond first aid (see 29 CFR 1904.7(b)(1)(iv)).

Although OSHA's recordkeeping regulations define the terms "medical treatment" and "first aid," the distinction between the two can be confusing. For instance, suppose an employee injures a knee while on the job and sees the company nurse or physician. If the medical professional gives the employee "a non-prescription medication at non-prescription strength" (e.g., two Tylenol pills), then that would be considered first aid and the injury would not be recordable. However, if the medical professional gives the employee three Tylenol pills instead of two, OSHA may find that the employee received "medical

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treatment" because the employee received a "prescription strength" dose.

Other examples where the line between "first aid" and "medical treatment" can be crossed include the use of oxygen, even if precautionary, the use of numbing or antibacterial eye drops, the use of certain skin creams, the use of rigid versus non-rigid splints, and the use of medical glue to close a cut.

Recommendations

To avoid potential liability related to first aid, an employer should consider the following actions:

- Conduct a job hazard analysis of the facility or worksite to determine what hazards exist and what injuries or illnesses could arise.
- Once the job hazard analysis has been completed, consider what type of first aid materials should be maintained at the facility or worksite.
- If the employer is located in California or another state that requires physician consultation, consult with a physician regarding what materials should be included in the first aid kit and obtain verification of that consultation in writing.
- Evaluate what medical services are reasonably accessible to the facility or worksite. If medical services are not reasonably accessible, the employer should provide documented first aid training to a select group of employees at the facility or worksite and ensure coverage throughout the entire workday, including the off-shift.
- Develop a written procedure that documents the company's first aid procedures and mandatory employee first aid training and retraining.
- Ensure that the first aid certifications of the first aid providers are current.
- Evaluate the type of treatment

employees receive in response to a work-related injury to evaluate whether the injury must be recorded in the OSHA 300 Log and supporting 300A and 301 documents.

If an employer undertakes these actions, it will minimize its potential liability as it relates to first aid and its implications.
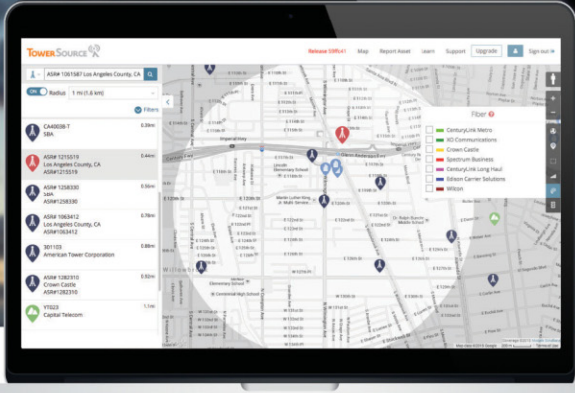
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SAFETY

/ **DEPARTMENTS** /

Product Showcase – Tower Lighting Products

PRODUCT SHOWCASE

Beacon Lamps

H&H Industries Task-Master Code Beacon lamps are made to provide an extra measure of protection against tall tower air traffic hazards. The bright lamps are life-rated for up to 8,000 hours. All lamps are covered by a one-year warranty. The lamps feature a weather-resistant hard glass envelope that stands up to rain, sleet, snow, physical impact and thermal shock. The lamps also feature a rugged filament design, a built-in reflector disk, a nickel-plated brass base, wrapped lead wires, a spring steel arbor and special lead wire supports.
www.lightsbyhh.com
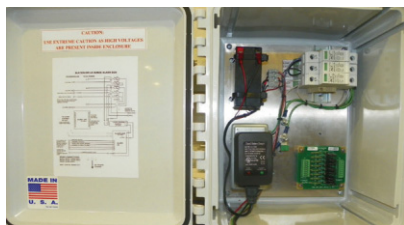
Lightning Surge Protection for Tower Lighting

FAA obstruction light OEM and distributor **Slatercom** offers the LB Series surge protection system. The system is provided in a 12-inch by 10-inch polycarbonate enclosure and includes 40-kiloampere surge devices to effectively absorb transient high-energy pulses that may be conducted from tower-mounted light fixtures or from nearby lightning strikes. Full power line protection and lighting fixture wiring are routed through the LB protection system prior to entering the lighting controller, thus absorbing the majority of surge energy. Systems are custom-manufactured for use with any new or existing lighting systems.
www.slatercom.com
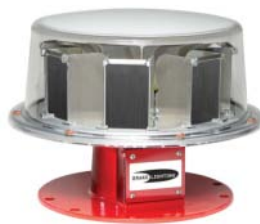
LED Lighting System

Drake Lighting's Mallard series is a line of FAA-certified LED tower lighting systems that have just one two-conductor wire to each beacon, marker and photocell. The systems are provided in a kit box to make ordering and handling the lighting easy. It features two conductor wires with no polarity; one-size cable for beacon, markers and photocell; high-powered LEDs driven at low current levels for maximum life; standard 13¼-inch bolt circle; a controller and power supply that are located at ground level; and FAA required monitoring (dry contacts). The lighting systems, weighing 24 pounds each, measure 19 inches by 14 inches and consume approximately 60 watts per day and 20 watts per night. They feature at least 10 years of lamp life and a five-year warranty.
www.drakelighting.com

LED Obstruction Lighting System

The **Dialight** Class I/Division 2-certified FAA-approved SafeSite integrated LED obstruction lighting system is for medium-intensity installations. The system includes Dialight's patented CID2-certified SafeSite L-864/L-865 dual red/white flash head, CID2-certified L-810 red side markers, CID1/CID2 integrated power supply/controller and CID2 long-life photocell. The system is covered by Dialight's five-year warranty.
www.dialight.com

LED System

Flash Technology's Vanguard II LED lighting system is more robust and easier to install than previous iterations. Standard features include a verified 25-kiloampere surge suppression rating, DC and AC power versions and LED bypass circuitry. Options include various monitoring protocols, including SNMP (Simple Network Management Protocol), and infrared (IR) LEDs for better visibility to night-vision goggles. The lighting system is available in dual, white and red configurations for domestic and international use.

www.spx.com/en/flash-technology

LED Warning Lights

The American-made Horizon LED series of warning lights from **Hughey & Phillips** is designed for use on new and existing structures that require aircraft warning lights. For retrofit applications, the warning lights can be installed with existing cable on the structure. The lights are available in red (L-864), white (L-865) and dual (L-864/865) medium-intensity lights. The dual-LED system provides daytime white and nighttime red in one compact unit weighing less than 20 pounds. It features a self-contained power supply with available

GPS sync and photocell. The internal GPS/photocell simplifies wiring and also accepts external signals. Other features include advanced LED modules, built-in alarm relay, cutting-edge community-friendly Eclipse optics, individual LED monitoring, active lightning protection, built-in test and microprocessor control. The units can be serviced and repaired in the field.

www.hugheyandphillips.com

High-intensity LED lantern

Avlite offers the L-864, a lightweight, compact, self-contained FAA-certified L-864 lantern with progressive optics using high-intensity LEDs to maximize light intensity and uniformity. The lantern features the highest operating efficiency by reducing energy consumption and eliminating maintenance expenses. The lantern is available in universal AC or DC and will accept voltages between 110 volts and 240 volts AC and 12 volts and 48 volts DC. The lantern is fully self-contained, unlike other obstruction lights, and requires no external control and monitoring enclosure. The 12-to-48-volt DC version is easily solarized with an Avlite solar-power supply. The lantern is also well suited to marking obstacles where no power is available. Optional GSM monitoring is available as well as GPS synchronization for flashing multiple obstruction lights in unison.

www.avlite.com
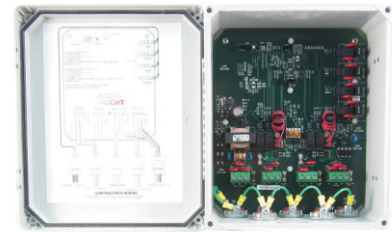
Lighting Controllers

Farlight's NV series of LED obstruction lighting controllers allows site operators to reliably monitor the latest low-power LED beacons and marker lights. Farlight manufactures alarmed controllers that operate from 100 volts to 277 volts AC, as well as 12 volts to 48 volts DC. Models are available to match all common tower configurations. They feature strong surge protection on all outputs and inputs, plus an array of alarm contacts to report on all aspects of system health. The controllers are compatible with all Farlight LED obstruction lights, as well as most other LED obstruction lights.

www.farlight.com

Dual Medium-intensity Beacon

The L864/L865 dual medium-intensity obstruction beacon from **OTL** is made of corrosion-resistant aluminum and glass. Routine maintenance of the beacon can be performed on the tower with a single wrench. The LED arrays can be replaced in minutes in the event of failure. In the unlikely event that an LED array needs replacing, the controller tells the service technician which array failed.

www.otlsolution.com

PRODUCT SHOWCASE

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