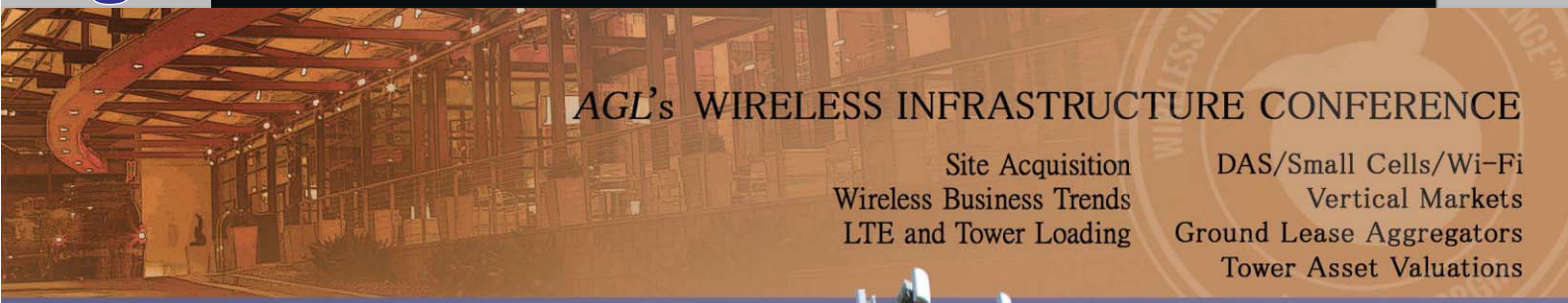

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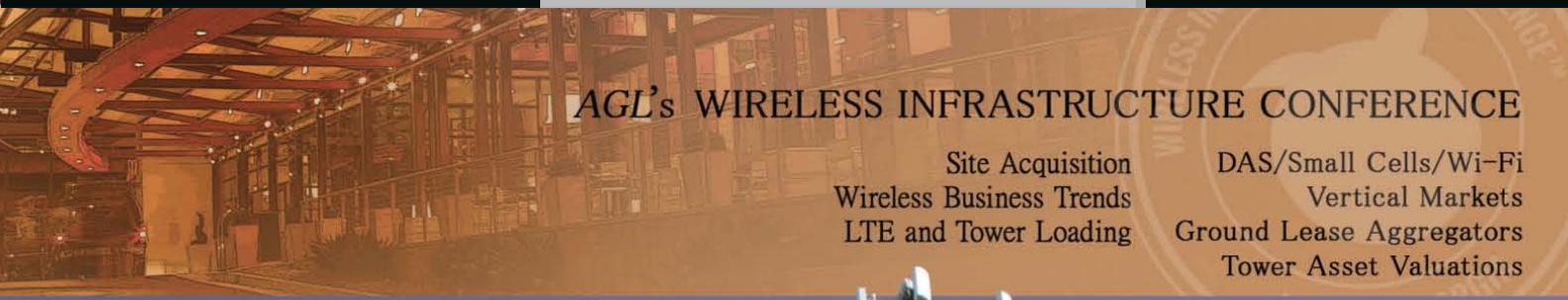

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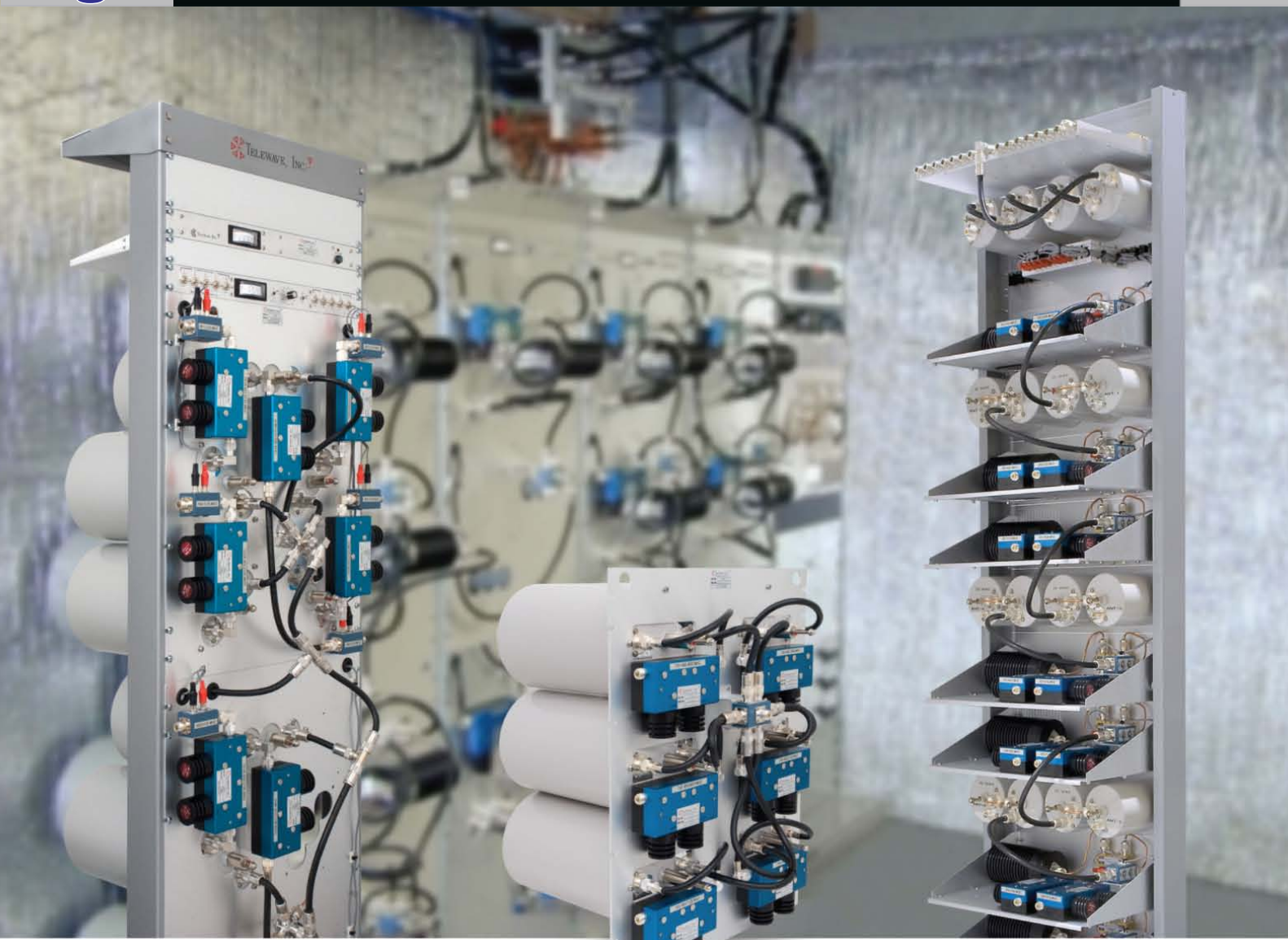

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AGL CONFEREN VISITS ATLANTA

on the cover

A combination of antennas mounted on booms and flush-mounted antennas adorn a tower owned and photographed by SSC, a company that provides services to the telecommunications, development and construction industries.

Cover design by Scott Dolash

AGL's Wireless Infrastructure Conference — Atlanta

With reporting and photography by Don Bishop, plus an article by Will Heiden, P.E., *AGL* covers educational sessions conducted at its Atlanta conference. Section design by Scott Dolash.

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editorial comment

Deemed Granted

The FCC antenna siting shot clock could become a tower developer's dream.

The FCC adopted the shot clock in November 2009. The shot clock sets deadlines of 90 days for collocations and 180 days for all other applications for wireless network antenna permits. Issued as a declaratory ruling, the shot clock applies to state and local jurisdictions.

When CTIA petitioned the FCC to ask for the shot clock, CTIA asked for deadlines half the length of what the FCC set and requested that if applications had not been finally acted upon by that time, the applications should be "deemed granted."

The FCC did not rule that way, and instead said that when the clock ran out, applicants could take their cases to court. In the meantime, the city of Arlington, Texas, and others sued the FCC to overturn the shot clock ruling. In a fresh decision, the U.S. Supreme Court upheld the antenna siting shot clock.

FCC Commissioner Ajit Pai said he favors language for the shot clock that would deem an application to be granted if the clock runs out and final action for the application had not been taken. In light of the court ruling, he said that it is incumbent upon the FCC to study the issue and make sure states and localities, along with the federal government, are standing out of the way and letting wireless infrastructure be deployed, especially in dense urban environments.

Pai said that although it should be within the FCC's power to act now to add a deemed-granted statement to its declaratory ruling, it would be better if the agency proposed new rules and accepted public comment.

"Theoretically, I guess we could issue a decision sooner rather than later, but given the fact that a lot of time has passed, I think it would be nice to make sure all the current commissioners have input, get public input, and get everyone on the same page," he said.

Pai made his remarks while being interviewed by Patton Boggs attorney Kevin J. Martin, who is a former FCC chairman. You can read the interview starting on page 10.

It may be a long way to a done deal, but Pai is opening the door. Beyond it may lie a tower developer's dream.

AGL conference

This issue offers extensive coverage of the *AGL* Wireless Infrastructure Conference conducted in Atlanta by *AGL* Regional Conferences. Thank you to the speakers who made the conference successful. We'll tell you who they were, and you can read some of what they had to say. Nothing beats the in-person experience, though, and I hope you can attend the next conference in Chicago on Sept. 19.

We thank the sponsors who make the conferences possible. In the ad on page 60, you can see who many of them are, and you can find them on the conference web page, *www.agl-mag.com/events*.

Thanks go to the team that puts on the conference, including J. Sharpe Smith, editor of the *AGL Bulletin* and the *DAS Bulletin*, who also is the conference chairman who prepares the session topics and invites the speakers. Traci Gregory of Transforums led the sponsorship sales, site selection and contract negotiations. Mercy Contreras, sales director for *AGL* magazine, the newsletters and website, assisted with sponsorships and registration — and just might have talked with some of the sponsors about advertising, as long as they were there. Solution Seven, led by Patricia Troxell-Tant, provided marketing and business development services along with conference program development and hosting. ■

By Don Bishop, Executive Editor
dbishop@agl-mag.com

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publisher's note

Dawning of a New Challenge

Working in Vermont has been such fun during the past year or so. I still can't believe I get paid to go see such a beautiful area of this country. Of course, I also can't believe so many locations are lacking cell service, STILL! Oh well, that leaves more opportunities for all of us. Of course, it would be so much easier with better and faster backhaul and with more things to stick antennas on, but that's a story for another time.

Photograph courtesy of mikefosterphotography.com

Driving down the roads in rural Vermont in mid-summer is a little depressing when I put my "RF eyes" on. I've been designing roadway coverage in some pretty remote areas, not the traditional, high-site tower model. In late June, I finished planning a new corridor, which involved looking at the difficult RF environment. We small-site (microsite) folks are going to face so many new and interesting challenges. Low transmit heights mean we are actually immersed in the surrounding clutter, not shooting down from above the clutter. Low power lowers the cost and reduces the concerns (and, hopefully, the regulatory requirements and public worry) about RF exposure and greatly reduces the coverage radius, thus requiring many more transmitters. Yep, that's what a micro/small system encounters, particularly at low transmit heights. There are a lot of leaves on them trees, and radio signals sure don't care much for those leaves.

Unfortunately, all indicators are that we will be trying more and more in the near future to put our transmitters down at street level, where we have to worry about things at a different scale. Propagation models and predictions are not so good at this middle ground between macro sites and indoor Wi-Fi. This use of 4 watts to 40 watts of effective radiated power at antenna heights closer to that of light poles is going be a learning experience. As a former software developer and propagation model tweaker, I'd say this is the dawning of a new challenge. I'll pull out my old FORTRAN manual and see what I can remember.

Here's a fun topic for RF engineers and for project managers who have to work with us RF folks: Intermodulation interference to LTE operations emanating from nearby FM stations. As an old broadcast engineer, I still read a number of the publications and am a fan of Barry Mishkind's *The Broadcasters' Desktop Resource*. An article about LTE operators filing complaints at the FCC that FM transmitters were causing interference to the LTE system caught my eye. Here's a link to the article: *www.thebdr.net/aticles/rf/site/LTEjoy.pdf*. It turns out that the 7th harmonic of some FM transmit frequencies is also an LTE receive frequency. The 7th harmonic! The interference signal (called a product) gets weaker as the degree of the harmonic increases. The 7th harmonic is about 2 or 3 degrees past what we would normally want to see analyzed. That is a weak signal, getting far into the noise, but that is exactly where LTE receivers are listening.

This indicates to me how important a good-quality intermodulation analysis is. Having run hundreds, if not thousands, of intermodulation studies myself over the years, I know the challenge of getting the right output and warnings of a potential problem is always finding a way to get the right input. To perform a proper study, you need to know exact frequencies, antenna models, transmission lines, and combiner and filter characteristics. I doubt that a truly complete intermodulation analysis has ever been run. There are simply too many variables. However, as a good practice, the analysis can help to identify the potential for interference. It is never going to eliminate the possibility, but it does provide a good means for knowing whether additional steps will be required or if it would be necessary to keep an eye out for interference.

Here in northern Virginia, we are preparing for the Japanese invasion — actually, at the *AGL* office in Kansas City. It looks as though Softbank has won the bid for Sprint, and Charlie Ergan is going to have to regroup before the next assault. I have to admit, I was rooting for Charlie. At least he would have shaken things up, and it was likely to have been more fun than what Softbank probably will do. Sprint is finishing up the Network Vision project, and the network is looking good. Around here, some of the old Nextel folks had a wake on the last day of June 2013, which was the last day of the iDEN network. I was in Europe, catching up on how things get done on that side of the pond. Interestingly enough, I seem to remember the last day of AMPS, the first day of CDMA network operations, etc. Some people remember time by their kids births, house locations, etc. Not me. The last day of iDEN is my current major reference point. ■

By Rich Biby, Publisher
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FCC Commissioner Ajit Pai Talks Wireless Infrastructure

By the AGL Staff

During a plenary session at the Tower & Small Cell Summit conducted in March in Las Vegas, Kevin Martin interviewed Ajit Pai. Martin is a former FCC chairman now in private practice with the Patton Boggs law firm. Pai is an FCC commissioner. Audience members also asked questions. Here are their remarks, edited for length and style.

Martin: The U.S. Supreme Court made a decision in the *City of Arlington* case involving the FCC shot clock that has implications for the tower industry and the FCC. What is your reaction?

Pai: It is a fundamental decision for the wireless industry and the FCC. The court affirmed what the FCC decided to do in 2009, which was to interpret its authority under Section 332 of the Communications Act to adopt a shot clock for siting decisions by localities on siting applications in 90 days for collocations and 150 days for all other applications. The court said that the FCC deserves deference from the judicial branch when deciding the scope of its authority. That's a fundamentally important principal for the FCC written large across the administrative law landscape and especially with the process of deploying wireless infrastructure. The process is fraught with peril at the state and local level. Many states and localities have adopted moratoriums or otherwise have ignored the shot clock for antenna siting applications. The Supreme Court's decision streamlined the application of the shot clock to wireless infrastructure.

Martin: You've talked about the importance of wireless infrastructure for connectivity and for the growth of the economy. How do you see some of the restrictions placed by local and state governments on the ability to deploy the infrastructure?

Pai: Traditionally, everyone thought of the wireless industry as just devices and big, macro cell site towers. Given the ubiquity of devices and the challenges that consumer demand places on the industry, it's not enough to simply talk about radio-frequency spectrum and forget about infrastructure. Infrastructure is a vital part of the equation. Last July, I visited with entrepreneurs in San Francisco who were focused on creating mobile applications for devices. They talked about video optimization and mobile cloud computing.

FCC Commissioner Ajit Pai (left) responds to a question from Patton Boggs attorney Kevin J. Martin, a former FCC chairman.

Industry bottleneck

Near the end of our discussion, I asked, "What do you see as a bottleneck in the wireless industry?" They said, "We find it ridiculous that in our own building in San Francisco we can't get wireless service." So I asked them, "What did you do in response to this?" And they said, "We had to go to the top of the building and build our own wireless mesh network." I asked, "What did you use?" And they said, "Chicken wire." I asked them why, and they said, "Because the city and the state make it so difficult to deploy wireless infrastructure in the heart of the city that we have to use whatever methodologies we can."

Something has gone wrong with regulation if the same technology that these entrepreneurs are using in San Francisco is the type of technology that farmers near my hometown of Parsons, Kan., use to keep wayward birds in the coop. It is incumbent upon the FCC to study this issue and make sure that states and localities as well as the federal government are standing out of the way — doing what they need to do to keep the public safe, of course — but other-

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wise standing out of the way and letting people deploy this central infrastructure, especially in dense urban environments.

Martin: Will the Supreme Court decision allow the FCC to enforce its rules more aggressively and take additional steps to help streamline site application processing?

Pai: I hope the Supreme Court decision allows us to make the shot clock more meaningful. When we issued the declaratory ruling in 2009 for 90 days and 150 days, many people expected: problem solved. In the years since, we have seen that is not necessarily the case. The decision gives us more leeway to apply those rules to make sure that they have teeth. Something I proposed last October at CTIA was for the FCC to adopt a backstop to those rules such that if a locality didn't act on an application within 90 days or 150 days, whichever is relevant, that the application would be deemed granted. That would give people submitting the application certainty. It would give the locality an incentive to study the issues with relative dispatch. It would give the FCC a sense that its interpretation of Section 332 was meaningful — that we're not just throwing out edicts into the air and hoping they stick. This would be a win for everybody.

Martin: There is precedent for the "deemed granted" approach. The Supreme Court's precedent represented by the shot clock ruling would give the FCC additional ammunition.

Pai: You deserve credit for that. The precedent that you're speaking of was the video franchising order issued in 2006 when you were FCC chairman. That was one of the things that inspired me to think that if we could do that on the video side, why couldn't we do it on the wireless side?

Martin: It would make a big difference. What do you see as the direction of the FCC with Mignon Clyburn as the interim chairman? What opportunities might she act upon?

Pai: I met with her to ask what her agenda would be for the next several months. I shared with her some of my own views of ways that we could work together. Something I pitched was wireless infrastructure because I don't see this as a partisan issue. Democrats and Republicans don't disagree on the need to make it easier for companies to deploy wireless infrastructure. We've worked very cooperatively together, the three of us who are there now and then-Chairman Julius Genachowski and then-Commissioner Robert McDowell, on ways to incentivize deployment.

Last December, for example, we adopted rules for wireless backhaul that are going to clear the way for microwave and other types of backhauling applications, especially in rural areas. I hope this will be seen as one of the less-controversial consensus items. Traditionally, an acting chairman doesn't feel the need or the ability to move things that are going to be tremendously controversial. Usually, those issues await the swearing in of the permanent chairman.

Martin: How do you see distributed antenna systems and DAS playing a role in additional connectivity and how the commission approaches the environmental processing and historic preservation rules?

Pai: We should be more open to thinking about wireless network architecture in a rich and textured way — thinking of DAS and small cells not as simply adjuncts to macro cell sites but as unique parts of the infrastructure. I've proposed that we exempt DAS and small cells for the most part from some of the more onerous environmental processing and historic preservation rules.

On the environmental side, the FCC requires as part of the construction of any DAS or wireless facility that an environmental assessment be issued. Conversely, the FCC's rules allow exempting any technology from those same rules if we determine that it is not going to have a significant impact on the natural environment. Almost by definition, DAS and small cells have a limited impact on the environment. With many small cells, people hardly notice they are there. I have held one type of small cell equipment in the palm of my hand. You could easily slip it into your pocket without anybody knowing that it was there.

Similarly, small cells operate at relatively low power. People who worry about RF emissions would have less cause for worry, especially because exempting RF emissions from the rules wouldn't necessarily take away RF restrictions that would still apply.

On the historic preservation side, the FCC would have to renegotiate some of the nationwide programmatic agreements with state officers, with

tribes and others. Nonetheless, it is important to do it because this type of infrastructure is not of a piece with the more traditional towers. The FCC needs to accommodate it.

Martin: Does the shot clock apply the same to DAS as it does to macro sites?

Pai: It should apply in some localities such as Temecula, Calif., where the city decided that it doesn't. Because the FCC now has clear authority under Section 332 and other parts of the Communications Act to say that the shot clock does

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apply, the FCC should do so.

Martin: Would the FCC be able to simply clarify that its intention is that applications not processed within the periods specified by the shot clock are deemed granted, or would it have to go through a rulemaking process to do it?

Pai: Given that time has passed, it would be better to issue another notice of proposed rulemaking and commence the rulemaking process to make sure that all current commissioners have input. Theoretically, we could issue a decision sooner rather than later, but given the fact that a lot of time has passed, it would be good to have public input and have everyone on the same page.

Martin: What is your view on clearing traditional radio-frequency spectrum versus sharing the spectrum?

Pai: I favor both. Whether the spectrum is licensed or unlicensed, cleared or shared, there is a place for everything. There are particular places where shared spectrum makes more sense. I have talked about unlicensed 5-GHz band spectrum as being an especially useful application. At 5 GHz, you can establish super-wide channels up to 160 megahertz wide that enable relatively high data throughput. You have relatively good propagation characteristics, which minimize the potential for interference. And you don't have the congestion that you have in frequency bands below 1 GHz or even below 3 GHz. I'm pleased that the chairman earlier this year teed up for consideration a proposal to free up more 5-GHz spectrum for unlicensed use. The Spectrum Act required us to do it, but he also proposed putting another 195 megahertz on the table. That's an exciting opportunity that we should embrace.

Generally speaking, I prefer cleared spectrum over shared spectrum. And the reason is pretty simple. Think of an analogy to land. If the federal government came to you and said, "We'll give you two options. Option A is we will give you the land on which to build a house and use it as you see fit. Option B is we'll lend you the land and you can build a house, and from time to time we might need to occupy it, but we can't really let you know in advance when that would be." You are more likely to want to build a house and make improvements to it under option A.

The same is true with cleared spectrum. It gives the private sector the maximum incentive to develop it and put it to use for the benefit of consumers. Although spectrum sharing has potential — for example, exclusion zones could be helpful — spectrum sharing is largely untested. It would require coordination among commercial cellular system operators and hundreds of federal users. Last year, a report said spectrum sharing would work a hardship upon smaller entrants and new entrants because they wouldn't have the resources to deal with many federal users with which they would have to coordinate.

Audience: Are there any steps necessary in frequency use or regulatory compliance for the national emergency services LTE network that the government is beginning to put out?

Pai: The FirstNet initiative is being led by the Department of Commerce with the FCC acting in a consultative role. We submitted technical recommendations for interoperability. Our authority is more for monitoring than for prescribing. We are engaged in part because Congress told us that the incentive auction has to generate enough revenue to help fund FirstNet.

Martin: When will the H Block auction occur?

Pai: By law, we have to hold it by February of 2015. My own goal — which I hope my two remaining colleagues share — is to auction it sometime this year. It's been five years since we held a major auction for the unpaired spectrum that is useful for commercial mobile broadband. I would hope that even though it's just 10 megahertz (1915 MHz to 1920 MHz and 1995 MHz to 2000 MHz), we would auction it in the near term. In December, we teed up the necessary issues to propose technical and interference rules for this spectrum block to make sure that it doesn't interfere with PCS operations. I hope we will get that done by the end of the year.

Audience: You didn't talk about Section 6409 and your views on how that has assisted in deploying wireless infrastructure. I wonder if the commission has gotten any feedback about how successful that has been.

Pai: I've taken any number of meetings where people have praised it or complained about it. It gives the FCC additional authority. It was useful for Congress to make clear that the FCC has authority in that area. I'm not sure what, if anything, the interim commission is likely to do about it. I believe we should take that authority paired with our general authority under Sections 332 and 253 of the Communications Act to adopt solutions such as the "deem grant" that would help to speed wireless infrastructure deployment. ■

The Tower & Small Cell Summit, collocated with CTIA Wireless, is owned by UBM Tech. *AGL* provided the conference programming, led by *AGL Bulletin* and *DAS Bulletin* Editor J. Sharpe Smith. The next Summit is scheduled for Sept. 9–11, 2014. For more information, visit *www.towersummit.com.* Photography by Don Bishop.

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By the AGL Staff

On March 22, *AGL* brought its Wireless Infrastructure Conference to the Atlanta Marriott Buckhead Hotel & Conference Center for a day of education, networking and vendor exhibits. With the Atlanta conference, *AGL*'s conferences entered their third year and began a series of six conferences for 2013. On April 18, *AGL* conducted another Wireless Infrastructure Conference in Irvine, Calif., and on June 6, an *AGL* Regional Conference in St. Louis.

"I go to the national conferences, two big shows a year, but many people don't have the budget to go to the national events," said Richard P. Biby, P.E., publisher of *AGL*. "One of the things we wanted to do was to take the content of *AGL*'s magazine and newsletters and bring it to the folks in the industry." Having served as vice president of the Virginia Wireless Association, Biby said he wanted *AGL* to support the state wireless associations with educational information. "I know how difficult it is to organize a day's sessions and pull that together. This is something we wanted to do to help the state wireless associations. We move the conference around to various cities to give the most people an opportunity to attend."

Ali Sar of 123eWireless gestures while responding to a question about small cells, DAS and Wi-Fi (see page 38). From the left: Darlene Braunschweig of Tempest Telecom Solutions, J. Derrick Smith of AT&T, Sar, and Mark Kerschner of TE Connectivity.

AGL's executive editor and associate publisher, Don Bishop, said that many *AGL* authors who are subject matter experts appear at the conferences where they can meet with readers, answer questions and offer advice for improving job results, business performance and technology deployment. "The authors and others who are invited to speak at the conferences help attendees solve problems, learn how to use new technology and services for superior results, and find best practices used elsewhere that they can use effectively," Bishop said.

The conference program chairman, J. Sharpe Smith, who edits two of *AGL*'s email newsletters, the *AGL Bulletin* and the *DAS Bulletin*, organized morning sessions about towers and afternoon sessions about small cells, DAS and Wi-Fi.

NATE training sessions

The day before the conference, the National Association of Tower Erectors conducted a training session that was scheduled to take advantage of collocation with the *AGL* conference at the Marriott. NATE conducted similar training at the Irvine, Calif., and St. Louis conferences and has scheduled training in conjunction with the next three *AGL* conferences. *AGL*'s coverage of the Atlanta conference continues on the following pages.

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Site Acquisition: Where Will All the Wireless Go?

Wireless carriers need sites, sites and more sites for antennas. Site acquisition specialists scramble to accommodate them as local governments struggle with the inflow of permit applications.

By Don Bishop

Attorney William J. Sill of Wilkinson Barker Knauer served as moderator for the session "Site Acquisition: Where Will All the Wireless Go?" at AGL's Wireless Infrastructure Conference on March 22 in Atlanta. The panelists were Kimberly Adams, zoning, permitting and project manager, Compass Technology Services; Shawn Blasingill, senior development manager, T-Mobile USA; Sonny Pieper, senior site acquisition PMO manager, Southeast Region, AT&T Mobility; Kathy Elliott, consultant, MasTec Network Solutions; and Marvin Webster, president, Environmental Corporation of America. The following are the panelists' remarks, edited for length and style.

Kimberly Adams
Zoning, Permitting and Project Manager
Compass Technology Services

During the past couple of years, site acquisition has involved more modification-type projects such as LTE projects. That's been a nice break from greenfield projects in some ways, but in other ways, modifications are more complicated because they can involve towers failing to meet strength requirements and older structures that weren't built for today's technology.

When jurisdictions go through ordinance rewrites, they should take into consideration that what new site carriers want are, for the most part, capacity sites, at least in metropolitan areas. We need to be close to residential areas. Tower heights are coming down, and along with that we have to place sites on smaller parcels closer to residential neighborhoods. Many ordinances we are dealing with are antiquated and have setback standards that are impossible to meet.

Back in the day, when we were building 250-foot towers separated by three miles, it was more doable. Antiquated ordinances are definitely a problem. Sometimes some of those high setbacks and restrictions on residential areas end up in new ordinances probably as a knee-jerk reaction to something that happened with a recent application.

Kimberly Adams of Compass Technology Services, a turnkey service provider to the wireless industry.

Many jurisdictions have good ordinances that were well thought out. But when you get into the actual zoning process, it becomes clear that approval is never going to happen. You meet every requirement of the ordinance, and you still get shot down. This doesn't apply to every jurisdiction, but many of them know that site developers can litigate, and they see that as the easy way out for them. In the long run, it doesn't benefit anyone. Litigation takes at least a year in federal court, and it takes a lot of money on both sides, whether it is the governmental side or the carrier side. But at the end of the day, the towers probably are more than likely still there.

In 2010, Georgia enacted the Advanced Broadband Collocation Act, predating the Middle Class Tax Relief and Job Creation Act of 2012 that included federal collocation language. The Georgia statute is a collocation and modification by right law. A few jurisdictions here and there may not have gotten the message yet, but for the most part, the major, larger jurisdictions,

William J. Sill, standing, listens as Shawn Blasingill, next to the right, responds to a question.

especially metropolitan Atlanta, are really in line with it, and it's working.

Our delays on collocations and modifications are more a result of the massive volume such that when we're all collocating and making modifications to sites at the same time and we hit a jurisdiction with a huge amount of building permit applications, they just don't have the staff to handle it. That leads to the subject of the FCC shot clock. Do we shorten the shot clock? Right now, it's at 90 days. But instead of shortening the shot clock, I would rather have automatic approval after 90 days. Not a judicial review, because all we're now allowed to do after 90 days is to sue the jurisdiction. And that's another year and a lot of money.

Shawn Blasingill
Senior Development Manager
T-Mobile USA

Despite an increase in awareness about site acquisition and siting needs, there hasn't been the same level of increase in education on wireless siting needs and requirements. There's a gap to fill in between awareness and education to make site acquisition easier. I'm not only dealing with municipalities, I'm also dealing with the general public, carriers and cross-functional partnerships.

There was a time when you would sit down with the carrier, your site acquisition team and your RF engineers to talk about your design location. Then you would pick it and submit an application for a permit.

Now, you have to form a relationship with municipal representatives and go through a vetting process for particular site candidates with the municipalities. It's a fast-paced business, and we can't afford to lose time. We don't want to work on a potential antenna site within our group and come up with what we believe is the perfect site and submit it for a zoning permit only to find out we wasted three or four months because a jurisdiction or municipality shuts it down immediately.

When I work with site acquisition engineers, the first thing we do is visit the municipal government office. We see what current applications are in process. We talk with municipal government representatives about their desires. We ask, "Where would you like to see wireless infrastructure in this area?" And then we see if it works in our plan. A larger partnership outside of your core group is required to get things done so that you don't waste time going down a path that will never get approved.

Early on in the industry, the majority of site acquisition specialists were formal real estate engineers or licensed representatives. Today, I don't see as many. Part of that is due to the fast pace of the industry and the needs we have. We need more individuals talking to municipalities. We take people from diverse backgrounds, whether it's real estate, zoning, construc-

Shawn Blasingill of T-Mobile USA, a wireless telecommunications carrier.

tion, anyone who could actually go out there and talk and educate the necessary people about the site and the needs for it and have those discussions. I do not see as many real estate agents in site acquisition as I did early on.

Shawn Blasingill: "Using the shot clock doesn't foster the relationship between you and the municipality. It's a threat that you can't carry through, or it takes a lot to carry the threat through."

We do have that concern at times. With some tough jurisdictions or municipalities, we want to make sure we have a little more involvement from a legal standpoint. At T-Mobile, we're seeing site acquisition agents who are not necessarily real estate agents. We have a legal team involved that gets into some discussions with the municipalities and that does a lot of the lobbying to open up the discussions about what we need. It's a combined effort between our legal team and our site acquisition agents.

For small cells, the major site acquisition challenge involves outdoor DAS. It requires a lot of work and compromise with several groups. The carriers have to work together. Then comes the question of ownership and who pays for the maintenance. We still have to work our way through it to get an idea what the microcell is going to look like and what's it going to do to our macrocell site network.

I see the small cells supplementing macrocells. We're nowhere near to eliminating macrocells. When it comes to cost efficiency, many of these microcells will have to be shared among carriers. The cost is high. When we build a macrocell at one location, we receive maximum benefit at that location. With a microcell, our coverage is limited. Sometimes we may need several locations to make a microcell work.

Much of the public doesn't understand the difference. They believe that the construction of a macrocell is going to be a big hindrance in the community. What they don't understand is if we have to construct outdoor DAS, we're not going to have a single tall structure. We may have 35- or 40-foot structures, but we will have to tap the right of way for the next 15 miles to build up the coverage. The biggest challenge with microcells is the relative cost-effectiveness of them.

Fewer municipal resources

When site developers use the FCC shot clock to push site approval, local jurisdictions feel like you're taking control out of their hands, which I can understand. I've noticed many municipalities honor the shot clock and do what they can to get our applications in as quickly as possible. But several things have happened. We have an economic downturn, and many municipalities have fewer resources on staff to process applications. When you couple that with the volume of applications caused by all the carriers going in at the same time, it presents a challenge. As we make it to that shot clock period, the carrier or whoever the applicant is has the opportunity to litigate and get the application process moving. Using the shot clock doesn't foster the relationship between you and the municipality. It's a threat that you can't carry through, or it takes a lot to carry the threat through.

Sonny Pieper
Senior Site Acquisition
PMO Manager
Southeast Region, AT&T Mobility

Site acquisition is a tremendous challenge, and the networks are throwing a tremendous amount of money at it. AT&T is no exception. AT&T announced a $14 billion investment to be spent during the next three years. We are going to be adding 10,000 sites nationwide, 40,000 small cells and a thousand new DAS sites. That's a tremendous explosion of our network, and it creates a lot of pressure on the site acquisition side because many people doing site acquisition are probably at full capacity, yet we're trying to increase the amount of touches to our network and increase the volume and speed at which we deploy.

AT&T senior executives expect return on investment. They want certainty when they deploy capital. Because of the time it takes to get through site acquisition, the process creates uncertainty. When you're a bean counter and you're allocating capital, that's a tremendous challenge.

A typical site could take 18 to 24 months to get through site acquisition and only take two months to build. The higher-ups at AT&T look at it and they ask, "Why does it take site acquisition so long?" When site acquisition takes so long and it only takes two months to build the site, there's a giant disconnect from our ROI standpoint.

The smartphone revolution has created a monster. Since we introduced the iPhone in 2007 or 2008, AT&T's network data traffic has risen 30,000 percent. An Alcatel-Lucent survey found that an average person with a smartphone looks at it 150 times a day. Seventy-three percent

Sonny Pieper of AT&T Mobility, a wireless telecommunications carrier.

of respondents said they would get in a panic if they lost their phones. To densify the AT&T network will require more unique solutions. In what direction will site acquisition go? It's a really tough question, but it's going to go somewhere because we've created monster devices that demand data capacity.

Boots on the ground

Successful site acquisition vendors and agents have local boots on the ground and local connections. They know which proposed sites would be nonstarters in a NOPE- or NIMBY-type environment. Successful site acquisition vendors and agents have the necessary relationships and can navigate the local mazes and regulations. That's where you do the front-end vetting and eliminate the roadblocks to make your project successful.

I just worry about the volume of work. I know how much network development AT&T is doing, and the other carriers are probably touching their networks as much. Everybody's touching their networks. We're touching existing towers. Many times we're touching towers built in the '80s that can't support additional load. LTE and 4G technologies have heavier, bigger antennas. It's a problem for the industry, but it's a good problem to have.

Small cells are coming, and they are going to be a tremendous challenge because many of the outdoor small cells are probably going to be in the public right of way. We're going to have to negotiate with utility pole owners, most likely the power companies, here in Georgia. We don't have a common utility pole joint use agreement. Georgia Power has a large portion of the geography in Georgia, and there also are electric membership corporations (EMCs).

I don't know how many EMCs there are, but how can we, as a carrier, negotiate bandwidth and negotiate with all the EMCs simultaneously? That's a tremendous challenge because that's the only way we're going to get the infill. If the NIMBYs and the NOPEs say no to a 150-foot tower in a given location, would they say yes to 5-, 10-, 30- or 40-foot towers and the utility poles strung along with them? That's the challenge, and that's how we're going to obtain the coverage that we need.

Indoor small cells

Meanwhile, there are many indoor small cells that anybody with a coat closet, an Ethernet connection and power can slap into some buildings to provide indoor coverage to supplement the mobile network.

Small cells are much cheaper than DAS solutions or macro cells. They will not replace the macro cell network; they will supplement it. Small cells are low-power devices. They're designed to cover a 1,000-square-foot area with 30 to 64 users, providing 3G, 4G and Wi-FI service in a small footprint that

supplements holes in our network.

There's a difference between small cell and a metrocell, and between an oDAS and an iDAS. Some of the DAS systems are designed as neutral hosts. Anybody can plug and play. Small cells alone are going to be just what we need to complement our network. They're not necessarily set up as something that can be hosted by another carrier.

Education process

With respect to the situation with local ordinances, it's tremendously frustrating when you meet all the setback rules, you meet the ordinance rules and then you get the gladiator vote-down when the permit comes up for a commission vote. You apply the law that's there. It's a decent law. You still get shot down. I don't know if there's any other way to combat that other than to say it is an education process that the industry needs to tackle collectively. There need to be more meet-and-greets and more talking about how these sites are coming whether the local government officials want them to or not. People are demanding wireless services. I think the approval of more sites is going to happen, one way or another.

We look at using federal land only as a last resort because the bureaucratic red tape is amazing to navigate to get permits. Although we have few sites on federal land controlled by large agencies such as the postal service, we deal a lot with military bases in Georgia such as Fort Benning and Fort Morgan. I think Fort Benning is the second- or third-largest army base in the country. Everybody on the base has smartphones. When troops arrive in the summer for deployments, our networks get crushed. Try to build a site there, and you can't get Ethernet to it. You're dealing with red tape. It's amazingly frustrating. You get the call that the individual who needs to approve the application has been deployed to Iraq for a year. You have to wait until that person returns. There are no good answers when dealing with the federal government. I wish there were a magical potion that we could use to expedite these difficult sites.

Kathy Elliott
Consultant
MasTec Network Solutions

The on-air people don't appreciate site acquisition. They don't have time for it. They want it done and out of the way. They want the site built, so it's no longer a dot on the map.

Meanwhile, when it comes to finding potential site locations, all of the low-hanging fruit is gone. Every site now is difficult. With carriers using more site modifications and fewer new site builds, their attitude toward site modifications can be, "We want it now. We want the modifications completed." So, it's challenging. It's not rocket science, but it's challenging.

Zoning scrub

With some of the more successful site acquisition projects, carriers have been willing to take more time at the front end and do a zoning scrub of not just the search ring but right around the ring. That way, we don't get into the zoning and find out there's an industrial park right outside of the ring. A zoning scrub also is helpful in case there's something like a Superfund site or a historic site nearby that would be affected and that would slow the site acquisition process or cause the developer to redesign the site well into the project.

FAA scrubs also are helpful because without them it is possible to move a site project pretty far along only to find out the height is much more limited than it was originally believed to be. We had one like that. You could actually see the eye color of the pilot, apparently, from the proposed site, and I'm not sure how he kept missing the nearby 90-foot trees, but he did.

Some homework and really good site acquisition investigation on the front end can save a lot of time and money and can save possibly redesigning the search ring way further down the line than anybody wants. Plus, you also need the results of your investigation when you do get into zoning and begin dealing with the public and the politics of the situation because those questions are going to come up. The homework needs to be there to show that the necessary considerations were made. My advice is to do the homework on the front end not while you're in the zoning process.

Concurrent projects

With modifications, it can be advantageous to run two projects for the same site simultaneously. Believe it or not, some people are just now installing UMTS — it does happen. But if you could install your UMTS equipment and then come right behind it with some LTE equipment for future use, you can use the same mapping things that hold you up that tower companies require now. The same applies with fiber-optic cable. If you're going to run fiber, why not do it while you're obtaining your LTE approval? Running projects concurrently can help speed things up.

Kathy Elliott, a consultant with MasTec Network Solutions, a company that supplies, designs and supports technology solutions.

Marvin Webster
President
Environmental Corporation of America

In the earlier days, to get a site approved for environmental purposes, all that was needed was a geotechnical report and sometimes a Phase I environmental site assessment. The National Environmental Policy Act and the FCC's NEPA regulations have been in place since 1970 and the current version since about 1986. Two nationwide programmatic agreements have been added for historic properties, and now an environmental notice for migratory birds.

Nevertheless, the crux of those regulations had not changed. There always was a question on Form 854 and Form 600 that asked, "Will this facility have an environmental impact?" And everyone just thought, "How could it possibly have an environmental impact, a tiny little cell site?"

Now, we've come to where we're dealing with all of the federally recognized Native American tribes, and it can be up to them whether the site gets built when it gets built because when a tribal government says it has an interest in a proposed antenna site, there's no requirement for it to reply on any sort of timeline.

Not only is it becoming more difficult to place wireless facilities within the RF criteria and to position them to meet property setbacks in zoning regulations, but also in many instances a setback from water also is required. Some jurisdictions want at least 150 feet between a wireless telecommunications site and a tiny little stream. If a carrier is trying to position infill sites in a greenway, it isn't likely to find a site more than 150 feet either side of the stream that is still within the greenway. There's really nowhere to go. Site acquisition seems to become more complicated and time-consuming every day.

It helps to pre-screen parcels and target sites for potential problems. When I started in this business, if you wanted a flood map, you had to go to the courthouse and to the city hall. "Where's the flood map?" you would ask. "You have to see the city engineer," a clerk would answer. "Where is he?" you would ask. "He's at lunch," the clerk would reply. "What time does he come back?" "Two o'clock."

Now, with Google Earth, you can load just about any layer you want. You can load flood plains. You can load wetlands. You can load historic properties. It's very user-friendly. A site acquisition engineer should be able to figure that type of thing out.

Even so, there are intricacies beyond the expertise of a typical site acquisition person that are environmental in nature. I would say if you do a routine screening and things look complicated, call the consultant who is ultimately going to be awarded that site. In a 15- to 20-minute phone call, the consultant can tell you what the problems are likely to be before you do further work.

When it comes to looking at various properties and trying to vet the process, if you end up in an environmental assessment process, you have a problem. You need a wetland permit. You may have a historic property impact or an archeology site. Before you can advance your application to the state historic preservation office or to the federal agency, NEPA requires an analysis of alternatives. You're going to have to show what other sites you considered and the frameworks in which you considered those sites. You have to consider what might be done to minimize any adverse effect, such as lowering the height or eliminating the lighting. So planning ahead can get you a lot of mileage down the road. ■

Marvin Webster of Environmental Corporation of America, an environmental, ecological, geotechnical and cultural resources consulting firm.

The next *AGL* Regional Conference is in Chicago on Sept. 19. For information, *visit www.agl-mag.com/events*. Photography by Don Bishop.

Wireless Business Trends for 2013 and Beyond

From using municipal rights of way for micro networks to Wi-Fi Hotspot 2.0 deployment, the build out of small cells and new carrier antenna leases, the wireless business offers many growth opportunities.

By Don Bishop

Neil Boyer, national director and general manager, AT&T Towers, served as moderator for the session "Wireless Business Trends Roundtable" at AGL's Wireless Infrastructure Conference on March 22 in Atlanta. The panelists were Paul Reynolds, president, CMA; Ben Moebes, director of strategic accounts, Ruckus Wireless; Jason Nicolay, vice president, Media Venture Partners; and Larry Harris, vice president of mergers and acquisitions, SBA Communications. The following are their remarks, edited for length and style.

Paul Reynolds
President
CMA

We have more cell phones than people in the United States, 340 million cell phones. This year, we had 110 million smartphones. Kids tell you where it's going. Their iPhone, their smartphone, is a critical aspect of their identity. Every high school kid has a smartphone.

Looking ahead to 2015, we won't only see data streaming, there will be more machine-to-machine communications that we won't see, such as intelligent cars with IP addresses. In 2008, 1 percent of the population had given up home phones to opt for cell phones. In 2012, 37 percent of the population, over 100 million people, had given up home landlines. Everything around us will become wireless. There are a lot of creative ideas going on right now that will drive a tremendous amount of bandwidth. The mobile network's use of micro sites is critical because micro sites are essential for getting the bandwidth low to the ground and close to the consumer. You have to have a lot of micro sites to make it work effectively.

Paul Reynolds, president, CMA, a company that repackages municipal assets to give them a profile that makes the micro-sites economic model work.

The challenges for the carriers are cost and approval, and that's where CMA comes in. We obtain city approvals in two weeks to put sites anywhere in the city you want. That's a tall challenge, but we do that. It's a very narrow focus. If instead you were to go to every single building owner to negotiate a rate of $150 per month, it would be impossible. Carriers have to have a format that allows a return on investment with small-cell technology, and it requires a big-footprint mentality. Carriers can't wait a year to prove the economics work. It has to be done in weeks. If you can solve those problems, you've solved a lot of the industry's problems.

Small cells for high capacity

Future software and systems will look at whether a user is mobile or stationary. If you're driving through town at 60 miles an hour, it's likely that you'll stay on a macrocell. But if you're sitting in a restaurant, the system will switch you to a microcell. It wouldn't make sense to drive through town at 60 miles an hour and expect that

Neil Boyer, standing, listens as Jason Nicolay, far right, responds to a question.

your device will be switching among micro sites. The macro and micro systems should work together. The small cells are for high-data, high-volume activity.

Some cities have ordinances that do not allow placement of micro sites in public rights of way. Others have ordinances that do not allow the government to collect money for it. So they can't make money on their assets. The sad part is, it's different from city to city. This is why many carriers won't pursue the use of rights of way. From city to city, the ordinances are different, the state laws supersede county laws, and the county laws supersede city laws. If you can dig through all of that and obtain an agreement to allow carriers to place micro sites seamlessly, you're well on the way to making microsite networks a reality.

Ben Moebes
Director of Strategic Accounts
Ruckus Wireless

For a successful user experience with Wi-Fi, the user has to be close to the access point. Low-power Wi-Fi devices such as iPhones have to be close to obtain the desired data speeds, and the ability for a tiny phone on Wi-Fi to reach a Wi-Fi access point on a tower is nonexistent. Access points must be closer to users. For years, we had been constructing outdoor Wi-Fi deployments with cities. Some went down in flames in the community Wi-Fi bust four years ago. Nevertheless, we became proficient at negotiating right of way use with municipalities to bring the Wi-Fi access point close to the user. It doesn't work with that.

Hotspot 2.0, also called PassPoint, will help make Wi-Fi even more popular. Hotspot 2.0 makes it so when you visit a business that offers Wi-Fi, you don't have to manually authenticate a session of wireless connectivity. If you turn on your iPhone, you get connectivity. Hotspot 2.0 also allows seamless roaming. As a user, I may never know that I'm on the Wi-Fi network. In an area where a macrocell doesn't deliver enough data capacity, carriers can move users onto Wi-Fi that gives the necessary capacity at a lower cost and that gives the carrier a more satisfied customer.

Hotspot 2.0 not only gives roaming capability but also security. It's only starting to roll out, and only a few handsets support it. Wi-Fi hardware already supports it. By 2014 or 2015, the anticipation is that most devices will support Hotspot 2.0 from a subscriber identity module (SIM) level and then non-SIM devices. For example, an AT&T customer with an iPad that only has Wi-Fi could roam onto an AT&T-supported Hotspot 2.0 system and AT&T could charge for Wi-Fi use with a device

Ben Moebes, director of strategic accounts, Ruckus Wireless, a leader of Wi-Fi in the carrier business.

that has no SIM and that's not even an AT&T device. It's a great moneymaker for carriers.

Whether a Wi-Fi network uses the neutral-host model and invites participation from multiple wireless carriers depends on where it is. In a metro area with assets close enough to users, you can build neutral-host Wi-Fi networks and give the service set identifier (SSID) today, or in the future, Hotspot 2.0. Carriers with customers who roam through the neutral-host Wi-Fi would be paid, just as they are in a neutral-host cellular world. If one carrier owns the infrastructure, it would be paid by the other carrier participants. That's what's behind a land grab that's going on now in the Wi-Fi space. Unlike most cellular technologies, Wi-Fi is unlicensed spectrum, and there's only a finite amount of it. In most heavily populated areas, you won't see five Wi-Fi networks from five carriers in one shopping mall. You're going to see one. He who builds it first, owns it.

For outdoor Wi-Fi, the big thing is proximity, and you have to have bandwidth. Thus, we're talking about many access points deployed on poles or cable TV strand. Think about what's close to the user. Cable TV strand is very close. We're often using cable to backhaul cellular towers. Now, we can use cable to backhaul a small cell, and the small cell is not going on a tower, it's hanging right on the strand. It gets the access point close to the user. I can't stress it enough — you've got to be really close.

Jason Nicolay
Vice President
Media Venture Partners

At Media Venture Partners, we don't see small cells being a competitive threat to the macro sites, which we don't see going away. Carrier and tower engineers we speak with view small cells as a complement to macro sites. Carriers use small cells to fill coverage holes. AT&T may have a coverage hole to fill with a small cell in one location, and Verizon may not have that same coverage hole, based on its macro coverage. So, the use of small cells probably is more of a complement than a threat. The use of small cells is in its infancy. Small cell is a big buzz phrase, yet what a small cell is actually going to be, whether it's Wi-Fi or a small node, remains to be determined.

Jason Nicolay, vice president, Media Venture Partners, a telecom-focused investment bank that raises capital and helps to broker deals for towers, wireless spectrum and wireless carriers.

We don't see small cells fitting the neutral-host business model. Integrating competing carriers' small cells is difficult. Technological advances may change that. But at least right now, we don't see small cells as offering a great neutral-host model. The manufacturers would love it, and for a tower owner such as SBA Communications, if it could find a neutral host to solve some problems, it would become an interesting business model to add on from a macro site.

As for new entrants into the tower-space leasing market, we all heard about LightSquared a couple of years ago as the golden child who was going to come onto the tower. That didn't materialize.

Now, everyone is watching Dish Network to see whether it becomes an active wireless carrier. If Dish is going to build a new network, it's going to take billions of dollars, or will they partner with another company such as Sprint or Clearwire to become a new entrant? If Dish partners with another company and it uses new spectrum, tower owners may receive an opportunity to obtain incremental revenue.

It's yet to be determined whether anyone else will make a national play. Additional small carriers may yet pop up in local and regional areas, but at the national level, we don't see any that are ready to do that.

When it comes to tower valuations, the reasons behind tower value remain mostly the same as they have been. Tower owners like to stress location. Sites that were difficult to zone are highly valuable.

There are other important factors for valuation. What's the capacity of the site? Can it hold more than a single tenant? Who are the tenants? Are they the Big 4 carriers? Clearwire is not much of an issue anymore, given its status with Sprint.

Then come some unique factors. Does a ground lease aggregator own the land? Do you have rent step-downs or a revenue-sharing agreement with the ground owner?

All of these factors are reasons behind the value towers have these days.

As tower portfolios grow larger, the number of people capable of obtaining the capital to purchase portfolios the size of Mobilitie's and T-Mobile USA's decreases. Nevertheless, potential buyers exist beyond the three public companies. You still have Global Tower Partners and several other private equity-backed organizations with access to capital and cheap debt. With smaller deals, we're seeing eight to 10 different offers come in. Tower sellers have an opportunity to maximize value by selling to others besides the three public tower companies because there's a lot of demand to purchase sites.

Larry Harris
Vice President of Mergers and Acquisitions
SBA Communications

Although the tower companies can hope that Dish Network may one day build out its own wireless telecommunications network, that task becomes more daunting every day. It seems more likely that Dish will fold into someone else instead becoming a new tenant. But we can all hope.

The FirstNet first-responder network seems to have federal money behind it, and although it's been talked about for a long time without materializing, it could one day become a new entrant and a boon to tower companies. Hopefully, the build out is done wisely. A lot of infrastructure already exists, but there will be many people who will try to build infrastructure exclusively for FirstNet. They may build some sites that don't need to be built. Maybe the wireless infrastructure industry can put forth enough lobbying to do what's sensible, which is use existing infrastructure instead of bowing to special entrants that are going to make a cash grab for federal funds.

Larry Harris: "The FirstNet first-responder network seems to have federal money behind it, and although it's been talked about for a long time without materializing, it could one day become a new entrant and a boon to tower companies."

When I evaluate a tower and obtain the tenant rent roll and see T-Mobile USA and Metro PCS, I know that within the next two or three years, those two will integrate down to one, once they figure out their path to 4G and when the lease expires.

Sprint Network Vision

I also look at the Sprint Nextel/Clearwire situation. Almost all tower owners are working on some type of Sprint Network Vision project to make Sprint's equipment work smarter, make it multifunctional, and make it work across different frequencies and different technologies. So, if I have three carriers on the tower, will they go down to one? Do they go from three to two?

We know that Sprint Nextel's iDEN network is being decommissioned. What equipment stays on the towers under the existing leases? Are the leases structured in a way that Sprint Nextel can't terminate one without getting rid of something else? I've seen Clearwire overlaid on iDEN. Sprint Nextel wants to remove iDEN, but it can't, because it has to keep the Clearwire equipment up. It's complicated. Leasing used to be as simple as bricklaying. Now, it's like splitting atoms. ■

Larry Harris, vice president of mergers and acquisitions, SBA Communications, a publicly traded tower owner and operator that owns 17,000 structures and manages others, and does business in eight countries.

The next AGL Regional Conference is in Chicago on Sept. 19. For information, visit www.agl-mag.com/events. Photography by Don Bishop.

Ground Lease Aggregators Are Aggravators

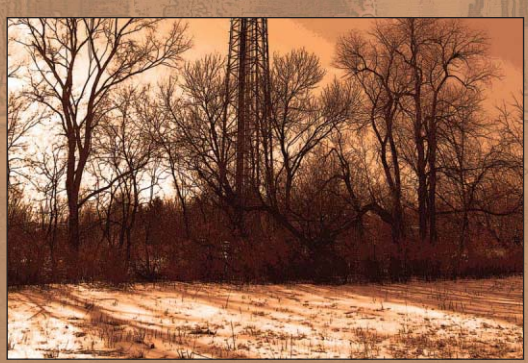
Ground lease aggregation has caused friction among tower owners and independent developers that have coexisted for 15 years or more, according to a public tower company executive with reason to know.

By Don Bishop

Ground lease aggregators call and write landowners with property beneath cellular telecommunications towers in an effort to persuade them to take actions ranging from selling the land or the lease to the aggregator to assigning management and negotiating rights to the aggregator for a fee or percentage of rent collected.

Larry Harris, vice president of mergers and acquisitions at SBA Communications, said that SBA has a staff that defends its turf and that buys land beneath SBA towers. SBA owns 17,000 towers and manages many more. It owns towers in eight countries.

"Our landlords are getting frequent calls and letters, and they're getting



hounded," Harris said. "They're being told that their rent is not high enough and that the tower owner should be sharing revenue with them. The ground lease aggregators are being disruptive to the relationships we have with our landlords. And the goal is to turn that tower owner against the property owner so that they can say, 'I'll save the day for you. I'll be your advocate going forward. Here's a check for $100,000. I'll receive all the future payments, and then I'll find new ways to make revenue at this site. It'll be us against the tower guy.' It's a pretty toxic pitch."

Harris said the pitch he described is the only way the ground lease aggregators could motivate the landlords, scaring them into signing deals. "Our landlords don't think as highly of us after these phone calls and letters, and it makes it challenging any time we need to amend the lease or get a permit signed or do anything," he said. "The ground lease aggregators will do anything or say anything or promise anything to get the deal signed and go off to the next one. If they get the deal, that's great. They convinced the landlord to do it. If they don't get the deal, I still have a problem because my landlord was told that I'm a bad guy and I don't pay him enough rent. So it's very disruptive, and that's why we have a big effort that is focused every day on defending our own turf."

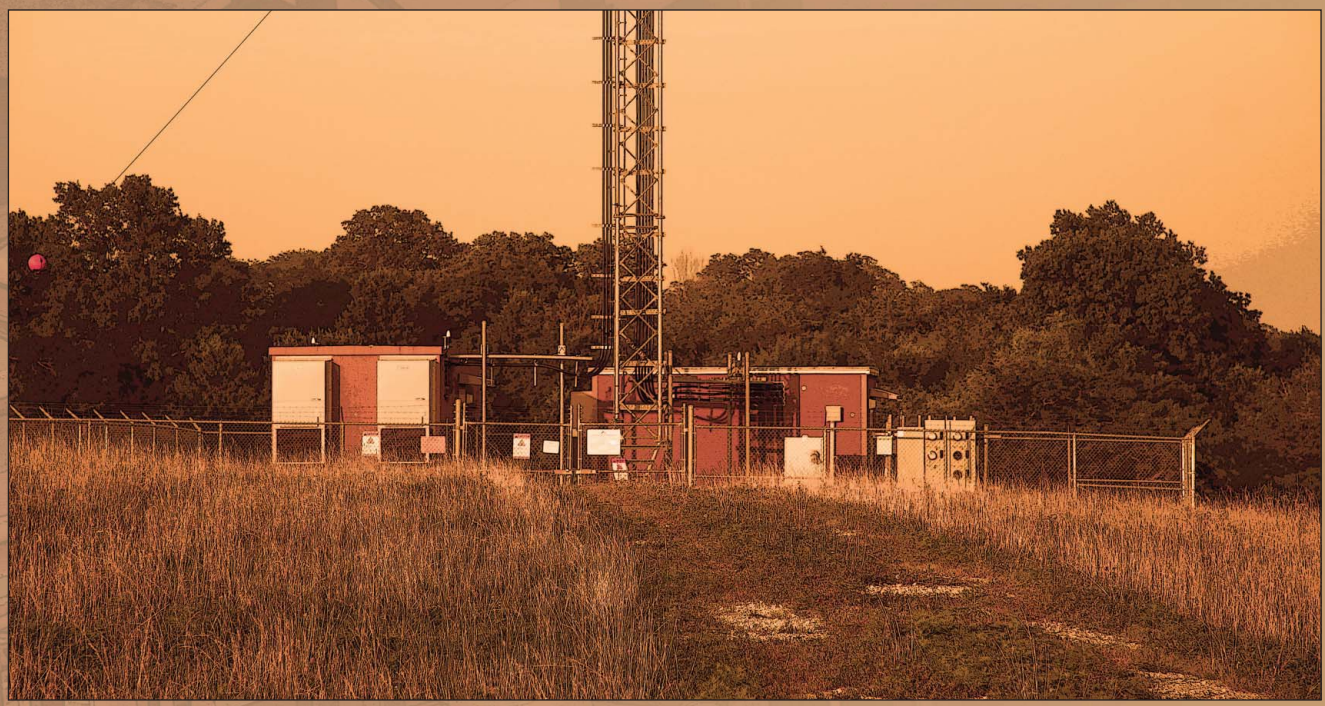
Landlord relationships

The tower company executive said that SBA spends a lot of time and a lot of money on landlord relationships because they are not short-term relationships. Leases can extend for 30 to 50 years, however long the tower stands and as long as the wireless infrastructure is useful.

"We want to be there at that site," Harris said. "Sometimes you throw out what the lease says and perform extra service for the landlord. For example, if the lease says it's a shared obligation to maintain the access road, we may tell the landlord, don't worry, we'll pay for the whole thing. SBA will maintain the access road because I want that relationship right. Oh, someone from the carrier drove over your flowerbed? I'll replant the flowers."

Friction points

Ground lease aggregation has caused friction among tower owners and independent developers that have coexisted for 15 years or more, Harris said. "We're all collegial, we're all cordial with one another," he said. "There are some turf wars where someone wants to build a new build here and somebody obtained a permit on the other side and the question then is do both towers get built, or do cooler heads prevail and only one tower is built? There are some friction points every day, but for the most part the tower CEOs and the people who work at these



Among tower owners, taking ownership of the land beneath their towers is becoming increasingly important.

companies have been able to coexist, and it's been a relatively good experience. There always have been good relationships among the tower companies."

Nevertheless, Harris said that the ground lease situation has put the tower companies at odds with one another because the steps taken by the aggregators force the tower companies to take sides against one another. "Instead of working with carriers, negotiating amendment pricing, now I have to defend my ground leases," he said. "It's been interesting these last couple of years because of the proliferation of these ground lease buyout companies. It's made for strange relationships among many companies." Harris mentioned pending litigation between TriStar and American Tower, saying it is "a real ugly situation."

Harris said he is thankful that the wireless infrastructure industry has for the most part risen above the infighting cause by ground lease aggregation. He conceded that the ground lease aggregation effort is to a degree a compliment about the accomplishments of the tower companies because regardless of what the aggregators say to the landlords, "their true intention is to clip coupons," he said. "They want rent checks from SBA, Crown, AT&T or Verizon in exchange for a lump sum payment. In the process of pursuing that objective, they make crazy, wild promises to the landlords and raise their expectations, but for the most part, all they really want is that cash flow stream. It's like buying out lottery winnings or other scheduled payments. It's a structured settlement. That's really all it is, but they've turned it into something else because the pitch has been somewhat effective."

Tower valuations

Jason Nicolay, vice president of Media Venture Partners, an investment bank that helps to finance tower purchases and that brokers deals among tower buyers and sellers, said that ground leases affect tower valuations, "especially if you get those kinds of adversary roles and there's an uncertainty of what's going to happen with that lease, long-term."

Nicolay said it is important for tower owners to secure strong ground lease rights. He said contracts with landowners should include first rights of refusal to buy the land and the leases should be for long terms, 20 years or longer. "I'm sure SBA would like the lease to be for 50 years or more, if you're going to sell the tower to them," he said. "Those are things that really help valuation for your site."

With a nod to his role in buying towers for SBA, Harris said that some contract language has evolved "sort of as an antidote to some of the ground lease buyout activities that are going on, so that generally, when you put that lease in front of the landlord, the comments aren't about what protects you from someone who might make an offer to the landlord in five years. If you have it in your original lease form when you put it in front of that landlord, you're most likely going to get that signed."

Harris offered to send to independent developers or site acquisition firms the contract language he recommends for the leases, "because if I end up owning the tower, I want that language in my ground lease." ■

Larry Harris and Jason Nicolay made their comments about ground leases at the *AGL* Wireless Infrastructure Conference in Atlanta. *AGL*'s next conference is in Chicago on Sept. 19. For information, visit *www.agl-mag.com/events*. Photos: left, by Scott Dolash; above, by Don Bishop, near Breckenridge, Mo.

Ready Money Boosts Tower Asset Valuations

Money now flowing quickly into wireless infrastructure investments may flee just as quickly if "in it to flip it" buyers do not see the return they told their investors they would achieve, potentially sending tower valuations lower.

By Don Bishop

Tower values reached all-time highs during 2012, thanks to high demand for antenna space rental on the part of wireless telecommunications carriers, low interest rates for debt that can be used in purchase offers and abundant availability of capital seeking higher returns on investment than many other industries offer.

Larry Harris, vice president of mergers and acquisitions at SBA Communications, spoke about tower valuations during the session "Wireless Business Trends Roundtable" at AGL's Wireless Infrastructure Conference on March 22 in Atlanta. SBA owns 17,000 towers and manages many others. It does business in eight countries. Also speaking about tower valuations was Jason Nicolay, vice president of Media Venture Partners (MVP), an investment bank focused on telecommunications, including towers, wireless spectrum and wireless carriers. MVP raises capital and helps to broker deals between those who buy and sell towers. Neil Boyer, national director and general manager of AT&T Towers, was the moderator for the session. AT&T Towers owns about 14,000 towers that are all but confirmed as being up for sale. Although Boyer was unable to speak about the possible sale of AT&T's towers, there was some banter about it. Making note of SBA's two recent tower portfolio acquisitions that put its total near 17,000, Boyer said to Harris, "With your last two acquisitions, you jumped ahead of us in size. Thanks so much."

Larry Harris, vice president of mergers and acquisitions, SBA Communications: "If I were to categorize the market right now, I'd say it's a little overheated."

Harris said that many investors are trying to get into the wireless infrastructure industry. "It's proven to be a good industry," he said. "There is tremendous access to capital seeking high returns, so there are a lot people who want to get into the business of tower ownership, ground lease ownership, tower development, site acquisition or site construction."

To define tower valuations, Harris said, "You can always look at trends. You can look at the public tower company valuations and the private tower transactions that Jason and I deal in every day, or the values of towers I'm buying from an independent tower owner or independent tower company that owns towers. Do the valuations in that private market exceed the valuations in the public market? There's a little bit of an imbalance right now, and that's because there are a lot of investors seeking higher returns, and wireless has enough panache that investors are throwing money at it. Therefore, returns are probably getting compressed. They won't realize it until they go to sell and they don't get the return they were expecting because there are too many people competing for too few sites. But if I were to cat-

egorize the market right now, I'd say it's a little overheated."

Priced right

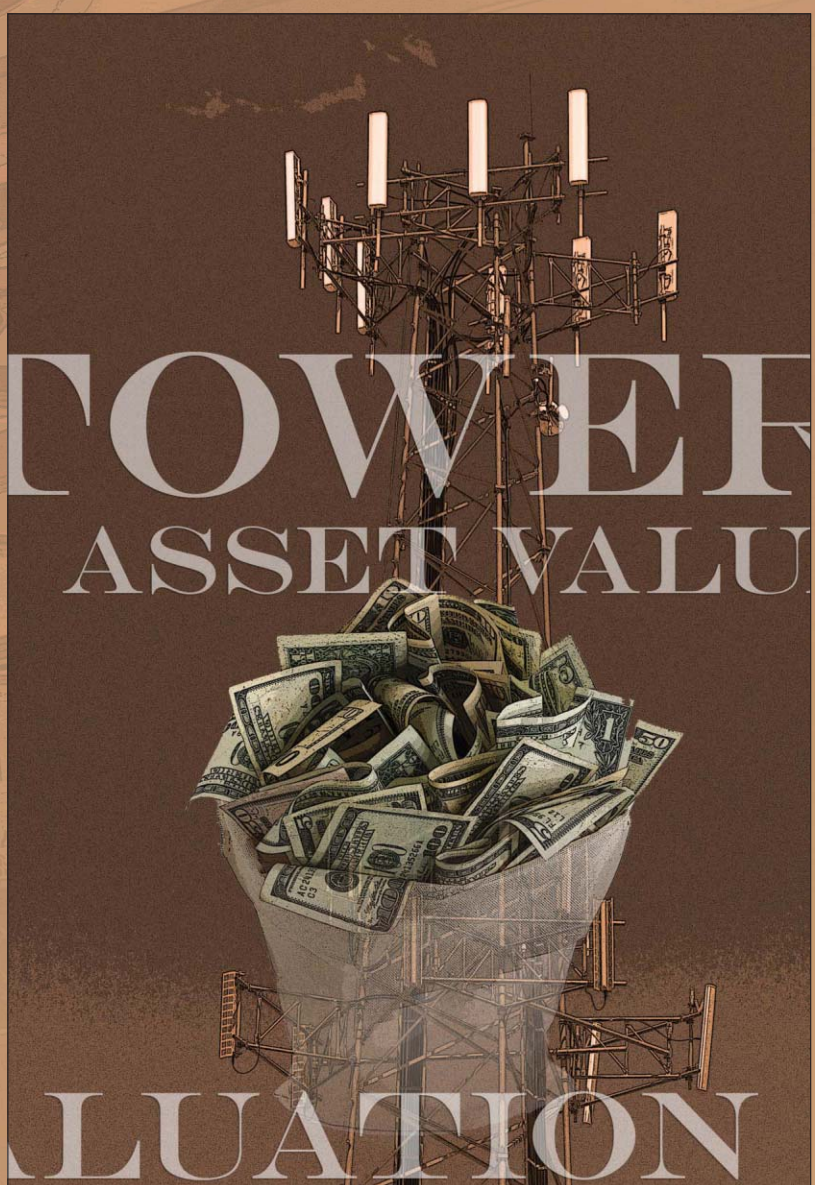
Boyer, whose company would reap the benefit of the higher prices if it decides to sell its towers, said, "I'd say it's being priced right."

Harris said he has an obvious vested interest in saying that the market is overheated, yet he has followed tower valuation trends for the past 15 years, and he said he believes current valuations are driven by previous success, "and they're also driven by the fact that the unprecedented access to capital at historically low rates has caused a lot of people to be at the table these days."

Nicolay said MVP breaks tower valuation into two categories, single-tenant sites and multiple-tenant sites. "With single-tenant sites, on the lower end the valuation is probably $300,000 to $350,000 dollars a site. And those are particularly for sites that may not have a Big 4 carrier as the anchor tenant. Such sites may be in a more rural or exurban area, on leased land, and those sites don't have the creditworthiness of the tenant. Not that they aren't creditworthy, but they don't have the same value they would with AT&T or Verizon as the anchor tenant."

The investment banker said that for single-tenant sites anchored by AT&T Mobility, Verizon Wireless, Sprint Nextel or T-Mobile USA, the valuation could be $350,000 to $400,000 and higher. "Those sites are typically in top-100 Basic Trading Areas (BTAs). They are on owned land or long-term land leases of 24 years or more. They are structures with ample capacity to hold an additional tenant."

Nicolay said that in top BTAs, for urban and suburban multiple-tenant sites on owned land, anchored by a Big 4 carrier and with additional high-quality tenants that largely take up all of the tower's capacity, MVP is seeing valuations equivalent to 15 to 18 times cash flow. "Taking it a step further, we are seeing above 18 times cash flow for multitenant sites in top BTAs on owned land that still has capacity to add another tenant," he said. "Sometimes we're even seeing as much as 20 times cash flow for such high-quality assets."



Harris, whose company more often buys towers than sells them and prefers lower valuations when it is buying, jokingly responded, "I didn't hear anything Jason just said."

Nicolay replied, "Just remember, the more you pay for it, the better you like it."

Harris said it was difficult for him to speak in abstract terms about tower valuations because so many factors affect value. Also, he said, "value is in the eye of the beholder, and because of access to capital, there are a lot of eyes looking at investing in towers, and there are some bad assumptions being made." He said that pricing towers requires really good information. By way of example, he asked, "Is this tower's iDEN installation going to be overlaid with Sprint Network Vision? Is this tower's Clearwire installation going to stick and get LTE, or is it one that might go away?" Harris said it is difficult to say that a single-tenant tower is worth X and a two-tenant tower is worth Y. "But I will tell you, it is a complete market and valuations are historically at the highs or at around the highs," he said.

"What makes it go down in value?" Boyer asked.

Neil Boyer, national director and general manager of AT&T Towers, said of the market for towers that it is near an all-time high for valuation: "I'd say it's being priced right."

Harris said what makes it go down is when investors who expected to get a 15 percent return on their new entry into the tower industry end up getting a 5 percent return and say, "Oh, it's not as good as I thought it was." He said what makes it go down is "when you buy a tower that has T-Mobile, Metro and AT&T on it and then two years later, it only has T-Mobile and AT&T on it. You go to sell it, and you can't get what you paid for it. Those things have to happen on a large scale to affect the overall market. Bigger companies don't have to buy to sell. They're in it for the long haul. But a lot of the new entrants are in it to flip it. If you buy one of those situations and it goes backward on you or sideways on you, you're not going to hit the return that you told your investors that you're going to hit, and money starts fleeing, just like it's flowing in now. If the returns aren't there, the money will flow right back out."

Nicolay said that potential wireless telecommunications carrier consolidation has been a factor ever since the erstwhile AT&T/T-Mobile merger announcement. He said tower owners take into consideration the risk associated with any sort of decommissioning of a site. "With the T-Mobile/Metro merger, T-Mobile's chief technology officer announced that 30,000 sites would be shut down after the merger," Nicolay said. "It's undetermined when that's going to happen. The companies have a GSM network and a CDMA network to combine, and that will take time. But decommissioning of sites definitely is something that they are considering."

The investment banker named Leap Wireless as a potential acquisition target.

"From a larger macro standpoint, tower valuation has to do with interest

rates," Nicolay said. "Interest rates are at historical lows, and access to capital from a high-yield perspective is really cheap for the public companies to raise debt. As you see interest rates potentially climb, the return to investors that they're going to expect is going to draw pricing for towers downward."

Nicolay said that as new investor entrants who are buying towers in hopes of selling them to one of the large consolidators for a profit find that they can't make the returns they promised their investors, they will exit, and then the market will have fewer buyers and that may dampen tower pricing a little bit.

Harris said that access to capital at low rates is not enough reason for valuations to be high. "Valuations should be high if you really believe in that tower adding future tenants," he said. "That's the best way. It's tower location. It's the same way with site acquisition. If you pick the right site, if you buy the right site, valuation is based on future lease-up. Valuation is not based on the fact that I could buy it with cheap money. That's not sustainable. What is sustainable is when you buy a good asset or buy a good portfolio of assets that will lease up and your lease-up projections are correct. You have to be prudent with how that applies. When there are a lot of people at the dance, there's a lot of competition. It's a seller's market, and that leads to the market being overheated." ■

Larry Harris, Jason Nicolay and Neil Boyer made their comments about tower valuations at the *AGL* Wireless Infrastructure Conference in Atlanta. *AGL*'s next conference is in Chicago on Sept. 19. For information, visit *www.agl-mag.com/events.* Photography by Don Bishop.

Jason Nicolay, vice president, Media Venture Partners: "As you see interest rates potentially climb, the return to investors that they're going to expect is going to draw pricing for towers downward."

The New Wireless Frontier: Small Cells, DAS and Wi-Fi

Various businesses find advantages in owning distributed antenna system (DAS) networks and Wi-Fi systems. Manufacturers do their best to supply products in a timely manner for rapid build outs.

By Don Bishop

Patricia Troxell-Tant of Solution Seven served as moderator for the session "Small Cell, DAS, Wi-Fi – the New Wireless Frontier?" at AGL's *Wireless Infrastructure Conference on March 22 in Atlanta. The panelists were Mark Kerschner, wireless product manager, TE Connectivity; J. Derrick Smith, manager of DAS engineering and standards, AT&T Antenna Solutions Group; Darlene Braunschweig, president, DAS and Small Cells Division, Tempest Telecom Solutions; and Ali Sar, president and chief executive officer, 123eWireless. The following are the panelists' remarks, edited for length and style.*

Mark Kerschner
Wireless Product Manager
TE Connectivity

During the last year, data traffic on wireless communications networks has grown 70 percent. Equipment manufacturers are bringing equipment to the service providers that allows them to access the end user more readily and bring the information back to the core network. Fifty percent of the data growth was streaming video. We're looking at 13-fold growth in the next five years, and two-thirds of it will be streaming video to the handset or mobile device. Ten exabytes of data will be pushed through the networks on a monthly basis by 2014.

For an equipment manufacturer to be able to supply the right products from inventory when needed for DAS and in-building wireless projects that have requirements that vary so widely from project to project means making the components configurable. We know what AT&T, Verizon, T-Mobile and all the other carriers have for radio-frequency spectrum. Having the right inventory of amplifiers on the shelf isn't too tough.

Mark Kerschner, wireless product manager, TE Connectivity, a company that designs and manufactures products that connect and protect data and power.

It's the last 10 percent of a project's requirements that gets a little hairy at times. We try to put programs in place to work more closely with project managers for wireless system deployments to monitor progress so we can get critical components in the pipeline in as timely a fashion as possible. We're always going to be short here or there. It's inevitable to get on a job site and find something is missing. We do our best to mitigate that by having the common components there, but it's tough.

Technology limitation

TE Connectivity uses digital transport, so it doesn't matter whether a carrier gives us GSM, LTE or any other signal. We can put it all together because 1's and 0's are going down our pipe, and for the amplifiers, it makes no difference. They amplify whatever signal they receive.

Some installations face a technology limitation that requires using a crane to remove an old unit from a pole and put a new unit on it that can support the latest and the greatest. At TE, we're putting in a modular design for amplifiers, so if something does change that we cannot support, we're not out there doing a full forklift take-off of the unit. We can go and place one new component out there.

Patricia Troxell-Tant, standing, and to the right of her, Darlene Braunschweig, J. Derrick Smith, Ali Sar and Mark Kerschner.

We provide equipment to wireless carriers, domestic and international, and to third-party integrators. We provide equipment for neutral-host systems, private enterprises, stadiums and campuses, both in-building wireless and outdoor DAS products. Whatever capacity problem needs to be overcome, we provide a product to put into the network to alleviate it.

With a neutral-host system, an intermediary buys a product and deploys units inside of a building or out in the outside plant. Then, it solicits tenants such as AT&T, T-Mobile and Verizon. We still see some conflicts among carriers. Most of them don't want to share amplifiers. They don't want to share the common transport. They don't want to

share the common equipment.

Campuses and private enterprises take on a similar role as a neutral host, although they do it on their own scale and in their own buildings where they build a wireless communications infrastructure and then solicit AT&T, Verizon and T-Mobile to use their network. Usually, that's a balanced mix with private groups. They are already talking with AT&T and Verizon saying, "We can get you in there, but we want to have control of it," and they want to make some revenue on it because they're private businesses and they want to see their revenue increase.

Equipment is becoming smaller, and that offers some advantages. Smaller equipment is easier to zone. It's easier to put inside a telecom closet. It's easier to put on a pole or inside of a pole out on the outside plant.

We can take advantage of smaller technology to either double the capacity or make units smaller. We have a fairly large unit with four amplifiers. With the smaller technology that we're using, we could either cut the size in half with four smaller amplifiers or add capacity with up to eight amplifiers in a same-size unit. It's great for neutral-host applications to add capacity, or it's great to have something smaller and more stealthy for deploying out in the networks.

Mark Kerschner: "Equipment is becoming more and more reliable. Carriers are relying more heavily on small cells and DAS, so we do extra tests beyond what we've always done."

Customers tell us that prices are important. The cost has to be right for them to deploy a small cell. At the prices of some systems, putting hundreds of units in the network means multimillions of dollars. If you can reduce that by 10 to 20 percent, it makes the business case that much more appealing to the bean counters.

Reliable equipment

Meanwhile, equipment is becoming more and more reliable. Carriers are relying more heavily on small cells and DAS, so we do extra tests beyond what we've always done. We've gone through extended highly accelerated life test (HALT) and highly accelerated stress screening (HASS) testing to reveal failure points. Then we fix the problem and rerun the tests again. We're trying to build a more reliable network for carriers because they rely on it for their revenue. Anytime it's down, it takes money out of their pockets, then they make the phone call to us, and that's not a comfortable place to be in.

Darlene Braunschweig
President
DAS and Small Cells Division
Tempest Telecom Solutions

One of the biggest challenges for wireless systems integrators that manage construction projects is that turnkey means something different to everybody, including each of the carriers, enterprises and tower companies. We establish a menu of our capabilities that lists the various undertakings we support. Turnkey generally means an integrator can do everything from site audits, leases and acquisition to the actual design, deployment, commissioning, optimization, ongoing maintenance and system monitoring. Those are all capabilities that your average contractor is now being required to support.

Wireless system quality is becoming more important. I've deployed thousands of these systems, and historically, they were always sort of a nice thing to have. Now, they truly are an extension of the macro environment for a carrier. We in the industry, at least in this space, underestimated that a little bit. It took us a while to figure out that quality is important because it takes on the dynamics of the requirements in the tower environment. We have continued to develop those core assets so we can provide that capability.

It may not be more difficult to provide turnkey DAS, Wi-Fi and small cells than for towers on the macro network. The challenge is that no two in-building systems are ever the same. Tower builds tend to have more components in common. The standards are now starting to be set for the in-building space, whereas for towers they've been set for quite some time. When carriers set standards, it helps systems integrators understand what the benchmark is and what it has to be.

Darlene Braunschweig, president, DAS and Small Cells Division, Tempest Telecom Solutions, a company that helps carriers and operators build, expand and manage telecommunications networks.

Each wireless carrier has its own business case. They have corporate customers for which they want to provide specific coverage and capacity. For a large enterprise customer that uses a carrier as its primary wireless carrier, the carrier will install a single-carrier in-building or outdoor DAS solution.

Public venue used to mean stadiums and arenas. Now it also means hospitals, college campuses, hotels, casinos and shopping centers. Those environments need neutral-host wireless systems. Each carrier wants to be the lead with those systems because when they have a high subscriber rate, being the lead means they can maintain the subscriber rate and either improve or maintain them at the levels they want.

Also in public venues, sometimes tower companies build the system and have carriers plug in and pay for portions of the system. That's a growing business, because carriers can't fund everything. Carriers have to choose where they are providing funding, what they are funding and how they are funding it to take advantage of the consolidated dollar through a variety of sources. It may make more sense for a carrier to plug into a stadium where there may be X number of home games and the carrier has a large subscriber rate instead of building the system itself and then worrying about how to sell the assets or add other carriers to the system. It tends to be a good business for the tower companies. We're seeing carriers migrate toward systems with a large public venue opportunity such as health care in which they have a number of independent consumers.

Darlene Braunschweig: "We're seeing carriers migrate toward systems with a large public venue opportunity such as health care in which they have a number of independent consumers."

Ongoing maintenance

We're seeing enterprises draw conclusions that a wireless foundation in their buildings is important. They decide to own and maintain an in-building wireless system because applications drive the requirement. We're seeing enterprises own and fund the systems and then bring the carriers on. If the system meets a carrier's requirement, the carrier may decide it can save money and keep customers happy in these venues. It depends on who's interested, what the type of venue is and the specific requirements or return on investment associated with

each carrier and tower company. There's no standard, so the answer is reached by working through the questions to find the most effective approach.

For aggressive carriers that understand the tower-like model and that have the funding and the capability to build a neutral-host system, that would be the way that I would go, and then on-board other carriers. Being the first one in is always the best position for a carrier.

We're still learning a lot about the small-cell environment. We are deploying small cells for a variety of carriers, and some of the enterprise femtocells are tricky to install — especially to install as quickly as some people seem to believe we should. As new technology is deployed, it has to cycle through a period for educating all of us, whether it's the integrator, the carrier or the venue owner. We are in the infancy stage regarding small cells. The business will evolve to support not only the deployment requirements but also the ongoing maintenance. Meanwhile, DAS doesn't break all that often.

OEMs deploying equipment

We've seen challenges in the deployment of LTE on DAS networks. It's a fairly new technology with new OEMs deploying equipment. Some parameters that had been set for previous technologies may not be the right parameters for the future. Working through some of those problems to find how the new equipment should be designed, manufactured or deployed will help to minimize ongoing maintenance requirements. With customers relying more on wireless communications as an absolute necessity, it becomes much more urgent on the OEM side to resolve the problems.

Extending public safety wireless communications into buildings more often involves new builds and for us has been focused more on the West Coast where jurisdictions were more on the forefront about this. The responsibility for deploying public safety communications systems in buildings falls on the building developer and usually is paid for by the building owner or developer, depending on the arrangements with the building owner. Where building owners have to provide for public safety radio communications to qualify for a certificate of occupancy, they have almost no choice but to pay for it. The carrier not only looks at potential liability, but also at funding for public safety requirements that are not the same in any two jurisdictions, which is extremely challenging.

In some areas of the country where DAS is being deployed, including public safety communications is required. Then it comes down to preference as to whether it should be integrated into the DAS or provided as a stand-alone system.

J. Derrick Smith
Manager of DAS Engineering and Standards
AT&T Antenna Solutions Group

An increasing number of wireless communications users are using smartphones, which require more data use. We look at whether people are using their devices more often indoors compared with outdoors while travelling, riding and driving. AT&T needs to cover its customers indoors or outdoors. With a wireless data growth rate of 13 times to 18 times over the next couple of years, it's important to make sure we have contiguous coverage to provide a seamless wireless communications experience as users go indoors and outdoors and whether high capacity or low capacity is required.

There are two ways to cope with the amount of data being carried. One is by using technology, and the other is by throwing infrastructure at it.

Heterogeneous network

From a technology standpoint, we've already gone through several iterations from analog to TDMA, GSM, UMTS, HSPA and now LTE. You reach a point where further technology advances are limited by physics. When technology can offer nothing further, you look at infrastructure. The amount of infrastructure that can be placed in one location to provide a feasible solution also is limited. That pushes us to the small-cell, heterogeneous network to offload some of the macro network traffic to small cells while providing coverage in small enterprise businesses that we haven't covered before.

"There are two ways to cope with the amount of data being carried. One is by using technology and the other is by throwing infrastructure at it."

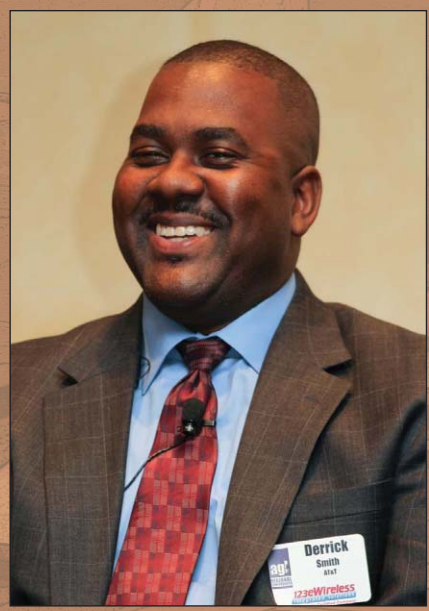
That's what's behind our push toward small cells. We ran out of a lot of spectrum that we have. We have to innovate to provide users with what they need and meet the large data demand.

From an operations standpoint, it's important to understand how to backhaul from small cells and how to maintain the backhaul. It makes a difference whether the backhaul is dedicated and whether we can monitor it ourselves. If it is a customer-based backhaul where the customer owns the transport piece for us, it makes a difference whether the customer allows us to put monitoring systems into their network to make sure that when there's an outage on their side, we're able to be more proactive in solving the problem as opposed to it lingering for a long period and degrading service for our customers. Overall, it looks as though maintenance of small cells will be easier than it is for DAS or for a macro site.

Small-cell deployment

An important aspect of small cells is the overall planning and making sure that we understand how small cells will affect the macro network. With femtocells or indoor 3G microcells, you can't just send them to a customer and say, "Here, install them." We have to have an indication of the amount of leakage that will occur from the venue. It's important to know how to overcome the existing macro signal that may be penetrating into the venue. So, the planning that goes into deploying small cells has been a big issue.

First field applications and other trials teach us what we need to do to provide customers with an accurate solution that provides good coverage, good quality and a seamless hand-off between the indoor small cell and the outdoor macro system. As you enter a building, you want to be able to maintain the same network quality. It's been a good learning experience to maintain standards for throughput and quality with small cells.



J. Derrick Smith, manager of DAS engineering and standards, AT&T Antenna Solutions Group, an AT&T division that builds distributed antenna systems.

Whether the technology deployed on small cells is UMTS or LTE depends on the vendors that we use. With respect to small cells, large builds like stadiums are not our main goal. Our goal is the small enterprise business.

"We haven't found any specific vertical markets for small cells. They can fit where you want to put them."

You'll also start seeing more small cells being integrated into other places where we have radio-frequency spectrum limitations. In the largest cities, you'll see small cells used inside of buildings.

We haven't found any specific vertical markets for small cells. They can fit where you want to put them. It's a matter of making sure they interoperate with the macro network and that they can be provided with the necessary backhaul.

Ali Sar
President and CEO
123eWireless

Anyone who has built a tower site probably came up a connector or a cable short, or found that an antenna didn't work, and it pushed back the switch-on date by a day, a week or a month. In the DAS arena or in-building wireless business, that's an everyday occurrence. It's a challenge to get a venue up and operating quickly, yet also have customization and the necessary parts.

A given antenna won't necessarily be used in other venues, so you can't buy a bunch and stick them in the warehouse and hope that the next stadium you do will be like the hotel you did last week. A cable you select for its fire rating to use inside a building can't be used outdoors because the fire rating for inside the building versus outside would be different.

All the carriers want to be first to market, and how do they get their systems up and running fast in such a competitive environment? The carrier or systems integrator, whoever is doing the design, has to work with flexible manufacturers or distributors of products that they can configure quickly. They work with their supply-chain partner to have 90 percent of what they need available at any given time. The 90 percent is a configurable product that can be used in different settings. The connector might be the same and the antennas might have a slight variation, but if you can configure them quickly to fit the venue, carriers and systems integrators get their systems up and running fairly quickly.

Ali Sar: "Macro sites now have integrated or power antennas. They're expensive, but I foresee in five or six years that integrated antennas with their own radios or other electronic components could come in smaller packages."

Ali Sar, president and chief executive officer, 123eWireless, a company that designs and manufactures integrated wireless solutions.

Quick-turn manufacturing

Increasingly, carriers and others within the supply chain will look for suppliers that can perform quick-turn manufacturing assembly for specific projects. They have to go outside their comfort zone to find these new, qualified support sources. It is no longer necessary to buy from China, India and other overseas sources. It's less expensive to manufacture and design in the United States. Carriers and other system builders are going to get what they need quicker and cheaper, and at better quality. And most importantly, they can go to a facility where the components are made, see for themselves what the manufacturer is doing, and verify the qualify themselves. When you buy assemblies from overseas, you never know what you're going to get.

Suppliers always need to be looking at tomorrow. What's the technology going to be tomorrow?

Antenna development

For example, our company started out making cable, then got into hardware, and then developed antennas. We understand antennas for DAS, our product allows us to configure antennas to meet the customer's needs. As technology increases, and as the need for capacity and the need for lower-cost material increase, different types of antennas will evolve.

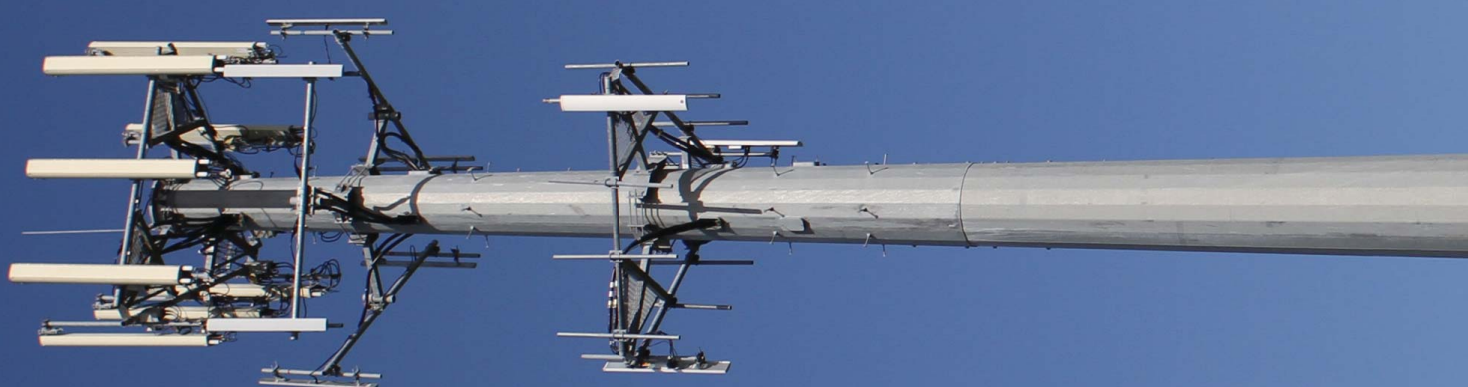
Manufacturers shouldn't be trying to design something they think is great and then try to sell it, saying it's the next new thing. What we need is customers telling us what to do.

Quality comes first, delivery is second, and price is third. Price isn't a factor because it is offset by quality and delivery. If you're putting in a system that's cheap, you're going to get what you pay for. Higher quality might cost more, but you get a better system.

More antennas, less power

Antennas are a big part of a wireless infrastructure. Configurable antennas that allow installers to configure them by plugging in a different cable or flipping a switch to change a pattern will decrease the cost and increase the quality. Macro sites now have integrated or power antennas. They're expensive, but I foresee in five or six years that integrated antennas with their own radios or other electronic components could come in smaller packages. It might cost $150 per antenna, but it would have an amplifier and a radio, and could be transported by fiber. The goal is to have more antennas with less power to confine coverage to smaller spaces. ■

The next *AGL* Regional Conference is in Chicago on Sept. 19. For information, *visit www.agl-mag.com/events.* Photography by Don Bishop.



JULY/AUGUST

AGL TOWER OF THE MONTH

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SITE NAME
Vic
SITE OWNER OR MANAGER
Crown Castle International
TOWER TYPE
Monopole
HEIGHT
100 feet
APPLICATIONS
Cellular
LOCATION
Homestead, Fla.

Vertical Markets and Small-cell Technology

Municipal Wi-Fi 2.0 overcomes the problems of the past. Distributed antenna system (DAS) networks thrive in stadiums, racetracks and hospitals. Some are built at an amazing speed.

By Don Bishop

Janet Gill, vice president of business initiatives, Solution Seven, served as moderator for the session "Vertical Markets: Fertile Ground for Small-cell Technology" at AGL's Wireless Infrastructure Conference on March 22 in Atlanta. The panelists were Ben Moebes, director of strategic accounts, Ruckus Wireless; Melissa Ashurst, regional DAS manager, AT&T Antenna Solutions Group; Chris Meyer, RF engineering manager, ExteNet Systems; and Ken Wedholm, global sales manager, Stealth Network Solutions. The following are the panelists' remarks, edited for length and style.

Ben Moebes
Director of Strategic Accounts
Ruckus Wireless

When it comes to deploying Wi-Fi, much has changed when Wi-Fi deployment is compared with deploying macro wireless telecommunications antenna sites and within the Wi-Fi world itself.

With Wi-Fi, we have to get a lot closer to the users. So, we're not typically deploying on towers, although we use towers for backhaul to feed bandwidth down to the Wi-Fi layer. But we're on streetlights, municipal poles and cable TV strand.

Wi-Fi in the city environment has been around for quite a while now. Cities love anything that saves them money. Most cit-

Janet Gill, standing, listens as Melissa Ashurst responds to a question.

Ben Moebes, director of strategic accounts, Ruckus Wireless, a leader of Wi-Fi in the carrier business.

ies don't have much money to spend. They love wireless, especially Wi-Fi, if it saves them money they're spending for another service. For example, maybe Wi-Fi saves the city money it otherwise would spend to extend a T1 data circuit to every traffic light. Miami has 3,000 streetlights and a Digital Signal 0 (DS0) phone line to every streetlight. Imagine $30 a month for every light. If you can deploy a wireless network that also can be used for other things, it can almost pay for itself just by getting rid of those phone lines to the lights.

The focus on selling Wi-Fi to cities is about how to reduce costs, because the money is unavailable for Wi-Fi as an add-on, luxury network. It's got to be paid for in cost cuts.

San Jose, Calif., offers an example of an early Wi-Fi network and an upgrade. San Jose first built out a network several years ago. With its upgrade, call it Network 2.0, the city learned several things.

One thing it learned is that the type of access point really does matter. You can put in an access point, but if a user's iPhone or iPad can't connect to it, you just spent money for nothing. A city has to do the research to select a vendor that provides client connectivity that actually works.

Another thing it learned is that five years ago, many cities building Wi-Fi networks used a single fiber connection that then meshed out across a broad area. Most of those networks had bad performance. The reality is that you just can't spread that single fiber connection over 50 square miles of coverage, which is exactly what many cities tried to do.

With San Jose's Network 2.0 upgrade, the city has a fiber pop every other radio. So, if there are 50 radios, you have 25 fiber connections to that network. There's a lot of capacity to feed and a lot of room to grow, which is really what we're trying to do. You're trying to build a network that the city can use for as many different things as possible. That's how a city can monetize the data. Once they've done that, then they can build a network that will truly work. As more networks like this are built, the impression cities have of Wi-Fi will slowly change back to an overall positive impression. For the past several years, the impression has been fairly negative.

Melissa Ashurst
Regional DAS Manager
AT&T Antenna Solutions Group

When AT&T created the Antenna Solutions Group about three years ago, we looked at a large number of public venues, focusing on occupancy and wireless communications capacity needs. We found that hospitals have needs that far exceed those of other venues. It's not just the physicians and staff who need wireless communications coverage. It's also critical for patients and their families.

At early meetings in large medical facilities, we saw people in scrubs wearing belts with multiple pagers and cell phones because it was critical that they would be able to take a call as it came in. It could be a matter of life or death. Meanwhile, as Brian Williams showed in an episode of NBC's Rock Center, emerging medical mobile applications are becoming available for iPhones and other wireless devices. What they highlighted was the change that these devices enable

Vertical Market

A vertical market is a form of niche market. A vertical market is composed of a subset of vendors and customers that conduct transactions based on particular needs. A vertical market will appear as a small group within a larger industry, with vendors supplying products and services directly related to a customer considered to be part of the same industry.

A vertical market addresses specific needs associated with the market sector. A horizontal market has broader appeal. Products and services offered in the horizontal market are still useful to the customer, but much less specialized. This makes it possible for vendors in horizontal markets to sell the same goods to businesses engaged in different industries.
—wiseGeek

The activities of participants within any given vertical market are typically similar in that they aim at solving the same or similar problems. These markets are typically competitive due to the overlapping focuses of the products and services provided to customers. The single defining characteristic of the participants in a vertical market is competition within a well-defined segment.

Horizontal market participants often attempt to meet enough of the different needs of vertical markets to gain a presence in the vertical market. Their similar products and services tend to be less of a fit but also less expensive than specialized, vertical participant solutions.
—Wikipedia

A vertical market is a group of companies that serve each other's specialized needs and that do not serve a broader market. A vertical market is tightly focused on meeting the needs of one specific industry. Vertical markets are focused on a single niche. A horizontal market, by comparison, is able to sell its goods and services in more than one industry, and is therefore focused on a wider range of business segments.
—Infopedia

Melissa Ashurst, regional DAS manager, AT&T Solutions Group, a division of AT&T that builds distributed antenna systems.

for physicians to interact with patients receiving ongoing treatment.

Beyond that, you have patients and their families in high-stress situations in which you could have the highest of highs with a new birth to the lowest of lows with the passing of a loved one, and their only connection to the outside world and other loved ones is their wireless devices.

Being able to provide coverage throughout the facility is important to a range of people. Hospitals want to have the best of the best. They have to have cutting-edge technology. That's the only way they're going to obtain the grants that they need to keep their facilities up to date.

Some hospitals wouldn't necessarily qualify for a public DAS because they don't have enough beds and enough people coming through their doors every day, but we still have an option that would assist them in obtaining the wireless coverage they need. A small cells launch will be able to reach even more of those users.

AT&T deployed the largest neutral-host DAS in the western hemisphere when it deployed a DAS in the Mercedes-Benz Superdome in New Orleans Not only was the deployment large, the timeline was extremely tight.

Since the Antenna Solutions Group was created, we've always taken a bit of beating from our counterpart on how robustly we design our networks and how we don't plan for the low point of occupancy but instead build for the highest point of occupancy. We didn't look at it just for this year but instead we looked at it for many years from now to ensure that the Superdome management would not have to go back and disrupt things to upgrade the DAS.

We deployed 204 UMTS sector carriers, 49 LTE sector carriers, over 1,000 antennas and over 69 miles of cable. Again, we took some hits on that, but while we were watching the Superbowl and the electrical blackout took place between 8 p.m. and 9 p.m., everybody involved with the DAS project was on the edge of their seats saying, "Oh God. Is it up? Is it running?" The next day, we were happy to find that during that hour, we had 78 gigabytes of data traffic over the AT&T network, about

20 percent of the total usage from the pre-game, game and post-game periods.

That's a massive amount of traffic. The reason it went up during the electrical blackout is that a Wi-Fi network there went down. The traffic was double the amount that we saw during the peak hour the previous year in Indianapolis.

So, we're very proud, and it helped to reassure us that we are taking the right approach to DAS deployment.

When you consider the days that we were allowed into the Superdome to work on the project, because some periods were excluded while events took place, we made the installation in 28 days. That included rebuilding the parking garage where the head end is located to waterproof the ceilings after water was found to be dripping into the area. There were nonstop problems with water leakage. Because of the weight of the backup batteries, we had to reinforce the parking garage below.

Chris Meyer
RF Engineering Manager
ExteNet Systems

Large venues present technical and business challenges. Large venues have large numbers of users in relatively small areas and demand high capacity for wireless communications. Examples include sports and entertainment facilities, convention centers, college campuses, fairgrounds and amusement parks.

A venue's geometry affects the technical challenges, such as where to place antennas and how to hide them or make them blend into the aesthetic of the venue. How people get into and out of the venue affects their wireless devices' transition from the macro network outside the venue to the network inside the venue.

With capacity, the necessary network vectorization or shrinking the cells calls for carefully placed, high-performance antennas that help to eliminate interference among cells throughout the network. Using high-performance components with low noise figures and

Chris Meyer, RF Engineering Manager, ExteNet Systems, a Chicago-based telecommunications infrastructure company for wireless service providers.

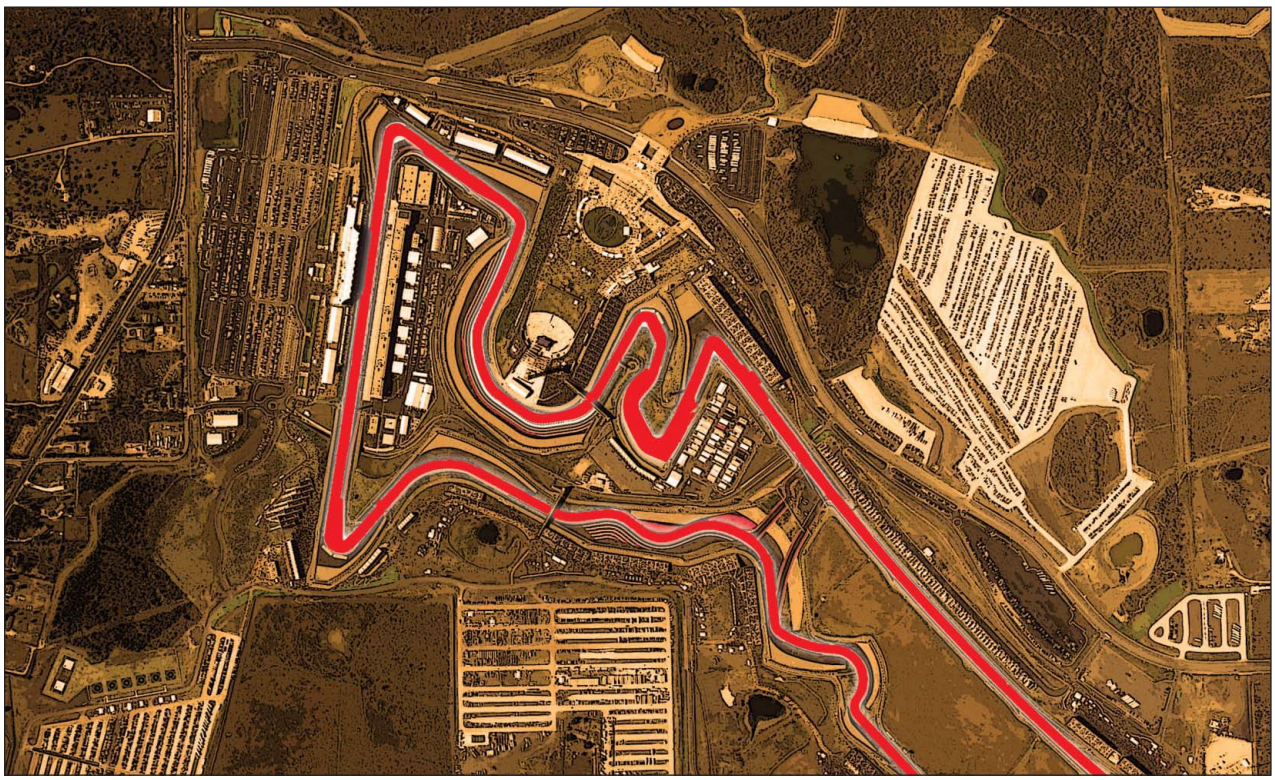

Photo 1. An aerial view of Circuit of the Americas in Austin, Texas, shows the racetrack traced in color. A large parking lot is on the left. The white-roofed building is the main grandstand. The track passes between it and the pit building, which has an elongated gray rooftop. To the right of the pit building inside a loop of the racetrack is a 230-foot observation tower and an amphitheater. Photo courtesy of ExteNet Systems.

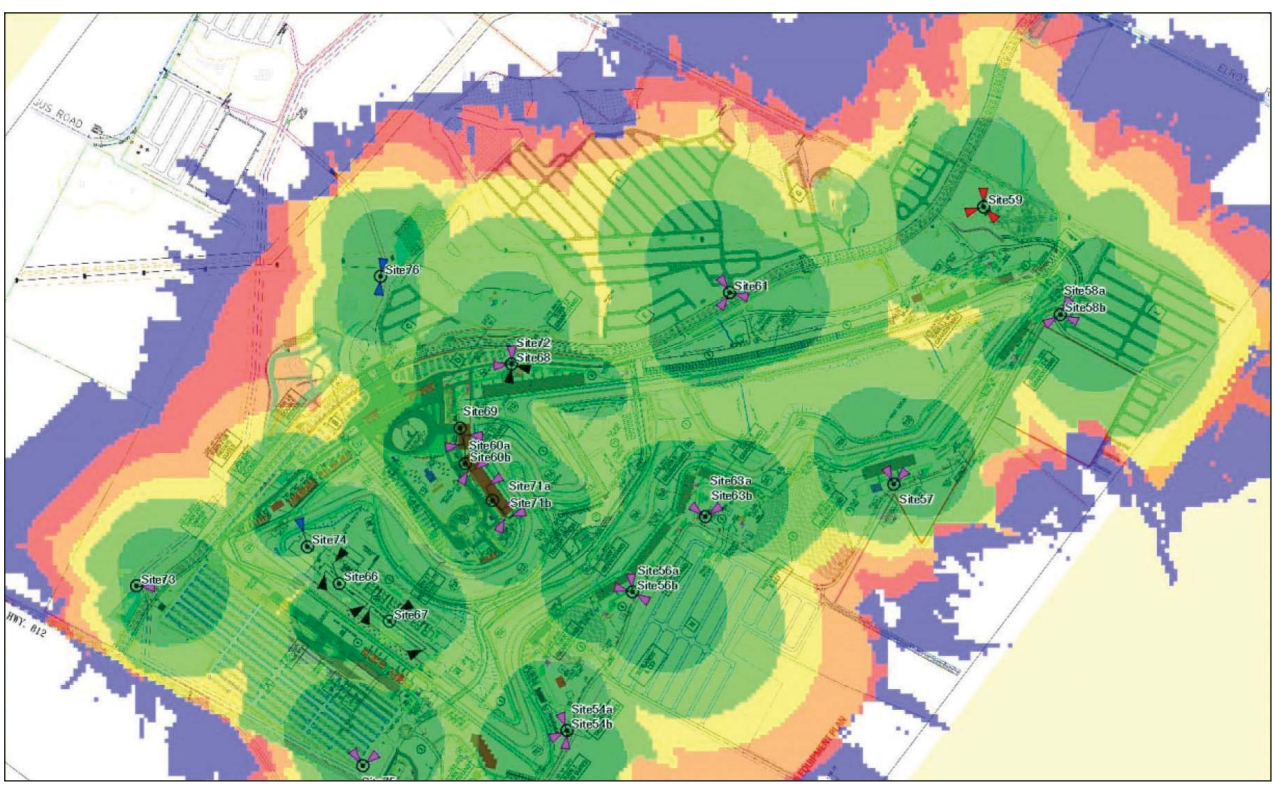

Figure 1. An overview diagram of the Circuit of the Americas property shows the distributed antenna system coverage as it was designed. The antenna sites are located throughout the property to provide blanket coverage. The signal strength is greatest where the color is dark green, then to green, and so forth. The prediction is for 700-MHz LTE reference signal received power. Diagram courtesy of ExteNet Systems.

eliminating passive intermodulation (PIM) interference becomes important, along with avoiding interference from outside sources. Sometimes that requires working with frequency coordinators or just hunting for an interference source.

The business aspect involves meeting a return on investment goal despite some venues having a low average rate of use. Some remain dormant for long periods, followed by high peaks of use. The business aspect involves making sure the project stays on budget, developing relationships with carriers, vendors and a venue's owner, and formalizing partnerships with them.

Triple constraints

A more general challenge that is common to any construction project is making sure the project stays within the triple constraints of time, cost and budget. You also need to make sure the network is properly alarmed and maintained.

An example of a large venue where we deployed a DAS is the Circuit of the Americas in Austin, Texas, the home of the Formula 1 United States Grand Prix (see Photo 1). From one end of the track to the other is a little over a mile. The main grandstand is in the left part of the photo along the straightaway. Just to the right of that, a large grassy area, is the grand plaza. There's a 230-foot observation tower and an amphitheater. Lining the track all the way around are various permanent and temporary spectator structures, grandstands, grassy seating areas and concessions. There are parking lots and lots of entrances all around the back.

Chris Meyer: "The business aspect involves making sure the project stays on budget, developing relationships with carriers, vendors and the venue owner, and formalizing partnerships with them."

Blanket coverage

An overview diagram shows the network as it was designed (see Figure 1). The diagram shows a prediction for 700-MHz LTE reference signal received power. It shows the type of blanket coverage that we provide for the venue.

Circuit of the Americas is the only purpose-built Formula 1 track in the United States. It's going to host the U.S. Grand Prix through 2021. It's a 3.4-mile circuit with a capacity for 120,000 fans. They're expecting about 1.2 million an-

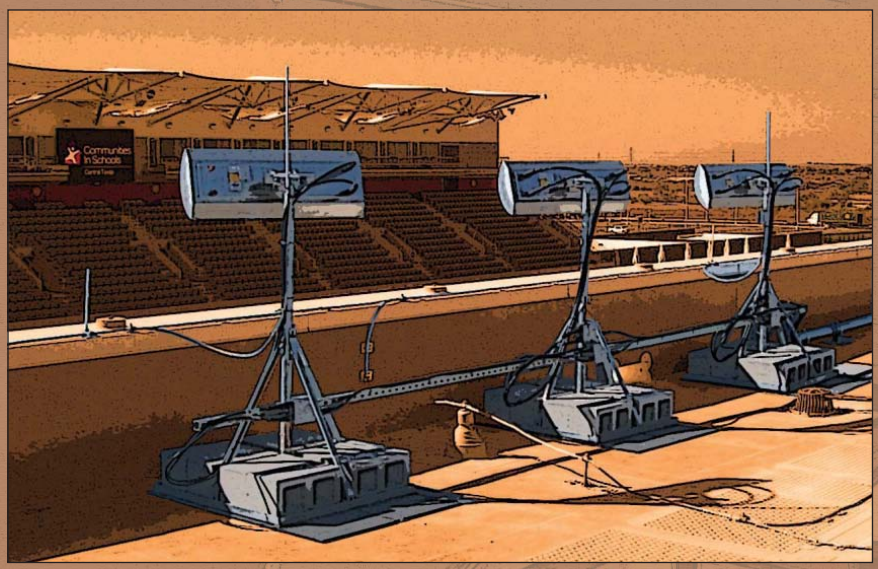

Photo 2. These three antennas atop the pit building are part of ExteNet's network assets for the Circuit of the America's distributed antenna system. The antennas serve the grandstand that faces the pit building across the straight section of racetrack. Photo courtesy of ExteNet Systems.

nual visitors. It's a 1,000-acre site, the size of a small city. Construction began in 2011. When I first started going to this venue, it was a prairie, nothing but shrubs and snakes.

The first race was back in November of last year. It's not just a racetrack. They've got spaces for public and private events, seminars, conventions, festivals, that sort of thing.

The pit building and the main grandstands seat 13,500 VIP spectators in premium seating. A paddock, a hospitality and media center, and race controls are in this area, together with executive offices and a high-end private club. For this area, our network assets are located on top of the pit building serving the main grandstand (see Photos 2 and 3).

Other grandstands and grassy seating areas are placed at the 20 turns around

Photo 3. The main grandstand area seats 13,500 VIP spectators in premium seating. The grandstand to the left faces the pit building across the racetrack that houses a hospitality and media center, the race controls, executive offices and a high-end private club. Photo courtesy of Circuit of the Americas.

Photo 4. Grandstands and grassy seating areas are placed at the 20 turns around the track. Each has a capacity for 3,000 to 15,000 spectators. They have different terrain, capacity requirements and aesthetic concerns. This view of a seating area shows the 230-foot observation tower near the amphitheater. Photo courtesy of Circuit of the Americas.

the track (see Photo 4). Each has a capacity for 3,000 to 15,000 spectators. They have different terrain, capacity requirements and aesthetic concerns.

Another part of the venue is the Austin360 Amphitheater, also known as the tower amphitheater because it is adjacent to the tower observation platform. The 17,000-person amphitheater can be configured for concerts or festivals (see Photos 5 and 6.). Circuit of the Americas has 15 concerts and two festivals planned for this year, with 320,000 people expected. The amphitheater was still under construction during the first race, so we initially located our network assets to cover the amphitheater on some adjacent grandstands (see

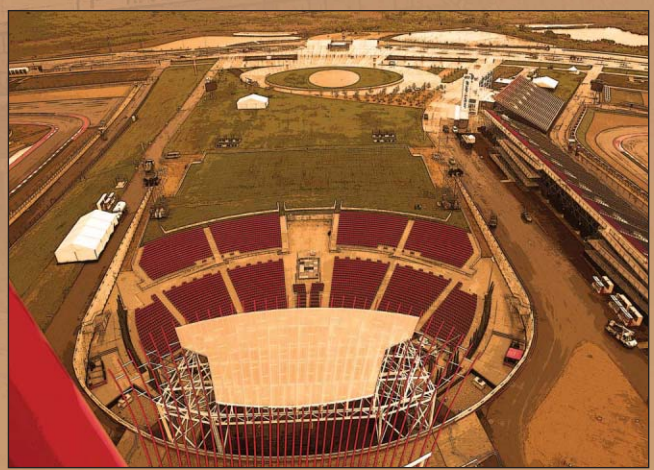

Photo 5. A view down into the bowl of the Austin360 Amphitheater from the observation tower shows the red seats and beyond them, a grassy seating area. Photo courtesy of Circuit of the Americas.

Photo 6. Another view of the amphitheater shows the stage adjacent to the 230-foot observation tower. The amphitheater has a capacity of 17,000 people. Photo courtesy of Circuit of the Americas.

Photo 7. While the amphitheater was under construction, some antennas were placed on nearby grandstands to deliver a signal into the amphitheater. Photo courtesy of ExteNet Systems.

Photo 7). But now that this amphitheater is complete, we're looking at some small upgrades to be able to better cover that area. We're serving most of the grandstands and grassy seating areas near the turns with multisector monopoles behind spectator areas (see Photo 8).

The way to deal with a venue like this is to divide and conquer. You break it down and look at each area and how to deal with it. You can't forget about ingress-egress, making sure those network transitions into and out of the macro network are smooth.

We try to be as flexible as possible to build networks that can move from the super-high-capacity, super-small-cell, dense designs to something that looks more like a coverage solution.

We take into consideration as much information and market knowledge as we can from the very beginning during the design stage to be able to look at carriers such as AT&T Mobility and Verizon Wireless. We're going to have the most limiting constraints on the number of channels and the amount of capacity they want in the venue. But we also want to be sensitive about how it will affect the cost to build the network so that we can get carriers like T-Mobile USA and Metro PCS to join the network as well. It is really a balancing act.

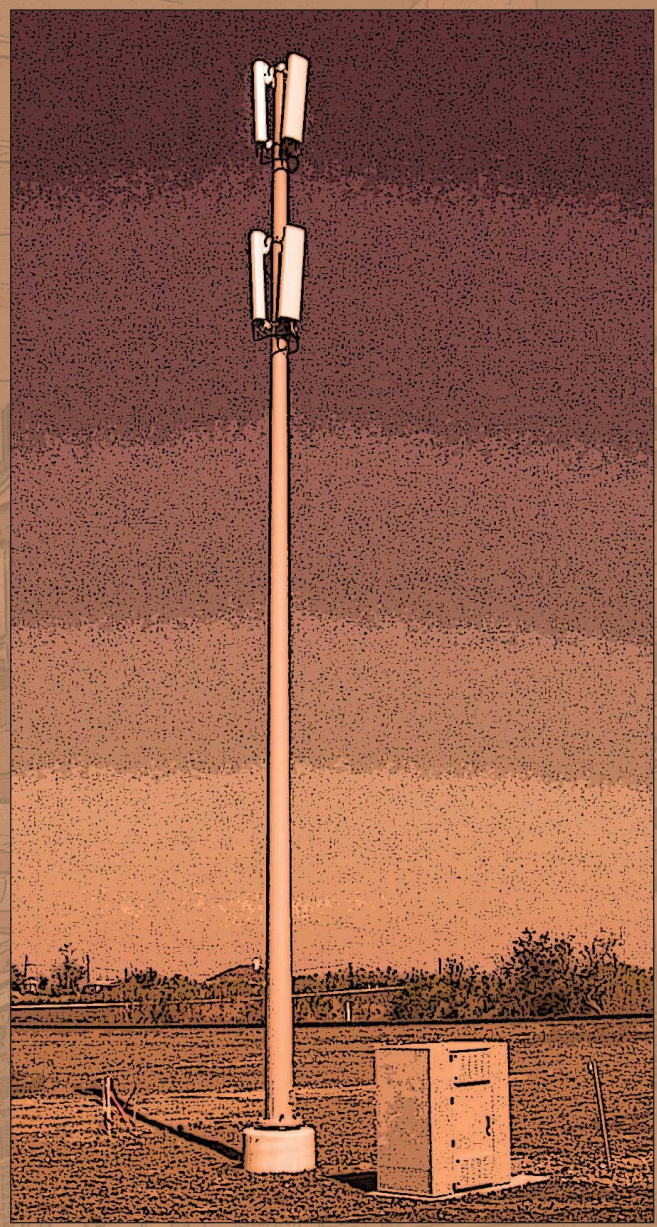

Photo 8. Multisector monopoles have been positioned behind spectator areas to serve grandstands and grassy seating areas near turns in the racetrack. Photo courtesy of ExteNet Systems.

Ken Wedholm
Global Sales Manager
Stealth Concealment Solutions

Municipalities want wireless communications service and they don't want to pay for it, so wireless carriers step in to negotiate with them. Carriers often find out that although the towns really want wireless service, they intend to put constraints on the designs of the antenna support structures.

With a project in Scottsdale, Ariz., the antenna structure could be no taller than 24 feet, no larger than 24 inches in diameter, and the electrical and electronic equipment had to be concealed within the structures. These constraints were met by disguising the structures to look like cacti. The structures were placed 20 feet from people's unfenced backyards, out in the open, so they had to be structurally sound, tamperproof and vandalism-proof, and they had to really look like cacti. We went through five or six planning and zoning hearings and reviews of samples.

It's difficult to get 10 people to agree on one thing, especially when it is an aesthetic item. We worked with the integrator and the carrier, and we got everybody happy. The sites are up and running and functioning.

There was a lot of interaction with the

town representatives. You have to come together and agree to agree sometime. You can't keep fighting and fighting to get the site deployed. It was challenging. It was actually a very good challenge. We learned a lot from it. We've done other installations like that with other municipalities.

With shopping malls and other construction, some of these buildings and structures have been designed by fairly famous architects who sometimes seem to take offense at us wanting to change the appearance of certain features that lend themselves to be used to conceal a wireless site. We deal on many levels with the building engineer and architect and many times with the leasing company to manage this phase.

It does come down to aesthetics most of the time, and it's challenging to build architectural features and elements with RF-transparent material. Textures, colors and RF interference make a difference.

Ken Wedholm, global sales manager, Stealth Concealment Solutions, a company that provides RF-transparent antenna concealment.

We may find the right spot, and it turns out it's near glass doors, or they're going to be building something else inside the mall nearby.

We have to work with the integrator and with the designer to find where we can deploy the antennas. They may have an idea of where they need to be. The question comes down to what can we make it look like and how can we make it fit in. In some cases, you can't fit them all. We're challenged with materials like glass. We have a hard time dealing with that. If it's a fairly normal type of building architectural element such as the molding panels, we could probably replicate it fairly easily and hide antennas inside.

In some instances, extending fiber-optic cable to the antennas is challenging. You just can't hang it in the air. You have to be able to design that into the concealment plan as well. ■

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How LTE Equipment Affects Tower Loading

LTE equipment affects towers and equipment mounts wherever it is placed, whether on new, raw land sites, on tower modifications, on existing mounts or on new mounts.

By Will Heiden, P.E.

Equipment designed for fourth-generation (4G) long-term evolution (LTE) wireless communications technology usually presents a greater surface area to the wind, if not a heavier weight for the tower to bear, compared with equipment for third-generation (3G) personal communications service (PCS) technology.

The 3G or PCS antenna configuration was mostly a 6x1 or 5x1 panel with an effective projected area, or the loading that the panel would present to the wind, of 78.6 square feet. LTE typically uses 8x1 panels with tower-mounted amplifiers and radios that increase the effective projected area almost to 118 square feet (see Figure 1). This is nearly a 30 percent increase in area.

The area on which the wind can blow acts like a sail, and this is what causes much of the difficulty with LTE equipment on towers. For the most part, it's not the weight of the equipment, although it can be heavy, it's the wind area loading that causes most of the effect on the tower. With equipment placed at an elevation of 300 feet, the tower will experience more stress from wind than from weight.

LTE equipment affects towers and equipment mounts wherever it is placed, whether on new, raw land sites, on tower modifications, on existing mounts or on new mounts.

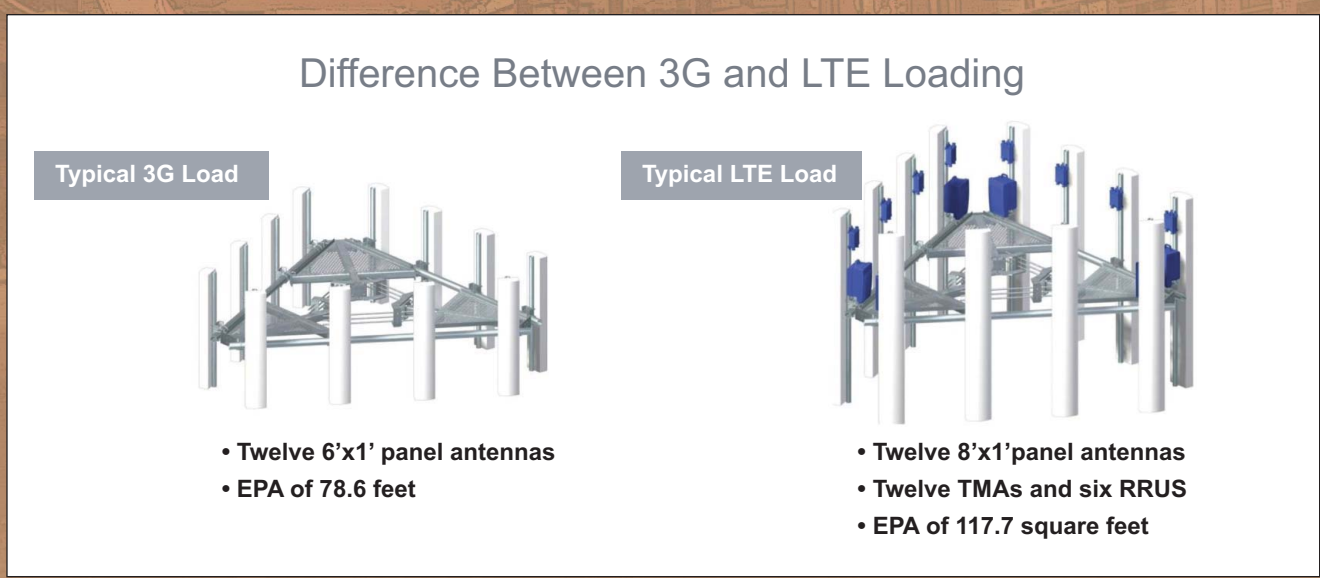


Figure 1. LTE's typical use of 8x1 panels with tower-mounted amplifiers and radios increases the effective projected area to almost 118 square feet, nearly a 30 percent increase in area compared with 3G equipment.

For example, with a raw land build, with a 150-foot pole, the weight in pounds of steel for LTE versus 3G represents an increase of 26 percent, on average. With a 250-foot self-supporting tower, the increase is about a 22 percent increase in weight (see Table 1). The forces and effects on structures are significant.

Raw Land Build

	3G Load	LTE load	% Increase
150 Pole	19,677 lbs.	24,838 lbs.	26%
250' Tower	34,700 lbs.	42,300 lbs.	22%

Table 1. With a raw land build, the use of LTE equipment versus 3G equipment increases the weight in pounds of steel as much as 22 to 26 percent, on average, depending on the type and height of tower.

Rev G

Modifying an existing tower can be expensive. When it is necessary to modify a tower to make it strong enough to add LTE equipment, tower mapping accuracy is highly important so structures can be analyzed accurately. It is critical to have accurate information about the type and model of all the equipment, including antennas, mounts and feedlines. The ANSI/TIA-222-G standard for steel antenna towers and antenna supporting structures, commonly referred to as Rev G, requires that all of the loading be documented where-is, as-is for structural analysis. The proposed LTE loads are bigger than existing 3G loads, and they may cause overstresses. When LTE equipment is added, strengthening the tower to meet Rev G requirements incurs more cost for the reinforcement.

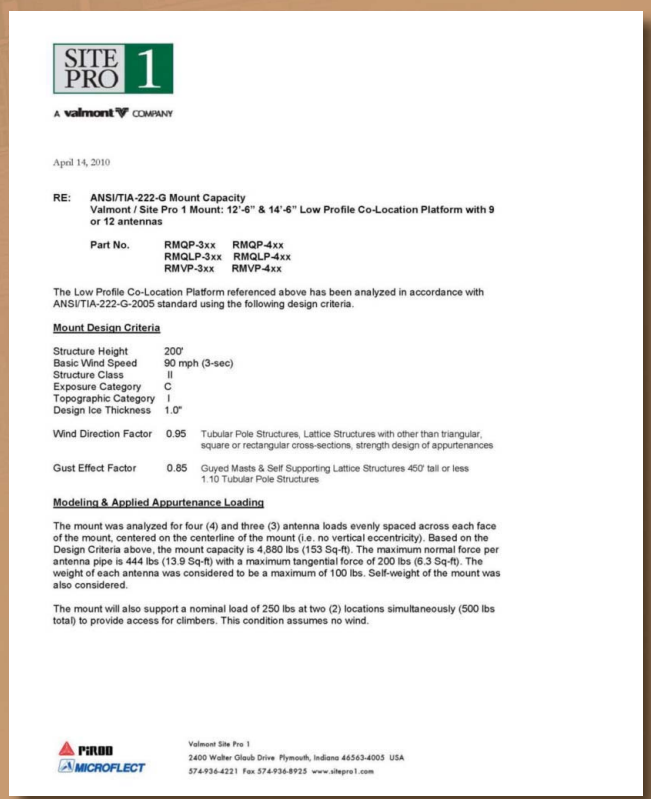
Existing mounts that may date back to the PCS build out may or may not have available capacity to hold the load represented by the new LTE equipment, whether it's the radios or the antennas. If the mount, let alone the structure, cannot support the load, there are two options. One is to add mounts to hold some of the smaller equipment such as the remote radio units and the tower-mounted amplifiers, and the other is to replace the existing mounts.

Other mounts are available that can hold LTE loading. The first step could be to analyze the existing mount to determine whether it can be adapted or modified, but experience indicates that tower owners more often consider modifying the tower than modifying the mount. It is possible to modify the mount, but it is more common to offload equipment to a new, adjacent, smaller mount or to strap the radio heads to the structure itself and then use jumper cables to connect the radios to the antennas to avoid placing additional load on the existing mount.

Tower owners who send reanalyses and other information, specifying new equipment to be placed on towers, sometimes send a statement for a certain mount type for an application for the site and then add the words, "or equivalent." The designs themselves may or may not be adequate for the LTE loading; however, assuming that the design is adequate, two critical aspects remain to be defined. One is the functionality of the mount itself and the other is the structural equivalency or structural capacity of the mount. It's important to take into account both. Many times, when the engineer chooses the "or equivalent," the functional portion of the mount analysis is met, and the structural portion of the analysis is overlooked. It is recommended that an architectural and engineering firm approve the substitution of an approved equivalent.

It is becoming more common to see a document that verifies structural equivalency, a mount certification letter or a standard loading letter. The letter details the information about the antennas and radios to be placed on the tower and the elevations at which they are to be placed. It includes the criteria that the loading meets, such as the wind speed, the classification under Rev G that the structure meets, and any other site factors that might come into play. ■

Will Heiden, P.E., is manager of engineering at Valmont's Plymouth, Ind., facility. This article is adapted from remarks he made at the *AGL* Wireless Infrastructure Conference in Atlanta. *AGL*'s next conference is in Chicago on Sept. 19. For information, visit *www.agl-mag.com/events.*



SITE PRO 1
A valmont COMPANY

April 14, 2010

RE: ANSI/TIA-222-G Mount Capacity
Valmont / Site Pro 1 Mount: 12'-6" & 14'-6" Low Profile Co-Location Platform with 9 or 12 antennas

Part No. RMQP-3xx RMQP-4xx
RMQLP-3xx RMQLP-4xx
RMVP-3xx RMVP-4xx

The Low Profile Co-Location Platform referenced above has been analyzed in accordance with ANSI/TIA-222-G-2005 standard using the following design criteria.

Mount Design Criteria

Structure Height	200'	
Basic Wind Speed	90 mph (3-sec)	
Structure Class	II	
Exposure Category	C	
Topographic Category	I	
Design Ice Thickness	1.0"	
Wind Direction Factor	0.95	Tubular Pole Structures, Lattice Structures with other than triangular, square or rectangular cross-sections, strength design of appurtenances
Gust Effect Factor	0.85	Guyed Masts & Self Supporting Lattice Structures 450' tall or less 1.10 Tubular Pole Structures

Modeling & Applied Appurtenance Loading

The mount was analyzed for four (4) and three (3) antenna loads evenly spaced across each face of the mount, centered on the centerline of the mount (i.e. no vertical eccentricity). Based on the Design Criteria above, the mount capacity is 4,880 lbs (153 Sq-ft). The maximum normal force per antenna pipe is 444 lbs (13.9 Sq-ft) with a maximum tangential force of 200 lbs (6.3 Sq-ft). The weight of each antenna was considered to be a maximum of 100 lbs. Self-weight of the mount was also considered.

The mount will also support a nominal load of 250 lbs at two (2) locations simultaneously (500 lbs total) to provide access for climbers. This condition assumes no wind.

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2400 Walter Glaub Drive Plymouth, Indiana 46563-4005 USA
574-936-4221 Fax 574-936-8925 www.sitepro1.com

A tower owner may be well advised to obtain from the mount supplier a mount certification letter, otherwise known as a standard load letter, that certifies a mount's load-bearing capacity, including the weight of tower climbers.

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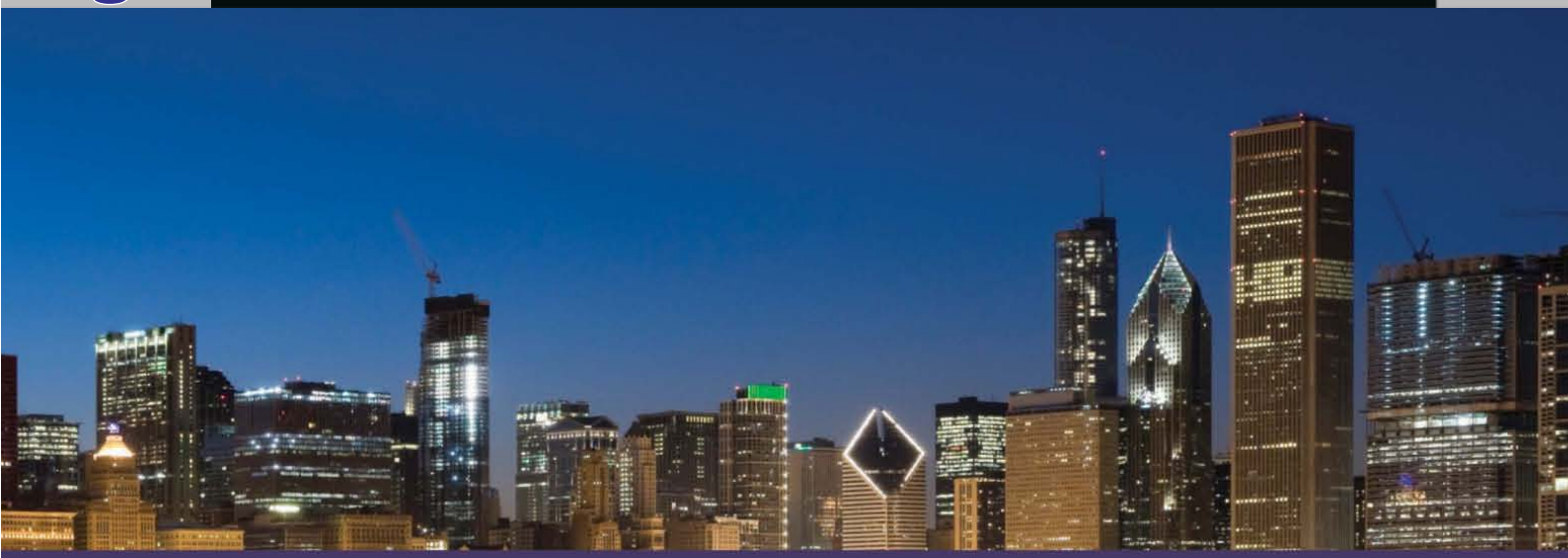

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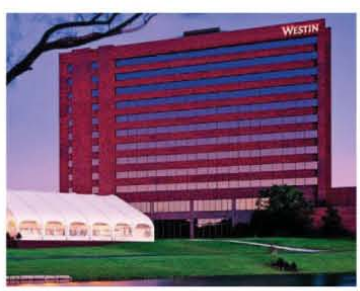

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Random Drug and Alcohol Testing — OSHA Trumps ADA

Employers should consider testing to reduce workplace injuries and to prove to OSHA that they are taking precautions.

By Mark A. Lies II

Employee impairment at the workplace due to drug and alcohol use is a chronic problem. By some studies conducted of workplace accidents, 20 percent or more of employees at the typical workplace are impaired due to drug and alcohol usage on any given day. Post-accident drug and alcohol tests confirm the significant numbers of fatalities and serious injuries that have been caused by such impairment. A recent federal court decision, *EEOC v. United States Steel Corporation, et al.,* __ F. Supp. __, Civil Action No. 10-1284 (USDC W.D. Pa., Feb. 20, 2012) gives employers added support for random drug and alcohol testing to combat these safety risks.

Case

The case involved a U.S. Steel facility in Clairton, Penn., which had established a random drug and alcohol testing program for its probationary employees at its coke production plant. The company's goal was a drug-and-alcohol-free workplace. A probationary employee was selected for a random breath-alcohol test, which indicated the presence of alcohol. The employee claimed that the positive test result was attributable to her diabetic condition. She was terminated, and she filed a charge with the EEOC claiming she was discriminated against under the Americans with Disabilities Act (ADA). The EEOC brought a court action against the company claiming that the random alcohol test violated the ADA.

ADA

The ADA does not permit employers to conduct medical examinations of employees once the employee has commenced employment, unless the employer can establish that the medical examination is "job-related and consistent with business necessity." The EEOC claimed that the company had not met its burden to permit such testing.

The court disagreed and found that the company had proved that the coke plant was an extremely dangerous workplace given the nature of the equipment, molten coke and the various employee job duties in the vicinity of the operation. The court also recognized that the drug and alcohol testing was related to legitimate safety concerns, including the obligation under OSHA's General Duty Clause, to protect employees against hazards to their safety and health. The court held "there is no question that maintaining workplace safety is a legitimate and vital business necessity."

After an extensive analysis, the court granted the company's motion for summary judgment dismissing the lawsuit.

Conclusion

This decision is meaningful because it provides strong support for employer efforts to maintain workplace safety by eliminating injuries due to drug and alcohol impairment. Employers should consider the efficacy of such programs as a means of reducing such injuries and a means to prove to OSHA that they are taking all reasonable means to eliminate accidents caused by such impairment.

There is one important caveat regarding such programs. Where this decision relates to federal law, employers must also determine whether there are any state law restrictions on such programs and tailor such programs to comply accordingly. ■

Mark A. Lies II is a partner in the Seyfarth Shaw law firm Chicago office. He specializes in occupational safety and health law and related employment law and personal injury litigation. His email address is *mlies@seyfarth.com*.

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Use Copper-clad Steel and Aluminum to Stop Copper Theft

When you replace conductors because of theft or when you build new installations, replace copper with copper-clad steel and copper-clad aluminum, which cost less and which deter, if not eliminate, theft.

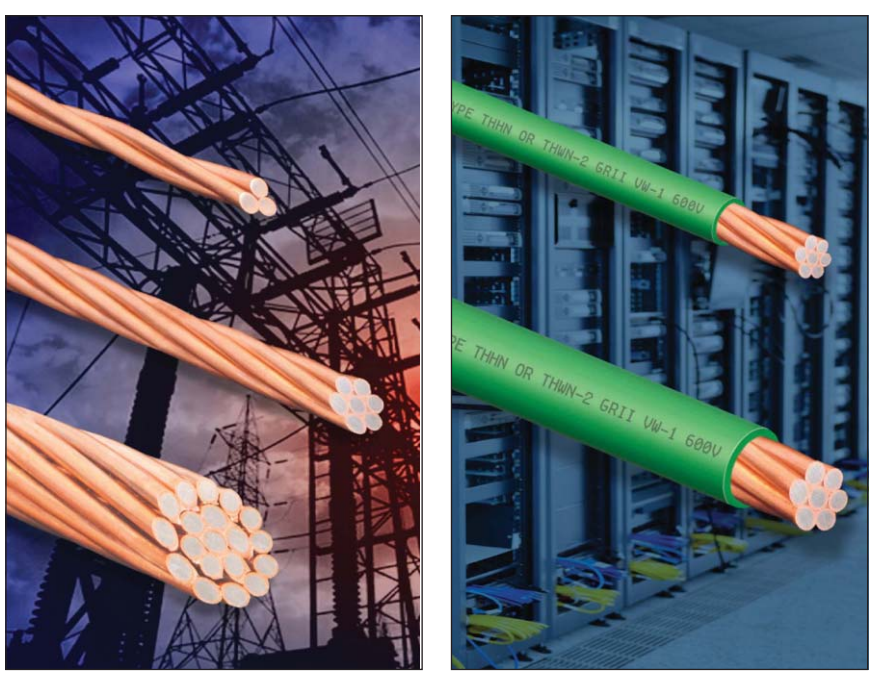
By John Chamberlain

We all know this fact — copper prices have fluctuated between $3.40 and $3.80 per pound for the last six months. With the price of copper being high, there will always be people stealing this metal to make a quick buck. Besides the rising costs, there are two other factors creating this problem — micro and macroeconomics. We cannot change the economics, and it's a bit pricey to put a fence around everything. What to do?

The answer is a composite metallic product millions of miles of which have been deployed for more than 40 years. The product is allowed by the National Electrical Code (NEC) and is listed in UL standards. It has advantages over copper at an even lower cost. The right answer is copper-clad aluminum for applications requiring conductivity and copper-clad steel for grounding applications where fusing current is the specification of concern.

Most important for potential thieves, the scrap value of both is almost zero because of the reduced copper content and the difficulty of separating the copper from the aluminum or steel to which it is bonded. In both cases, when deployed, the products can be marked CCA or CCS with the warning "no scrap value." Experience has shown that thieves typically ignore the warning once, but even if they do ignore it and take the stolen metal to the local scrap dealer, they never steal it again.

Before you roll your eyes and say to yourself, "Not this aluminum thing again. We tried that years ago and it didn't take hold," you must understand that copper-clad aluminum has all the



Copper-clad steel on the left, and copper-clad aluminum on the right.

advantages of copper without the disadvantages of aluminum.

Copper-clad aluminum is a composite of which 90 percent of the cross-sectional area is aluminum. The high percentage of aluminum takes advantage of aluminum's lower cost per conductivity. By applying the copper to the outer surface of the aluminum, only copper is exposed to the elements, and copper is the metal in contact with connection points.

Here is a history lesson. The problems with solid-conductor aluminum wiring in the past were:

- The aluminum was prone to oxidation, leaving a white powder where metal used to be.
- The aluminum was prone to dissimilar metal-induced cathodic corrosion, causing problems when connecting it to copper.
- Aluminum is prone to "cold flow" or "creep." The metal itself slowly conforms to pressure points. This phenomenon was another connection point failure mechanism of aluminum wiring.

One more history lesson that is not common knowledge in the wireless telecommunications industry — millions of miles of copper-clad aluminum have been deployed during the past 40 years without incurring the problems mentioned. The standard coaxial cable that runs down your street to deliver cable television, Internet and telephone services is made from copper-clad aluminum. It is deployed in aerial and underground plant, and is a standard in the industry. In addition, 90 volts of AC is applied to the copper-clad aluminum to constantly supply power to the system's amplifiers.

In other words, a test bed for copper-clad aluminum has been in place for more than 40 years with none of the failures seen in solid-aluminum conductors. There are technical reasons this composite of copper and aluminum is superior in performance to aluminum alone. Copper-clad aluminum is no more prone to oxidation than a solid copper conductor. It has no dissimilar-metal corrosion problems because of its outer copper conductor. In cold-flow or creep tests, copper-clad aluminum's performance is more than 90 percent closer to copper than to aluminum. Copper-clad aluminum has a lower price than copper for the same conductivity.

In addition, copper-clad aluminum is already an allowed conductor in most of the NEC codebook specifications. In particular, NEC Article 310, which covers products such as THHN, THWN-2, RHW, and TW, allows the use of copper-clad aluminum conductors. In fact, if a company already has these listings, it is a simple process of informing UL as to the use of copper-clad aluminum under the same listings to have the product approved for use. The only difference is that the NEC requires a larger gauge for copper-clad aluminum than for copper to equalize the resistance or ampacity of the product (i.e., No. 6 copper-clad aluminum would replace No. 8 copper). Even with this required upsizing for ampacity, copper-clad aluminum remains less expensive per foot.

Copper-clad steel has been used as a grounding conductor for years by the power industry. Copper-clad steel was originally adopted as a ground rod, allowing for a copper surface area to earth ground; however, with the strength and lower cost of steel, copper-clad steel grounding rods are an industry standard.

Connections and welds

Both mechanical connections and exothermic welds are equivalent to copper, and exothermic weld molds are available in all the correct sizes.

So, do you have copper theft in your system, or are you looking to save money? When you have to replace conductors because of theft or when you are building new installations, replace copper with copper-clad steel and copper-clad aluminum. Save on the initial investment, save on a reinvestment in the case of theft, and deter, if not eliminate, theft in your system. ■

John Chamberlain is engineer principal for product development at CommScope. The company sells copper-clad aluminum and copper-clad steel under the brand name GroundSmart, a registered trademark. Visit *www.commscope.com*.

Designing Cables for Remote Electrical Tilt

Your remote electrical tilt (RET) system is only as strong as the weakest link. Improving the composite cable and connector makes a big difference in overcoming mechanical problems that may lead to cable failure.

By Ali Sar and Megan Flower

It can be time-consuming and costly when a remote electrical tilt (RET) system fails. Taking the time to fully understand all working parts of the system before deployment can eliminate headaches. The most common causes of an RET system failure can be attributed to firmware interoperability, mechanical interoperability or mechanical failure. The following information examines the reasons for failure and offers suggestions to make RET systems foolproof.

Interoperability

Firmware variations among manufacturers happen all too often and may cause problems. For example, an antenna from one company may use RET firmware version A.A, and an antenna from a second company may use version A.B. This leads some designers to rely on a single manufacturer to supply RET system components in hopes of avoiding firmware problems. Unfortunately, many times a single manufacturer provides an antenna with one version of firmware and an RET control unit with another version. Just because all components come from the same manufacturer doesn't mean all interoperability problems would be eliminated. Stringent control on firmware compliance with the manufacturers is critical to ensure smooth deployment.

Mechanical interoperability can be just as much to blame for RET system failure as firmware variation. One common mechanical problems is a lack of a fully seated RET cable in an RET motor installation, which results in an improper electrical connection and which causes RET alarms. A second mechanical problem is a loss of a microcontroller unit (MCU) connection to an RET system, which leads to a need to hard-reboot the MCU, thus allowing the RET system to reconnect the RET antenna to the MCU.

Another mechanical problem is caused by corrosion of the internal contacts and cable that results from water permeating to the inside of the RET connector. Water ingress can cause long-term electrical complications with the RET system. One more mechanical problem stems from vibration that can loosen the RET cable's coupling nut that may have been hand-tightened.

The XRET connector as installed on a jumper cable.

Something else that could cause a mechanical problem is a tension disconnect, whereby too much tension on the RET cable run causes the cable and the internal conductors to break away from the internal connection within the AISG connector, a connector made to meet specifications of the Antenna Interface Standards Group. Another mechanical problem involves intermittent operation caused by an on/off effect when the alarm sounds seemingly at random for unknown reasons.

Of the six potential mechanical problems mentioned, five stem from RET cable failure. The RET cables play an important role in keeping the RET system operating. Conversely, the cable all too often is the last item added to the system design, sometimes as an afterthought. This can be a serious oversight, because to minimize failure risk, it is important to think through the RET cable design at an early stage.

Cable design considerations

Here are some key elements to consider when selecting RET cable.

Climate: The cable should be designed to withstand all weather conditions.

Reliability: For maximum reliability, the cable should be manufactured in a quality-controlled environment.

Ease of installation: The cable design should allow for quick and easy installation.

Design: The cable design should be functional. It should allow customizing to resolve potential problems. The design should include synergistic products that assist with installation.

Performance: The cable design should meet electrical requirements and environmental and reliability standards.

Availability: The manufactured product should be available for quick delivery.

Cost: The cable design should incorporate the highest level of product quality, performance and delivery at an acceptable cost.

RET cables that have come to be known as standard RET cables represent a composite of a cable and a connector. One company may make a connector that can be used to terminate a cable by installing the connector with the use of a crimping tool. Although such a standard cable may be functional, it might not be an optimum configuration because the standard cable may have been designed by a manufacturer whose primary business is to make and sell connectors to cable assembly houses. These manufacturers simply perform the labor of assembling the cable using a design supplied by the connector company.

In most cases, antenna manufacturers focus on making antennas and outsource cable manufacturing to cable assembly houses to build their RET cables. Some antenna manufacturers that make RET antennas do not offer an RET cable and instead suggest that installers acquire their cables from competing companies.

Although some cable assembly houses design assemblies, usually they refer to the connector manufacturer's suggested use for the connectors when they make their standard cables. Because antenna manufacturers have chosen to use an 8-pin circular DIN audio connector as the mating interface, the challenge is to create a weatherproof cable that uses an audio connector not designed for outdoor use. Rarely do cable assembly houses design their cables based on the need for weatherproofing.

After making a standard RET cable for AISG antenna manufacturers for years and coming to understand the mechanical interoperability problems, 123eWireless began making RET cables designed to work in extreme weather conditions that standard cables do not. Designated XRET (the X stands for XtremeWeather), the cable differs from standard RET cables in five ways.

First, the connector and cable form one unit. The connector mates with the AISG standard connections, but its design is unitary such that the internal connector, mating terminals and the cable are molded into one piece.

Second, all airspace is sealed from the inside of the connector to prevent moisture from reaching critical electrical components.

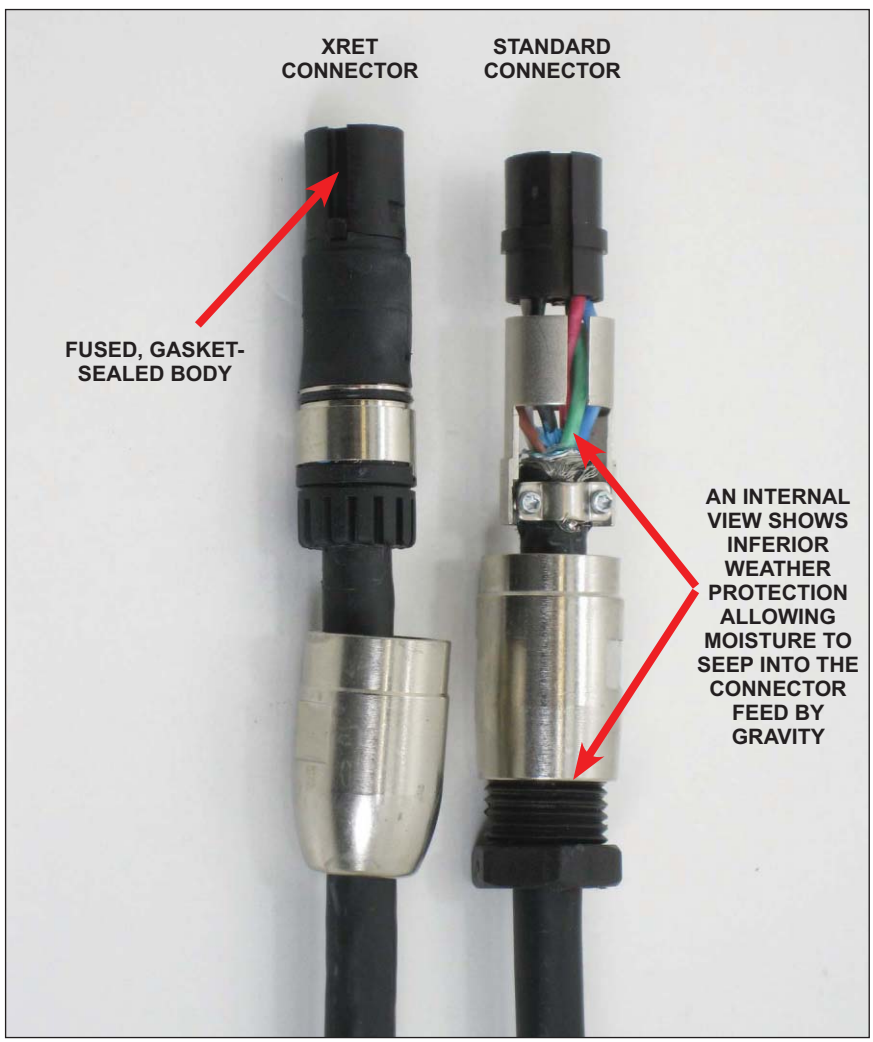
Third, the materials withstand temperature changes, saltwater and sunlight.

Fourth, a tool is provided that allows installers to tighten the RET assembly to a specific torque to meet the specifications of the XERT connector.

Fifth, a published installation procedure explains how to install the cable and how to use the tool.

The connector design process has not ended. Input from the field helps with the continual improvement of the cable. ■

Ali Sar is president and chief executive officer of 123eWireless; Megan Flower is the company's executive vice president. The company manufactures the XtremeWeather XRET cable described in the article. Sar's email address is *asar@123eWireless.com*.



A comparison of an XRET connector and a standard RET connector shows the use of a fused, gasket-sealed body versus the use of the 8-pin circular DIN audio connector without adequate weatherproofing.

LED Lighting Offers Tower Operators Savings and Safety

The next generation of light-emitting diode (LED) high-intensity aviation obstruction marking systems pays off for tower operators. LED obstruction systems can save hundreds of thousands of dollars in maintenance.

By Dr. John Peck and Mike Slater

Communications tower operators face a never-ending battle when it comes to maintaining sophisticated tower obstruction lighting. In an effort to reach a broad audience, wireless and broadcast towers can reach almost 2,000 feet high, presenting new challenges for FAA-mandated aviation obstruction lighting to ensure the safe operation of aircraft. The conventional high-intensity xenon obstruction lightning systems have been around for decades; however, the product development trajectory has essentially flatlined. A new generation of light-emitting diode (LED) high-intensity obstruction lighting systems is providing longer life, better performance and a lower total cost of ownership. Already a number of towers in the United States, Canada and Mexico have installed high-intensity LED

obstruction lighting. The LED industry is hitting its prime as this robust, reliable technology proves to be a money-saving technology on towers of all heights.

The LED tech evolution

Originally developed for use as indicator lamps in the 1960s, LEDs have become commonplace in traffic signals, automotive applications and industrial, commercial and residential lighting. By virtue of their smaller size, rugged design, energy efficiency and light output, these solid-state devices are ideally suited for obstruction lighting applications that demand optimum performance and reliability in some of the toughest conditions.

Advances in electronics, power supply and the LEDs themselves have catalyzed LED obstruction technology development, spurring rapid evolution over the last decade. The first FAA-certified L-810 obstruction light became available in 1999, with the dual white/red L-864/L-865 model hitting the market in 2007. The first L-856 high-intensity white strobe achieved FAA certification in 2011, and just last year, the first dual, high-intensity white/red L-856/L-864 strobe achieved FAA certification.

Along the way, LED systems have become smaller, more compact and more energy efficient, with wattage consumption down to just 250 watts for high-intensity white strobes on daytime mode, compared with the 500-watt to 600-watt consumption of comparable xenon systems. But that's not all. Although the upfront cost of a new LED obstruction system might come in at around 40 percent higher than traditional xenon technology, it's a worthy investment that pays dividends for years to come.

Maintenance-free for a decade

Maintaining a traditional xenon system is a major strain on a tower operator's budget. Although most are rated to last 18 months, some xenon tubes are prone to failure in as little as six months when subjected to the difficult environment atop a tower 1,000 feet high or higher. The cost of replacement strobe tubes alone is around $500, with higher-end models in the $750 range. Add the expense of dispatching a crew for a tower climb — and the higher the tower, the higher the price — multiplied over several times per year, and the cost of annual maintenance can skyrocket.

The high operating voltage of xenon systems is also an issue. High voltage is hard on components and capacitors, plus it's a safety problem for maintenance workers. Requiring about 1,000 volts, xenon systems produce ozone, which corrodes component parts, compromising the fixture and exacerbating the maintenance problem. To work at such high voltages, maintenance crews should wear utility lineman-style personal protective equipment, including shock-resistant gloves, chest protectors and a mask. But, all of that gear is extremely cumbersome — and may itself pose a safety risk to a worker hanging on the side of a tower with nothing but a safety harness between the worker and the ground thousands of feet below. It's a situation that forces many tower climbers to forego the use of the personal protective equipment, which is a safety concern.

Lower-voltage operation requires less costly wiring, plus it eliminates the risk of parts corrosion from ozone discharge and it eliminates safety concerns for workers.

LED high-intensity systems, on the other hand, virtually eliminate the challenges and cost of system maintenance, outlasting even the best xenon systems by five years or more. With no delicate filaments or other failure-prone parts, LED systems can offer maintenance-free, worry-free performance for up to

a decade. From an electrical standpoint, LEDs operate at a fraction of the voltage xenon systems require. The most efficient use just 150 volts. This lower-voltage operation requires less costly wiring, plus it eliminates the risk of parts corrosion from ozone discharge and safety concerns for workers.

Unlike xenons, LED systems can report more precisely which component is in fault condition so that maintenance crews know on the first trip exactly what to bring and where to go on the tower.

Delivering a return on investment payback in as little as three years based on maintenance savings alone, LED systems pay for themselves in about a third of their lifespan, which means operators could save as much as $40,000 a year on maintenance during the seven years following installation — money that goes straight to the tower owner's bottom line.

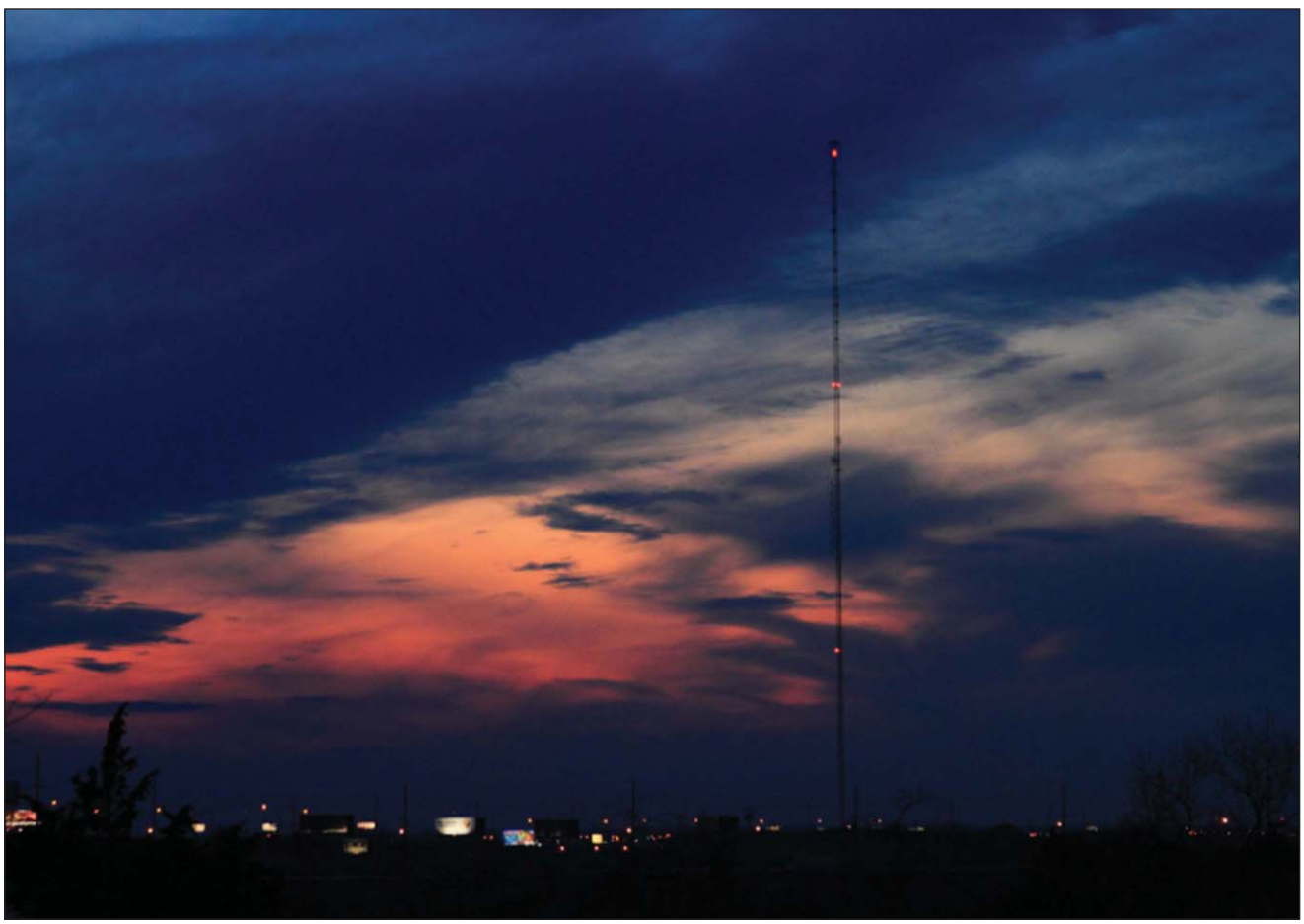
Monitoring and controls

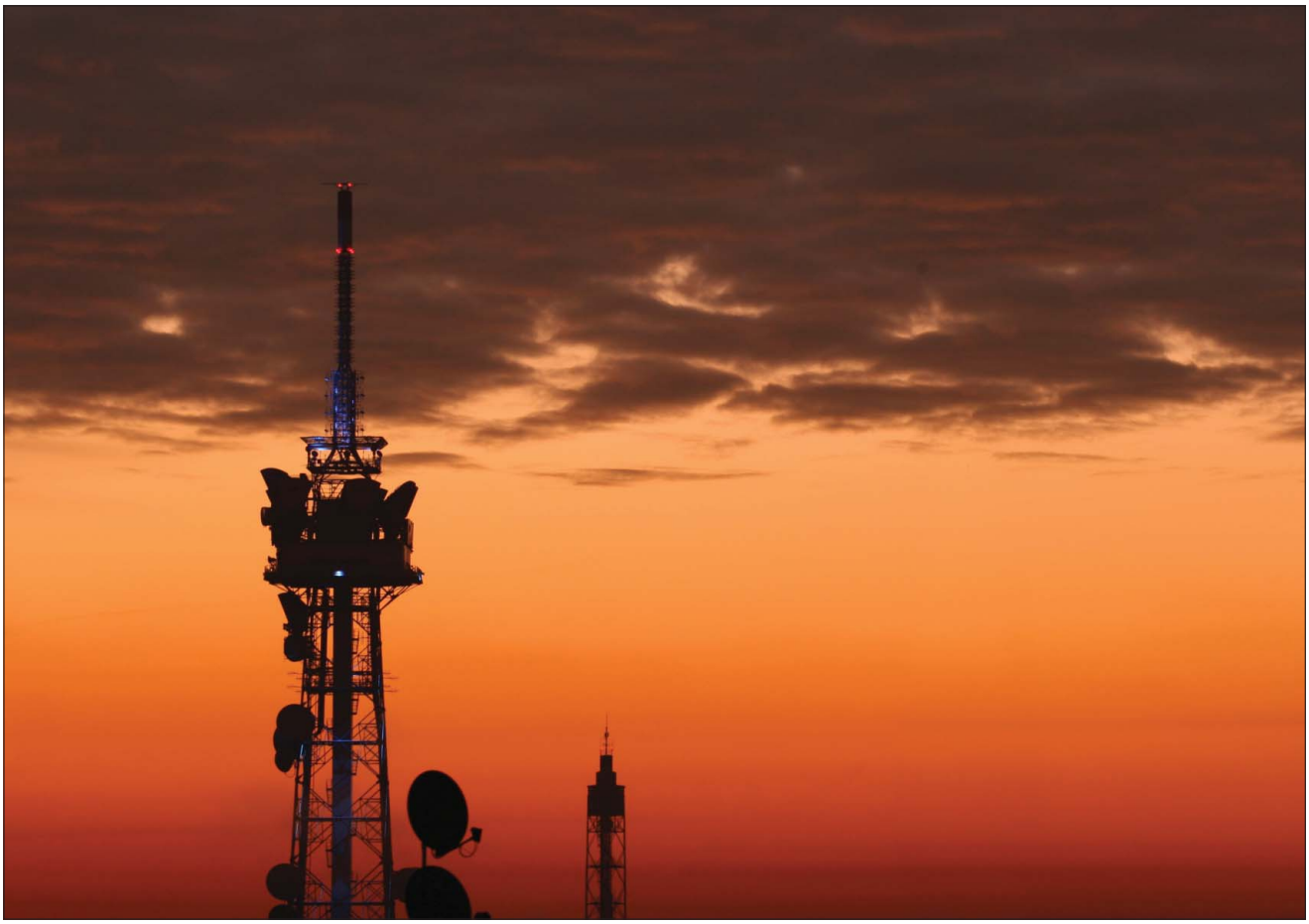
Unlike conventional xenon lighting systems, LED lighting systems are electronic devices that can offer cutting-edge capabilities — namely, the ability to remotely monitor nearly every piece of the system to save significant time and money in the rare event repairs are needed.

In the event of a traditional xenon failure, the system would trigger an alarm, and a maintenance engineer would be dispatched to diagnose the problem. Until arriving on site and climbing the tower, the engineer would have minimal information about the cause of failure or which parts might be needed to complete the repair. After lengthy troubleshooting, the engineer would be likely to need to leave and return to make the repair at a later date, subject to changing weather. That's two trips and two tower climbs, plus the risk of FAA fines during the outage, for just one repair incident.

Minimal replaceable parts

With the latest LED high-intensity obstruction lighting, each piece of the lighting system on the tower can be monitored and fault conditions can be relayed to the network operations center, providing unprecedented visibility into system status for both functional reassurance and troubleshooting assistance. Unlike xenons, LED systems can report more precisely which component is in fault condition so that maintenance crews know on the first trip exactly what to bring and where to go on the tower. Further reducing the troubleshooting burden, LED systems are designed with minimal replaceable parts — only the flash head module, power supply board and controller board can be changed.





On the other hand, a comparable xenon system consists of many components, and operators must keep a stockpile of replacement parts on hand for repairs. This takes up valuable storage space and adds to the cost of xenon for procurement and storeroom management.

Community-friendly lighting

Whether located in rural, suburban or urban environments, communications towers are imposing structures in any area, and tower operators are keen to reduce the disturbance and effect on the quality of life for neighboring residents. Despite the safety requirement, few nearby residents appreciate flashes of light in the night sky. Although xenon systems provide some mechanism for directing the light at an angle so it alerts pilots without illuminating the ground, the mechanism has limitations.

The most advanced LED obstruction systems mitigate the problem of light reaching the ground with state-of-the-art optics technology that uses reflector optimization along with precise placement of the individual LEDs to provide a sharper cutoff angle and reduce ground scatter. By the very nature of the xenon tube form factor, obtaining a similar precision in optical design is not possible, giving LED technology a clear advantage when it comes to optimal light placement for a more community-friendly obstruction warning system.

Communications towers are imposing structures in any area, and tower operators are keen to reduce the disturbance and effect on the quality of life for neighboring residents.

LEDs can grow the bottom line

Compared with conventional xenon technology, LED high-intensity systems eliminate the continuous drain on maintenance resources, enabling tower operators to save substantial sums of money over the lifetime of the system. Although many may consider LEDs a no-brainer for new tower installations, there's no doubt LEDs are an economical retrofit choice for existing towers as well. For an operator with a tower due for repainting, which can cost upward of $80,000, or for an operator with a tower that has a xenon system near the end of its useful life, switching to an LED obstruction system can save hundreds of thousands of dollars in maintenance costs over the lifetime of the LED system, for a bottom line boost that any operator can appreciate. ■

Dr. John Peck is director of engineering at Dialight. His work concentrates on the development of LED lighting products. Mike Slater is sales manager at Slatercom-WCD, a master OEM stocking distributor for Dialight LED lighting, a manufacturer of obstruction lighting controllers, and a tower installer and tower maintenance company in Salem, Ore.

Self-aligning Antennas Improve Nomadic Wide-area Networks

A nomadic network solution with high throughput, self-steering and self-aligning operation, low latency and a focused beam overcomes shortcomings of other nomadic network solutions for private wide-area networks.

By Leigh Chang

For wireless broadband communications networks to offer service that competes with fiber-optic cable, they have to overcome the challenges of throughput, range and latency that traditionally have limited wireless network performance compared with fiber. Wireless networks that operate at fast Ethernet speeds (100 Mbps) in both uplink and downlink paths and maintain broadband throughput over distances up to 50 miles with low latency offer a useful alternative to fiber.

Some networking options require either significant time to set up and specialized IT skills and training to operate, or they are limited in their ability to function within the application. Omnidirectional antennas, such as those used in Wi-Fi access points, broadcast radio signals in all directions simultaneously, limiting their range and creating uncontrolled RF interference. Satellite-based connectivity is costly. It requires additional time and special training for set up and operation, and its long signal delays result in substantial latency that render satellite connectivity unsuitable for many real-time applications.

A wireless network product development with 2 X 2 multiple-input, multiple-output (MIMO) communications and enhanced fourth-generation wireless technology delivers broadband throughput, long-range coverage and low latency. The software-configurable system provides point-to-point (PTP) or point-to-multipoint (PMP) links and allows system operators to add capacity, security or different quality-of-service levels when needed. The use of industrial-grade components and hardened, ruggedized enclosures fits industrial, security and military applications where wireless networks must withstand temperatures ranging from severe arctic cold to intense desert heat, high humidity, sandstorms, rain, sleet and ice.

The flagship of Redline's Virtual Fiber nomadic wireless communications network system is the RDL-3000 wireless broadband system. The RDL-3000 incorporates 2 X 2 multiple-input, multiple-output (MIMO) communications and enhanced fourth-generation wireless technology to deliver broadband throughput, long-range coverage and low latency.

Reliable performance in extreme conditions and the ability to update and configure wireless networks remotely over the air reduce or eliminate the need to send service crews to work on network equipment mounted on towers and masts in remote areas and minimize or eliminate downtime where network outages can cost millions of dollars in lost production per minute, or could expose personnel to risk.

A nomadic solution that can address the challenges of operating from a semi-mobile platform offers advantages when it can operate in extreme environments and can withstand vibrations and shocks when moved. Making the nomadic solution easy to set up and to operate by people having a variety of job functions — not just by the expert

crews that installed the fixed wireless network — helps to expand the number of places where it can be used.

When a mobile component of a nomadic wireless network is designed and manufactured with the idea in mind that it should be able to locate, aim toward and connect to a network base station automatically, it makes the process easier for establishing reliable, high-speed connectivity to and from roving assets over extended areas. A nomadic wireless network with self-aligning antennas and its own power systems can be engineered to support nomadic applications for the oil and gas industry, the military and utilities. It can enable multiple applications from a single vehicle or rig, including real-time machine-to-machine communications, supervisory control and data acquisition, high-resolution video, Wi-Fi, telephony and automation controls. With a nomadic wireless network that automatically connects with the best available base station, roving rigs, vehicles and other equipment can have automatic and reliable wireless connectivity as they move from place to place across large distances in rugged terrain and harsh environments.

An all-solid-state design engineered without moving parts helps a nomadic wireless network withstand shock, extended vibration and virtually any weather. Part of what can help a wireless nomadic network establish and maintain wireless connections with speeds up to 100 Mbps is the use of an intelligent scanning and sensing algorithm to perform a rapid survey to locate the closest base station, which might be many kilometers away, and then use automatic beam-forming and interference-mitigation technology, all automatically.

When nomadic wireless network equipment includes auto-provisioning functions that establish the required quality of service and security, it requires no special training to install or operate. With the ability to initiate a new scan for frequencies when RF interference or a change in orientation occurs, the nomadic equipment becomes increasingly suitable for attachment to vehicles, rigs or other moveable assets. With over-the-air management, configuration and upgrade capabilities, an IT department can keep the nomadic equipment properly configured and in compliance even while the units are deployed and operational in the field.

A nomadic network solution with high throughput, self-steering and self-aligning operation, low latency, and a focused beam with a range exceeding tens of kilometers overcomes the shortcomings of other nomadic network solutions. ■

Leigh Chang is associate vice president of product management at Redline Communications, a company whose rapid alignment system for nomadic wireless networks incorporates the functions and advantages described in this article.

Quick-Guide to Legal Services Companies

As a supplement to *AGL*'s January Buyers Guide, a list of legal services companies offers more detail to help you choose a vendor for your next project. Each service is coded numerically according to the legend displayed. Where shown, logos and company descriptions were provided and paid for by each company.

1. Acquisitions
2. Asset management services
3. Broker services
4. Consulting
5. Dispute resolution
6. Divestitures
7. Escrow services
8. FAA and FCC compliance
9. Federal litigation
10. Financing
11. Insurance
12. Investment banking
13. Lease negotiations
14. Local and state litigation
15. Mergers
16. Purchasing and sales
17. Real estate services
18. Restructuring services
19. Valuation
20. Zoning and permitting

Black & Veatch
10950 Grandview Drive
Overland Park, KS 66210
Kevin Bukaty
bukatyk@bv.com
(913) 458-7967
www.bv.com
Services: 6, 13, 15, 16, 17, 20
Other: M&A, due diligence, lease auditing
See ad on page 13

Cell Tower Attorney
761 Middle Country Rd.
Selden, NY 11784
Katharine Burton
katharine@celltowerattorney.com
(214) 551-4524
www.celltowerattorney.com
Services: 1, 5, 13, 16, 17
Company description: Cell Tower Attorney has seasoned wireless attorneys with more than 20 years in the business working for carriers and tower owners. The firm specializes in master lease agreements, vendor agreements, purchase and sale agreements, license agreements and amendments. Cell Tower Attorney is a one-stop shop.

Cuddy & Feder
445 Hamilton Ave., 14th Floor
White Plains, NY 10601
Chris Fisher and Tony Gioffre
telecommunications@cuddyfeder.com
(914) 761-1300
www.cuddyfeder.com
Services: 1, 4, 8

Davis Wright Tremaine
1919 Pennsylvania Ave. NW
Washington, DC 20006
Scott Thompson
scottthompson@dwt.com
(202) 973-4208
www.dwt.com
Services: 1, 5, 8, 9, 10, 13, 14, 15, 16, 20

Higgs Law Group
1028 Brice Road
Rockville, MD 20852
Delaney M. DiStefano
ddistefano@higgslawgroup.com
(301) 762-8992
www.higgslawgroup.com
Services: 3, 7, 8, 9, 13, 19

Lashly & Baer
714 Locust St.
St. Louis, MO 63101
Michael C. Seamands
mseamands@lashlybaer.com
(314) 621-2939
www.lashlybaer.com
Services: 9, 13, 14, 17, 20

MEDIA VENTURE PARTNERS
Media Venture Partners
244 Jackson Street, 4th floor
San Francisco, CA 94111
Clayton Funk
cfunk@mediaventurepartners.com
(816) 977-2822
www.mediaventurepartners.com
Services: 1, 3, 4, 5, 7, 9, 11, 13, 14

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WWW.CCA-CONVENTION.ORG

Alcatel·Lucent

ERICSSON

Interop TECHNOLOGIES

Syniverse

TNS Transaction Network Services

CCA
Competitive Carriers Association
Rural • Regional • Nationwide℠

buyers guide

1. Acquisitions
2. Asset management services
3. Broker services
4. Consulting
5. Dispute resolution
6. Divestitures
7. Escrow services
8. FAA and FCC compliance
9. Federal litigation
10. Financing
11. Insurance
12. Investment banking
13. Lease negotiations
14. Local and state litigation
15. Mergers
16. Purchasing and sales
17. Real estate services
18. Restructuring services
19. Valuation
20. Zoning and permitting

Company description:
Media Venture Partners is a telecommunications-, media- and technology-focused investment banking firm. MVP has advised on over $15 billion worth of transactions with hundreds of sellers in a variety of areas of shared telecommunications infrastructure including tower companies, DAS providers, backhaul companies, and wireless/ground lease aggregators.

Milestone Media
848 N. Rainbow Blvd., Suite 680
Las Vegas, NV 89107
Derrick Engel
milestone.de@gmail.com
(303) 335-9843
www.milestonemediallc.com
Services: 1, 3, 4, 13, 16, 19

Phillips Lytle
3400 HSBC Center
Buffalo, NY 14203
Douglas Dimitroff
ddimitroff@phillipslytle.com
(716) 847-5408
www.phillipslytle.com
Services: 9, 10, 13

RBC Capital Markets

RBC Capital Markets
3 World Financial Center
200 Vesey St.
New York, NY 10281
Nick Stevenson
nick.stevenson@rbccm.com
(212) 428-6405
www.rbccm.com/communications
Services: 1, 3, 6, 10, 12, 15, 16, 18, 19
Other: merchant banking, underwriting
Company description: RBC Capital Markets is a premier investment bank that provides comprehensive equity and debt financing products and M&A advisory services to the tower and telecom infrastructure industry. According to Bloomberg and Dealogic, RBC Capital Markets is ranked among the top 10 global investment banks.

Schwaninger Law
6715 Little River Turnpike, Suite 204
Annandale, VA 22003
Robert Schwaninger
rschwaninger@sa-lawyers.net
(703) 256-0637
www.sa-lawyers.net
Service: 4
Other: legal services

Shulman, Rogers, Gandal, Pordy & Ecker
12505 Park Potomac Ave., 6th Floor
Potomac, MD 20854
Alan Tilles
atilles@schulmanrogers.com
(301) 231-0930
www.shulmanrogers.com
Services: 3, 4, 5, 7, 8, 9, 10, 13, 14, 15, 16, 17, 19, 20
Other: legal services
Company description: Shulman Rogers has assembled a team of professionals with unparalleled experience in tower transactions. From site and ground leases to brokerage and financing arrangements, the firm's attorneys will help maximize the value of client assets. Shulman Rogers also provides zoning expertise and a deep understanding of the regulations impacting the tower industry.

TOWER ECONOMICS CO. INC.

Tower Economics
700 Route 130 North, Suite 204
Cinnaminson, NJ 08077
Leonard B. Stevens
len@towereconomics.com
(856) 786-7200 Ext. 301
www.towereconomics.com
Services: 1, 2, 4, 6, 13, 19
Company description: Since 1980, Tower Economics has been a full-service site development, marketing and management company operating in 17 states.

US Title Solutions
3 Werner Way
Lebanon, NJ 08833
Jim Kudless
jkudless@ustitlesolutions.com
(908) 849-3017
www.ustitlesolutions.com
Service: 17
Other: title search, title insurance

Young America Capital
141 East Boston Post Road
Mamaroneck, NY 10543
Peter Formanek
peter@yacapital.com
(914) 777-0100
www.yacapital.com
Services: 1, 6, 10, 12, 15, 19

When you join the Wisconsin Wireless ahelp to make a difference.

Through donations to the General Federation of Women's Club's Wisconsin chapter, the Wisconsin Wireless Association helps to purchase pediatric jump bags for use by Wisconsin ambulances. Pediatric jump bags help to save the lives of small children because medical requirements for small children often differ from those of adults. The right equipment optimizes the care that the responding team is able to provide.

Wisconsin Wireless Association

Promoting awareness

The Wisconsin Wireless Association helps to promote positive awareness about the wireless infrastructure industry by representing the industry at the Municipal Treasurers Association Annual Conference and the League of Wisconsin Municipalities Annual Conference.

The Wisconsin Wireless Association is participating in the Public Service Commission of Wisconsin's development of a statewide broadband plan, "Wisconsin's Playbook for Broadband Progress."

Wisconsin Wireless Association

wisconsinwireless.org

ACTIVITIES

Sept. 19 *AGL* Wireless Infrastructure Conference in Chicago

Oct. 16 League of Wisconsin Municipalities in Green Bay

Dec. 5 Holly Jolly Trolley Tour Fundraiser in Milwaukee

A public service ad from *AGL*
Photo courtesy of R&B Fabrications

Physical Access Management Hardware

CyberLock manages physical access and liability at remote telecom locations with no access to power. Its product incorporates mechanical lock hardware already used in a facility and does not require structural changes to retrofit existing locks. By replacing each mechanical lock's core with an electronic cylinder, users gain electronic access control. The hardware gives management the ability to track contractors and employees where multiple wireless carriers share subdivisions within a rooftop equipment room. Owners know when vendors visit because the electronic lock cylinders and keys record lock openings and unauthorized attempts to gain entry. To further enhance access security, each employee's or contractor's electronic key can be programmed to open selected locks on specific days and during specific hours. This can include dates and times to begin and end operations. The electronic key cannot be duplicated and a missing key can be quickly deactivated. The hardware can be installed on virtually any entry including perimeter gates and RTU cabinets.

www.cyberlock.com

Solar-powered Video Surveillance

Micropower Technologies' solar-powered, wireless video system enhances data transmission capabilities. It consists of the MPT2500 solar-powered, wireless video surveillance camera and the MPT2700 wireless video hub that receives video and data from cameras via an external directional antenna. It coordinates transmission to video management software. The Helios system reduces the cost of camera deployment through patented technology that delivers improvements in performance and power without compromising video quality and reliability. The system is flexible and adaptable for redistributing cameras as needed. It also offers rapid deployment capabilities for use in temporary security applications because the wireless platform allows surveillance cameras to be easily installed anywhere within a half-mile radius of the central hub and taken down to be reused when needed.

www.micropowerapp.com

Enhanced Perimeter Protection

SmarterFence is a fiber-optic intrusion-detection system from **Smarter Security** that intelligently detects and warns of intruders while minimizing nuisance alarms. The fiber-optic sensor cable is sensitive to a wide range of vibrations, flexing, compression and cutting, giving it a demonstrated ability to tune out environmental nuisances and detect real attempts to cut, climb or lift the fence. SmarterFence offers enhanced reliability because it is unaffected by lightning and other electromagnetic interference. The system provides cost-effective protection for zones up to 3,000 linear feet, and it can be integrated with other outdoor security measures to maximize protection of assets.

www.smartersecurity.com

New Jersey Wireless Association donates fundraising proceeds to the Wounded Warrior Project

New Jersey Wireless Association members pose with a $10,000 check for the Wounded Warrior Project.
From the left: Jim Kudless, Rob Ivanoff, Matt Bartlett, Peter Broy, Dominic Villecco, Tony Suppa, Gail Goldman, Michael Lee Foster

The mission of the Wounded Warrior Project is to honor and empower wounded warriors. The purpose is to raise awareness and to enlist the public's aid for the needs of injured service members, to help injured servicemen and women aid and assist each other, and to provide unique, direct programs and services to meet their needs. Thousands of wounded warriors and caregivers receive support each year through Wounded Warrior Project programs designed to nurture the mind and body, and encourage economic empowerment.

NEW JERSEY WIRELESS ASSOCIATION

Activities

September 19
Quarterly Educational Luncheon

November 20
NJWA Holiday Social
Sheraton Atlantic City

Important Contribution

The New Jersey Wireless Association was instrumental in the enactment of New Jersey collocation legislation.

Award

The New Jersey Wireless Association received the Gold Medal in the 2012 State Wireless Association Program Olympic Games, a program created to encourage participation, communication and unity among state wireless associations.

A public service ad from *AGL*

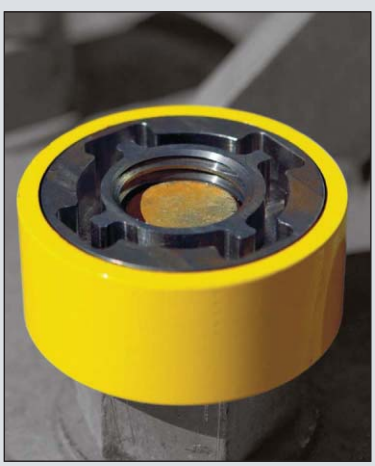
NJWA
NEW JERSEY WIRELESS ASSOCIATION

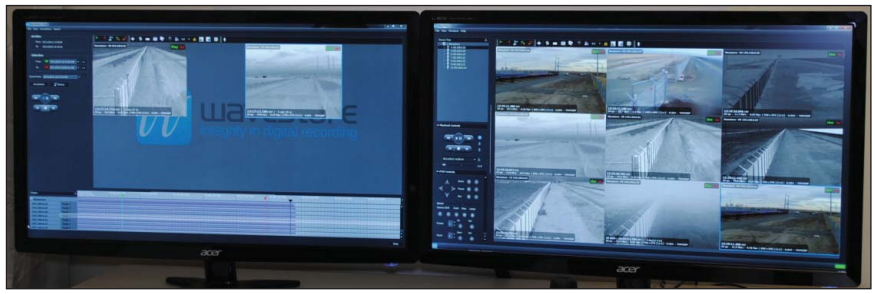
newjerseywireless.org

product showcase — site security

Security Hardware

Vandalism, radical activism and terrorism are just some of the daily threats to mission critical, infrastructure, telecom buildings, towers and other installations. A simple, yet effective, tamper-resistant product from **SpiNut** helps to thwart such unauthorized access. The device has a spin collar and matching socket developed for customer applications. It features a secure database that catalogues a customer's proprietary design, and a SpiNut socket fits any standard type drive. It is designated by the Department of Homeland Security as a qualified antiterrorism technology that limits claims for any act of terrorism. The locking device is for industrial-level hardware bolting systems.
www.spinut.com





Enhanced Video Surveillance Software Platform

Wavestore offers enhanced camera support with its V5 version of surveillance. The open platform video management software is an intuitive video management system that enables users to integrate 360-degree cameras into existing surveillance systems. V5 facilitates the recording of original fisheye images captured by a 360-degree or hemispheric camera and simultaneously displays the dewarped images alongside captured images from other cameras in a multi-image display. Original images captured by the 360-degree cameras are stored unaltered in the event video data must be presented in a court of law. Additional features of model V5 include instantaneous search and display of specific events within live and archived video data, authentication and encryption of video and audio content, and searchable metadata functionality for integrated video analytics, including facial recognition and people counting. The system can also integrate third-party point-of-sale data. Adding hemispheric camera support to the V5 delivers cost savings to users because one 360-degree camera can replace up to four traditional cameras and the absence of moving parts leads to less maintenance. **www.wavestoreusa.com**

Access Control Software

Frontier 2010 access control software from **Matrix Systems** features built-in interfaces for Schlage and Videx CyberLock wireless hardware. The software offers comprehensive and scalable security that provides real-time monitoring of access doors and alarm points for local and remote locations, plus improved import/export configurability. Utilizing wizard-based import/export functionality, users can customize data formatting, data fields and the amount of data that is transferred. The wizard is compatible with most popular personnel data software formats that human resources, IT, law enforcement, security and other professions use. The system can import background raster images such as JPG, BMP or TIFF files and combine them with imported native vector images such as CAD or custom-drawn images that are editable within the software. **www.matrixsys.com**

Keyless Gate Entry Systems

GateCuff is a keyless gate access system from **Mi-Jack Systems and Technology** that improves security and efficiency at cellular communications sites and other remote facilities. It eliminates the need to daisy-chain locks and minimizes problems associated with keyed, keypad and combination entry such as lost keys, unchanged keypad codes, jammed padlocks and unauthorized access. It is a reinforced lock that is securely mounted on any fencing or gate, providing a strong and secure lock for any facility. Instead of keys or combinations, it uses programmable RF key fobs, which are handheld remote devices that eliminate problems associated with traditional entry systems and allow greater control and tracking.
www.mjst.com

A Bell Center volunteer talking with Drayton.

The Bell Center for Early Intervention Programs

Dedicated to maximizing the potential of children from birth to three years of age who are at risk for developmental delay.

Participate in Alabama Wireless Association events and help to raise funds for charities such as the Bell Center, the Community Kitchen and Toys for Tots.

Quarterly AWA meetings offer you the opportunity to network with customers and suppliers while learning ways to improve your business.

Alabama Wireless Association

www.alwireless.org

AWA ALABAMA WIRELESS AWA

A public service ad from *AGL*

product showcase — site security

Network Security Solutions

Verint Systems has expanded its video portfolio line with Nextiva IP products designed to address vertical-specific security and operational challenges. Additions include a software-based receiver and mobile client application that enables organizations to view the Nextiva video management software from Apple iOS-based devices, including the iPad and iPhone. The application allows security operators to remotely access video and enhance operational efficiency and effectiveness by viewing live and recorded video from multiple cameras simultaneously. It provides 10 predefined screen layout options, zoom-in or zoom-out capabilities, and the management of most used and recent camera views. **www.verint.com**

High-resolution, Network-based Security Solutions

Double-hemispheric cameras for next-generation, high-resolution, network-based security from **Mobitex** includes model S14 for subtle mounting applications and 180-degree, high-resolution views. It is available in mono and dual versions. The S14D can be equipped with two hemispheric modules and an integrated microphone that connect to the camera housing via cables, enabling users to secure two rooms next to or on top of one another with a single S14 system. The weatherproof device can be discreetly installed with long-term flash memory and external connectors behind a wall or ceiling. **www.mobotix.com**

Carolinas Wireless Association donates fundraising proceeds to Victory Junction

Members of the Carolinas Wireless Association pose with Richard Petty for the presentation of an $18,000 donation to Victory Junction. From the left: Ken Van Riper, member at large; Scott Smith, vice president; Petty; Mitzi Parker, secretary; Joel McMillan, treasurer; and Daniel C. Agresta III, president.

The Carolinas Wireless Association conducted its 8th Annual Charity Event at Pinehurst Country Club and raised funds for its largest donation to date, $18,000 to Victory Junction.

NASCAR Hall of Fame's Richard Petty accepted the donation on behalf of Victory Junction, which was founded in honor of his grandson.

carolinaswirelessassociation.com

Carolinas Wireless
ASSOCIATION

Victory Junction

Victory Junction is a year-round camping environment for children, ages six to 16, with chronic medical conditions or serious illnesses. Founded by Kyle and Pattie Petty, in honor of their son Adam, the camp is located in Randleman, N.C. Victory Junction offers programs for a range of disease groups and maintains strong relationships with more than 30 partner hospitals.

Victory Junction's mission is to provide life-changing camping experiences that are exciting, fun and empowering, in a safe and medically sound environment, always free of charge. As a not-for-profit organization, the camp operates solely through the support of generous individuals, foundations, organizations and corporations to provide this experience at no charge to children and their families.

Since the camp's inception, more than 17,000 children and families have received not only a circle of support but experiences thought to only be possible by healthy children.

A public service ad from *AGL*

product showcase — shelters and enclosures

Lightweight Steel Shelters

Dupont Building has added a line of lightweight, steel interlocking panel buildings as an option for equipment shelters at cell sites. These shelters are lightweight and economical to transport, and have limitless design choices. The shelters expand the company's already extensive portfolio line of fiberglass, lightweight shelters.
www.dupontbuilding.com

Climate-control Solutions

Bard Manufacturing offers single- and two-stage compressor air conditioners for telecom applications. The units are designed to establish and maintain exacting environmental conditions for sensitive telecom equipment, ensuring optimal operating environments. Units are available in five colors, as well as stainless-steel or aluminum cabinets. All models can be equipped with new full-flow fully modulating economizers, with either enthalpy or dry bulb-only control. Dual unit lead/lag controller systems are available with alarms to meet user requirements.
www.bardhvac.com

Shelters Withstand Harsh Environments

Shelters designed to protect sensitive equipment from the harshest of environments are available from **American Products**. The company's Thermal Fort lightweight equipment shelters are constructed of heavy-gauge galvanized steel and are powder-coated. They exceed GR487 salt spray requirements. The lightweight design makes them economical and easy to deploy. All-metal construction ensures years of maintenance-free service. The shelters can be installed in remote locations or on building rooftops. Available in five standard sizes that range from 6 feet X 6 feet to 9 feet X 15 feet, the shelters can handle applications requiring one to 12 19-inch or 23-inch equipment racks or up to 500 rack units of space.
www.amprod.us

Modular Shelters

The Maxi-Mod precast building system from **Oldcastle** allows for design flexibility for large shelters. The shelters are ideal for wireless sites. An advantage of the buildings is that the construction process is concurrent with site preparation and permitting. Maxi-Mod shelters are manufactured with precision-steel forms to produce exacting tolerances required for superior quality, storm resistance and watertight design. Available in 20- and 30-foot widths and various lengths, these enclosures can be easily expanded vertically and horizontally to meet future needs.
www.oldcastleprecast.com

Shelters Reduce Building Weight up to 60 Percent

When site accessibility is limited, **Fibrebond** lightweight equipment shelters offer a secure and durable building that can reduce weight by up to 60 percent, making them suitable for difficult site locations and rooftop applications. The buildings can be highly customized with a variety of sizes and exterior finishes. Standard designs are rated for 120 mph wind load. Designs with higher wind-load ratings are available. The shelters are backed by a 10-year structural and roof warranty.
www.fibrebond.com

Of all the things Shea's dog is trained to do, the most important is opening doors.

A rare muscle disease keeps Shea confined to a wheelchair. But thanks to her best friend Mercer, she's not confined *by* it. Mercer is at Shea's side 24 hours a day to help her do all sorts of things on her own, from picking things up off the floor to opening the refrigerator and turning on the lights. How inseparable are Shea and Mercer? Take a look in her school yearbook and you'll find his picture right there next to hers.

For more than 30 years, Canine Companions for Independence has been teaming people like Shea with dogs like Mercer completely free of charge. To find out more about making a donation, volunteering, or applying for a dog of your own, visit www.cci.org or call 1-800-572-BARK.

CANINE COMPANIONS FOR INDEPENDENCE®

product showcase — shelters and enclosures

Outdoor Enclosures for Broadband Backhaul Support 3/4G Service Deployments

Suited for wireless data broadband backhaul applications supporting advanced 3G and 4G service deployments, the FlexSure outdoor enclosure from **Purcell Systems** is highly configurable, modular and GR-487-certified. Featuring a compact footprint with a variety of mounting options, the enclosure can be mounted on a pad, pole or wall. It can be mounted using enclosure-on-enclosure vertical stacking to maximize limited deployment space. Options include AC and DC power distribution and rectifier systems, battery backup, and fiber and copper management and protection. A range of thermal management system technologies and capacities ensures that the equipment deployed in the cabinet will operate within its design parameters The company's internally designed and manufactured heat exchangers provide superior above ambient temperature thermal management with closed-loop systems that isolate outdoor ambient air from inside air. Closed-loop systems prevent intrusion of particulate contaminates such as dust, moisture and humidity.
www.purcellsystems.com

Custom Prefabricated Buildings

GFRC provides distinctive prefabricated buildings to meet the specific needs of each client. Construction options include standard and lightweight concrete and metal options. The buildings are highly adaptable and can be utilized in a variety of applications and environments. The patented Extended Slab design suits projects that require factory-installed equipment such as generators, packaged HVAC and pressurization equipment. **www.gfrc.com**

Outside Plant Enclosures

Telecom building scalability and flexibility for global network deployments are two objectives of the NetXtend Flex integrated outdoor enclosures from **Emerson**. The enclosures ensure environmental stability for sophisticated electronics in wireless network applications. The enclosures utilize proven engineering, integrated thermal components and a sealing system that withstands rain, dust, snow and hurricane-force winds. They have a variety of heat exchangers, air conditioners and thermoelectric coolers. Venting options contain environmentally friendly controller logic that allows for less energy consumption and that operates at lower noise levels.
www.emerson.com.

Faraday Cage Enclosure

Pepro is extending its line of hybrid-powered radio sites. The latest addition is a two-bay shelter with 54 units of rack space protected by patented Faraday cage technology. It can include a 20-foot tower and a trailer dismount system that can install the site for long-term use without disturbing the enclosed equipment. The site includes three solar panels, batteries and a DC generator to power the site for months without fuel service. The installation could be for short-term emergency use or fill-in RF coverage. It could serve as a long-term solution for remote locations without being limited by source power or fuels. The unique trailer dismount system keeps the shelter level, enabling a single person to set the enclosure in place without extensive training. These convenience factors make the Hybrid MicroSite especially useful in hard-to-reach locations where bringing in trained teams or fuel would be difficult to schedule or inefficient.
www.peprollc.com

Compact Enclosures

Charles Industries' universal broadband enclosures are small cell-enclosures designed to house Ethernet demarcation devices, AC/DC rectifiers, small-cell equipment and backup battery systems. They are made in the United States and have ISO 9001/TL 9000 certifications. The units are rugged enough to stand up to the outside plant environment, yet are small and lightweight enough for placement in urban environments.
www.charlesindustries.com

We lost everything in a fire.

The Red Cross gave us hope. They showed us love and were very understanding and helpful during my tragedy.

PHOTO AND STORY BY:
THE PEREZ FAMILY

On a cold January morning, Angelina and her family woke to a fire that within hours had destroyed their home. The American Red Cross was there with shoes, warm clothes and shelter that allowed her family to stay together. Your donations help the Red Cross respond to a home fire like Angelina's every 9 minutes.

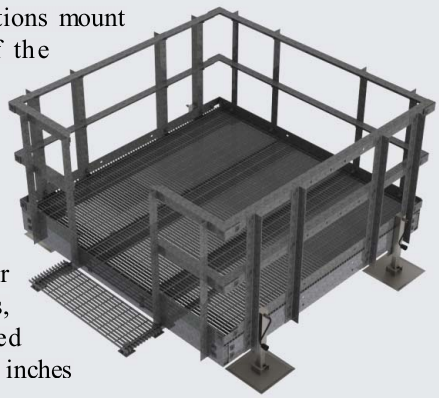
Please donate now at redcross.org

American Red Cross

product showcase — shelters and enclosures

Alternative Platforms

Equipment shelter platform systems provide an elevated surface for supporting and securing base station cabinets and other wireless equipment, eliminating the need for more expensive, permanent concrete pads. Equipment platforms are available in 10-foot-X-10-foot, 10-foot-X-15-foot and 10-foot-X-20-foot sizes with or without adjustable legs, suitable for raw land (cell tower site) or rooftop applications. The **CommScope** platform's pivotable and adjustable legs for raw land applications mount to the perimeter of the platform allowing for maximum use of platform space. The top of the platform can be adjusted from 25 inches to 36 inches above ground level. For rooftop applications, they can be adjusted from 22 inches to 29 inches above the roof.



www.commscope.com

Prefabricated Structures

VFP provides prefabricated structures made of metal, concrete and panels to serve the telecommunications, public safety, utility, government and modular building industries. Products range from communications equipment shelters to substation control houses and commercial modular buildings. For use where access is difficult, VFP developed its Build On Site modular panelized system that can be brought to the site in pieces and erected by VFP field service workers. **www.vfpinc.com**

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www.agl-mag.com


99% of Americans have seen combat on TV.
1% of Americans have seen combat in Iraq or Afghanistan.
We know where you're coming from.
We've got your back. Join the online community
at IAVA.org
IAVA
IRAQ and AFGHANISTAN VETERANS of AMERICA
Ad Council
Photo by Petty Officer 2nd Class Sandra M. Palumbo, U.S. Navy - Bahrain, November 6, 2007

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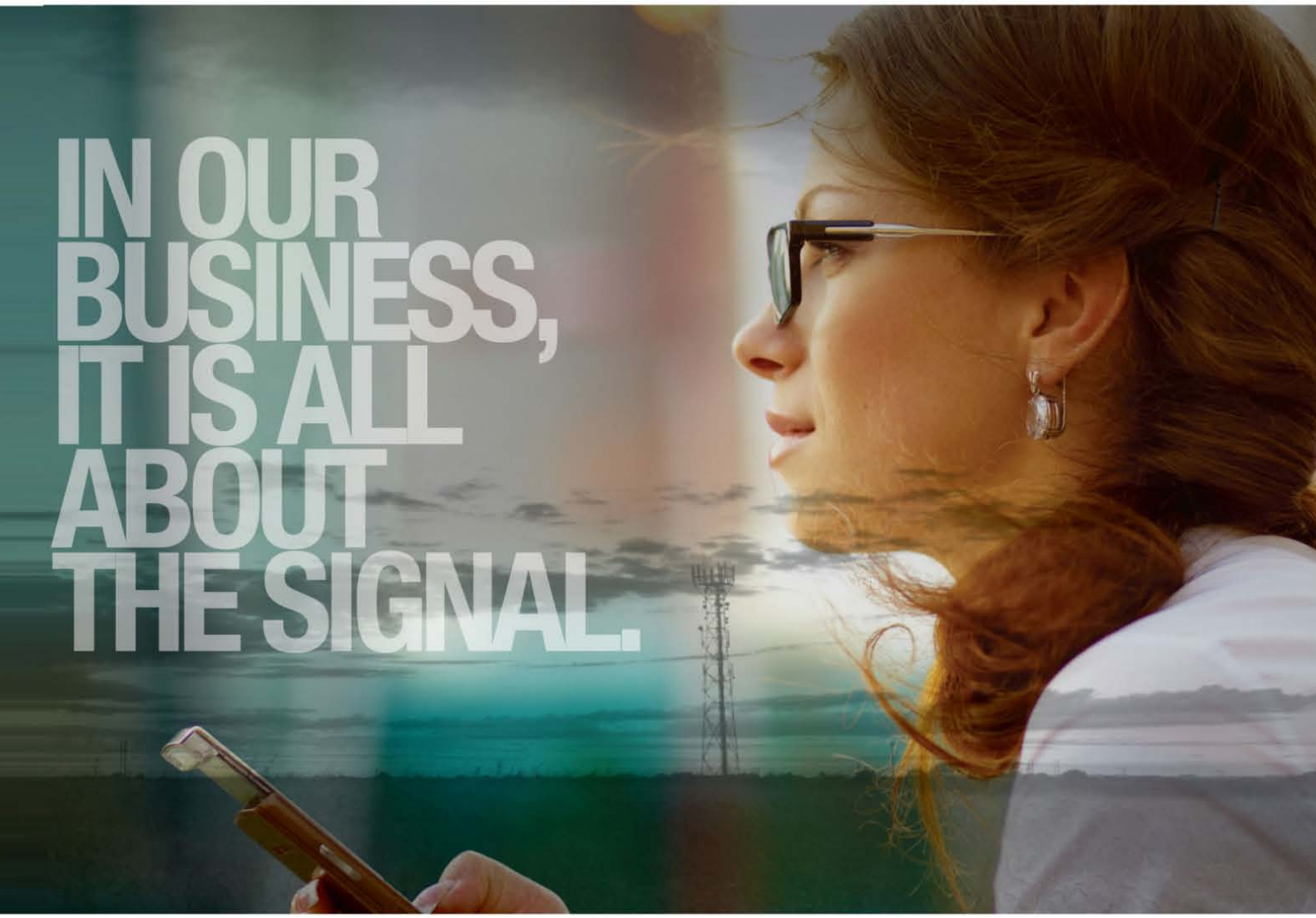

Our clients depend on SBA to provide the wireless infrastructure that allows them to transmit the signal to their customers. As their first choice provider of wireless infrastructure solutions, we are continuously setting the standard for customer satisfaction by "Building Better Wireless".

800.487.SITE | sbasite.com

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- SITE MANAGEMENT
- SITE DEVELOPMENT
- CONSTRUCTION
- TECHNICAL SERVICES

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